APPENDICES

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OVEN MOUNTAIN PUMPED HYDRO ENERGY STORAGE EIS

Geochemistry assessment

OVEN MOUNTAIN PUMPED HYDRO STORAGE

EMM creating opportunities

Oven Mountain Pumped Hydro Energy Storage

Geochemistry Assessment

Prepared for OMPS Pty Ltd

March 2023

Oven Mountain Pumped Hydro Energy Storage

Geochemistry Assessment

OMPS Pty Ltd

J210465 OMPS EIS - Geochemistry

March 2023

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Executive Summary

ES1 Introduction

OMPS Pty Ltd (OMPS) is proposing to develop the Oven Mountain Pumped Hydro Energy Storage Project (the Project), an off-river pumped hydro energy storage system located approximately half-way between Kempsey and Armidale adjacent to the Macleay River in northern NSW. The Project is located within the New England Renewable Energy Zone (REZ) and the Armidale Regional Local Government Area (LGA), proximate to its border with Kempsey Shire LGA.

At a basic level, the Project will consist of upper and lower water reservoirs, an underground waterway connecting them, and a hydro-electric power station connected to the national electricity market (NEM) that is capable of generating or consuming electricity.

The Project has been declared by the NSW Government to be critical State significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Infrastructure projects are declared to be CSSI if, in the opinion of the NSW Minister for Planning, they are essential to the State for economic, environmental, or social reasons. The Project will aid in the transition of the NEM towards cleaner, more reliable and affordable electricity by supporting - new renewable energy projects by providing up to 900 megawatts (MW) of electricity generating and load capacity, and up to twelve hours of dispatchable energy at full generation to be stored and made available to the NEM through the New England REZ.

The expected operational lifespan of the Project is in excess of 100 years.

ES2 Risk characterisation

Approximately 5,500,000 bank cubic metres of excavated material (spoil) will be generated through construction activities. Characterisation of the geochemistry within the Project area is essential to develop an understanding of risks associated with spoil stockpiling. Spoil stockpiling leads to oxidation of the minerals entrained in the geology which can result in acidic or neutral rock drainage. Typical key minerals include sulphides (potentially leading to acidic or neutral rock drainage) and leachable metals (potentially leading to metalliferous drainage).

The geochemistry assessment, supported by field investigative works, characterise the potential and, if present the significance of these risks to the environment.

ES3 Assessment and findings

The geochemistry assessment has been informed through a combination of desktop review and field investigative works. The field investigation program relies on drill core return from the Geotechnical Investigation Program (SMEC 2022) and drill chip return from the Hydrogeological Investigation Program (EMM 2022). Data obtained from nine boreholes across the Project area and at varying depths below ground level (targeting Project relevant geological units) was assessed to understand the risk of acidic or neutral rock drainage and metalliferous drainage.

Based on the samples analysed:

- spoil is expected to meet the NSW waste classification guideline's definition of virgin excavated natural material
- concentrations of leachable metals within the spoil are considered low and are generally below pre-construction groundwater conditions onsite. The risk of increasing metal concentrations through leaching is considered low.

ES4 Mitigation and management

A monitoring program will be implemented as part of the water management plan to identify material that may contain concentrated metals. The monitoring program will be developed with ongoing consideration for risk to nearby water sources and in line with the construction schedule.

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1 Introduction

1.1 The Project

OMPS Pty Ltd (OMPS) is proposing to develop the Oven Mountain Pumped Hydro Energy Storage Project (the Project), an off-river pumped hydro energy storage system (referred to as the 'pumped hydro system') located approximately half-way between Kempsey and Armidale, adjacent to the Macleay River in northern NSW. The Project is located within the New England Renewable Energy Zone (REZ) and the Armidale Regional Local Government Area (LGA), proximate to its border with Kempsey Shire LGA.

Figure 1.1 and Figure 1.2 provide the regional and local context of the Project respectively.

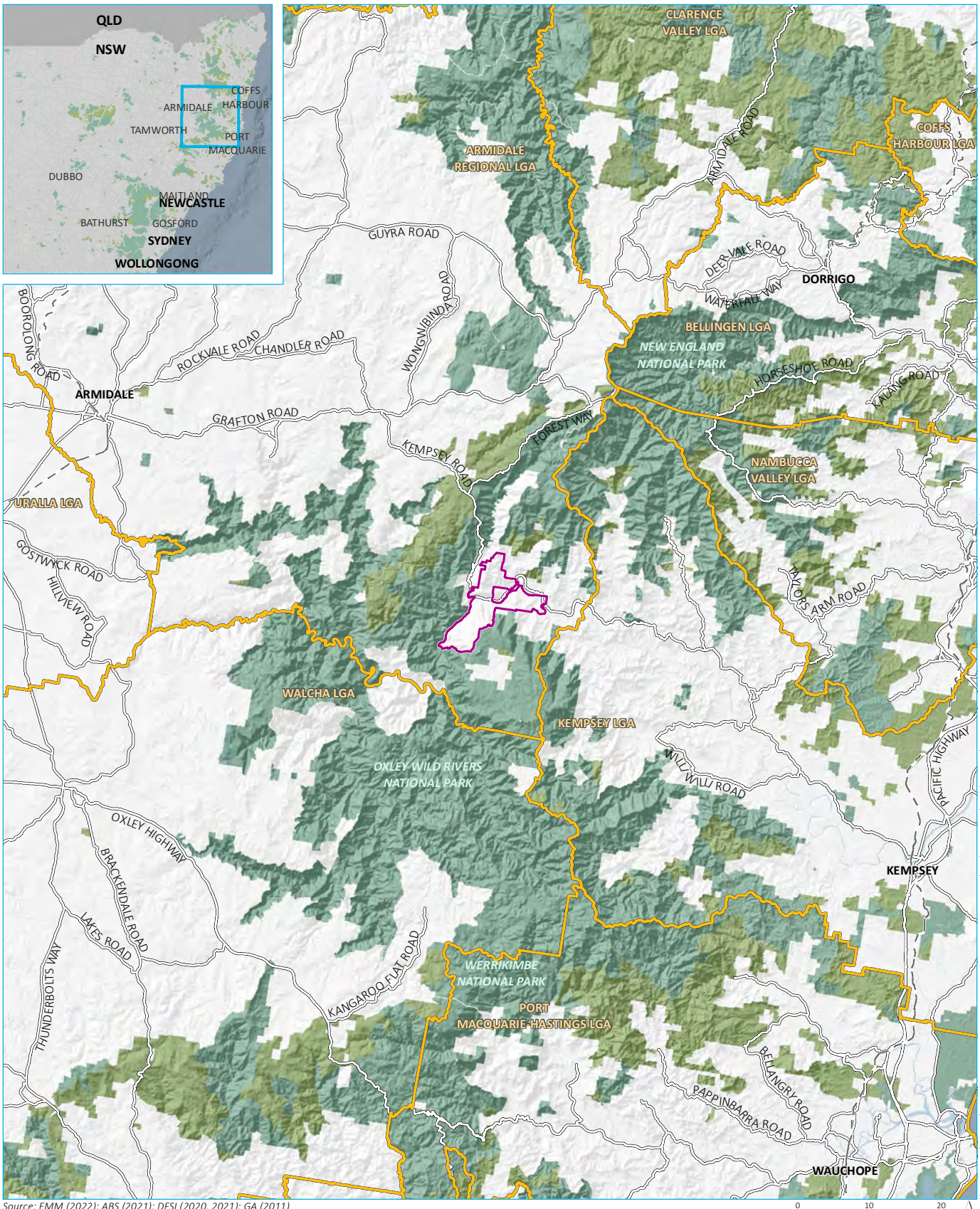
At a basic level, the Project will consist of upper and lower water reservoirs and an underground waterway connecting them via a hydro-electric power station.

The Project has been declared by the New South Wales (NSW) Government to be critical State significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Infrastructure projects are declared to be CSSI if, in the opinion of the NSW Minister for Planning, they are essential to the State for economic, environmental, or social reasons. By providing up to 900 MW of electricity generating capacity, the Project will aid in the transition of the NEM towards cleaner, more reliable and affordable electricity. It will also provide up to between eight and 12 hours of dispatchable energy at full generation to be stored and made available to the National Electricity Market (NEM) through the New England REZ. The expected operational lifespan of the Project is in excess of 100 years.

The Project will utilise the highly favourable natural terrain of the site on which it sits to allow electrical energy from the main grid to be stored by pumping water from the lower reservoir to the upper reservoir. Energy can then be generated when needed by allowing water to flow back down to the lower dam and reservoir via the hydro-electric power station, effectively enabling the Project to act as a large battery.

1.2 Proponent

OMPS (ABN 22 160 259 174) is developing the Project and is located in Kempsey at 2/28 Clyde Street, Kempsey NSW 2440.



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011)

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KEY

- Project area
- Rail line
- Major road
- Named waterbody
- Local government area
- NPWS reserve
- State forest

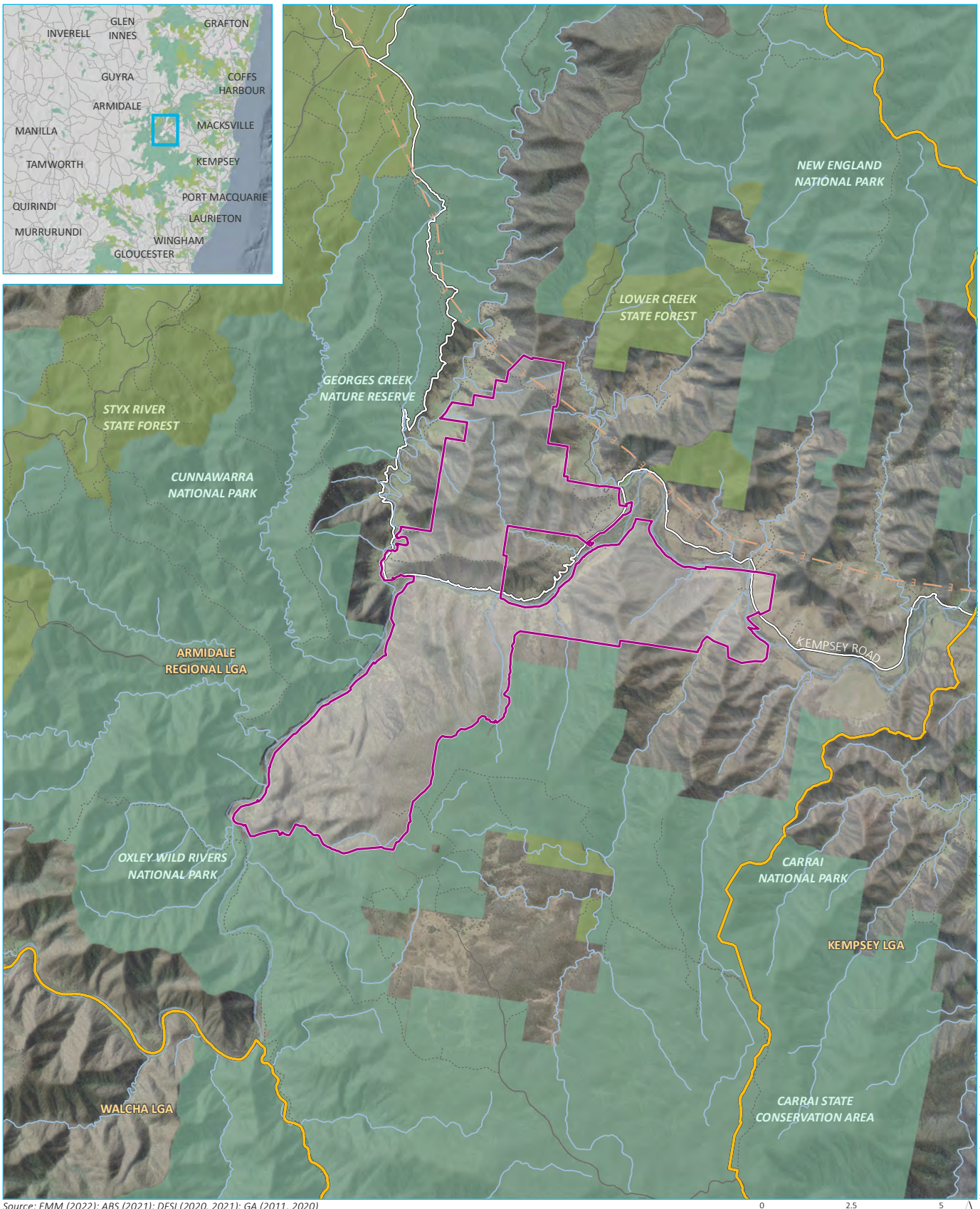
INSET KEY

- Major road
- NPWS reserve
- State forest

Regional setting

Oven Mountain Pumped Hydro Energy Storage Project
Geochemistry Assessment
OMPS Pty Ltd
Figure 1.1

EMM creating opportunities



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

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KEY

- Project area
- Existing transmission line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- Local government area
- NPWS reserve
- State forest

INSET KEY

- Major road
- NPWS reserve
- State forest

The Project area – local context

Oven Mountain Pumped Hydro Energy Storage Project
Geochemistry Assessment
OMPS Pty Ltd
Figure 1.2

EMM creating opportunities

2 The Project description

2.1 Project overview

The Project involves building two 'off river' water containment structures to create an upper and a lower reservoir (referred to as 'the upper dam and reservoir' and 'the lower dam and reservoir'), on an ephemeral tributary of the Macleay River. An underground hydro-electric power station complex will be connected to the reservoirs by infrastructure including a power waterway and tunnels. During operation, the water will enable the generation of electricity as it passes through the underground power station while moving from the upper to the lower reservoir, from where it is pumped back up via the same waterway in a 'closed-loop circuit'. The pumped hydro system will be connected to the existing transmission network via new overhead high voltage transmission lines.

A detailed description of the Project and its strategic context is provided in the Project's EIS which should be read in conjunction with this report.

An overview of the key components and elements are provided below.

2.2 Key Project design elements

Broadly, the Project has been categorised into three key components, which are further broken down into the Project's key elements in Table 2.1 and shown in Figure 2.1:

- pumped hydro-electric and generation works (PHGW) – including:
  - new upper and lower water storage dams and reservoirs
  - a new underground pumped hydro-electric power station and transformer hall
  - water tunnels, access tunnels, portals and adits
  - tailrace
  - intake and outlet structures
  - associated gates, shafts and screens
- transmission connection works – including:
  - new electricity transmission lines to connect the PHGW to the existing electricity transmission network (Line 965)
  - new electricity transmission infrastructure
  - a new substation
- ancillary development – including but not limited to:
  - access roads, tracks and bridge
  - on-site quarries and related infrastructure
  - utilities and communications infrastructure
  - construction pads containing assets such as workshops, concrete batching plants (CBPs), and offices

- laydown and storage areas
- construction accommodation
- pumping infrastructure
- operational facilities such as offices, and camps for staff
- construction and operational power supply.

Table 2.1 Key Project elements

Project element	Description
PHGW	
Underground power station complex	An underground pumped hydro-electric power station located below the upstream end of the pumped hydro system to optimise the hydraulic arrangement of the Project. The power station complex consists of: • two main caverns comprising – the machine hall – the transformer hall • interconnecting tunnels, the transformer hall tunnel and isolated phase busbar (IPB) tunnels.
Dams and reservoirs	Two concrete faced rockfill dams (CFRD) and reservoirs, referred to as the upper dam and reservoir and lower dam and reservoir, with the following specifications:
	Upper dam and reservoir: • CFRD approximately 70 metres (m) high and 780 m long • reservoir covering a total area of approximately 20 hectares (ha) and an inundation extent of approximately 16.7 ha • reservoir height of approximately 881 m Australian Height Datum (AHD) at full supply level (FSL) and approximately 830 m AHD at minimum operating level (MOL) • total reservoir storage capacity of around 5.1 gigalitres (GL) at FSL.
	Lower dam and reservoir: • CFRD approximately 70 m high and 280 m long • reservoir covering a total area of approximately 24.7 ha and an inundation extent of approximately 21.6 ha • reservoir height of 250 m AHD at FSL, 215 m at MOL and 205 m AHD at lowest operating level (LOL) • total reservoir storage capacity of around 6.5 GL at FSL.
Water intake structures	Two intake structures, one at each reservoir, including: • a morning glory, vertical-type intake structure situated at the upper dam and reservoir • a lateral intake structure, with head gates and stoplog slots, and an intake channel, at the lower dam and reservoir.
Spillway	Two concrete lined spillway chutes, one for each of the upper and lower dams and reservoirs. Both spillway crests will comprise of ungated ogee-shaped overflow weirs on the upstream ends of the spillway chutes.
Macleay River pump facility	A pump facility on the edge of the Macleay River, which will include an access road, duty and standby pumps for the initial fill and for ongoing reservoir top-ups as required.

Table 2.1 Key Project elements

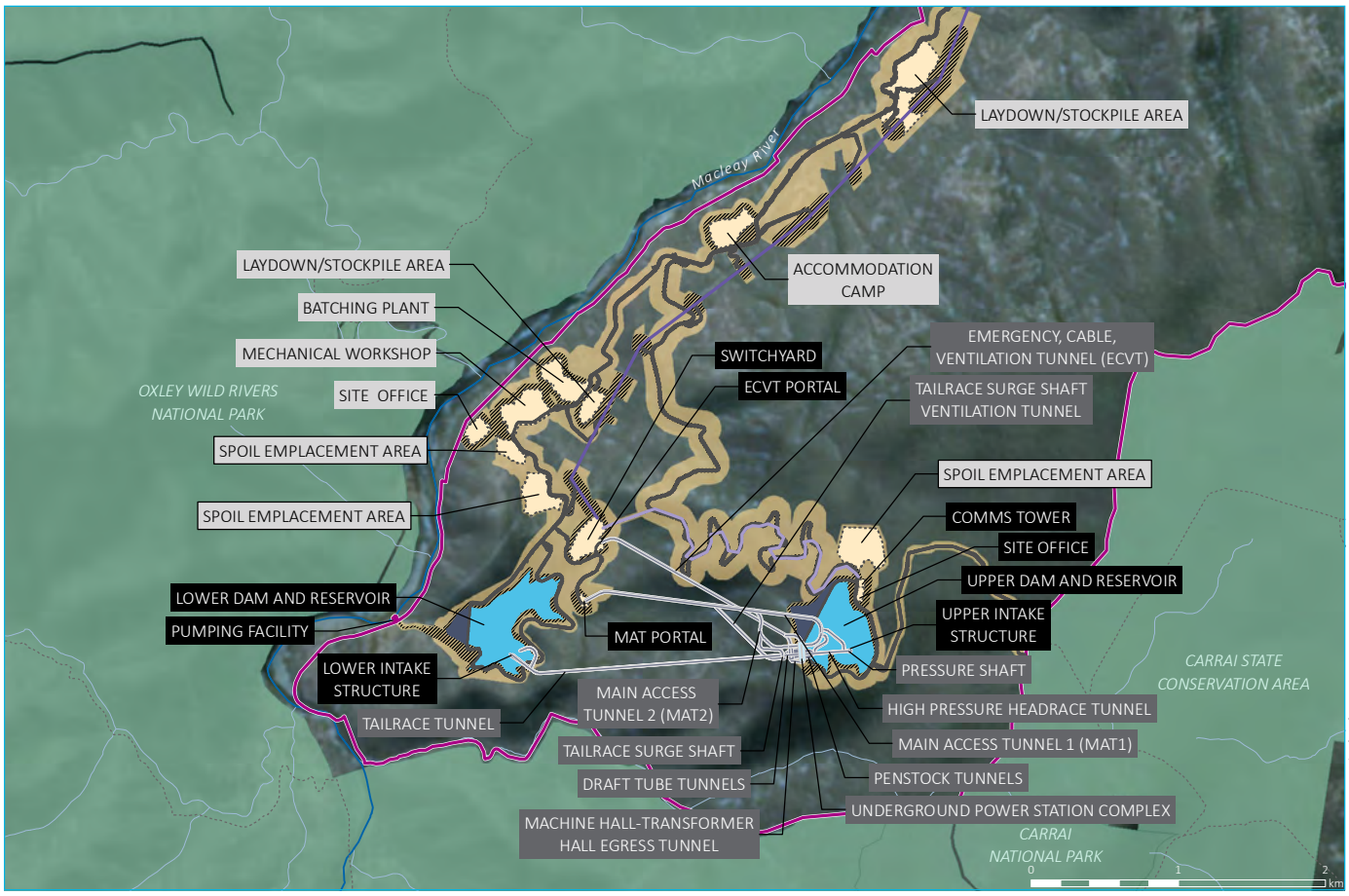
Project element	Description
Tunnels	Three main tunnels comprising of: • two main access tunnels (MAT1 and MAT2) • the emergency, cable, ventilation tunnel (ECVT). The MAT1 and MAT2 will provide loop access to the power station complex from the MAT portal. The ECVT will provide services access and egress between the switchyard portal and the transformer hall. The ECVT portal will contain the station switchyard, control rooms, ventilation and firefighting equipment, with blast walls separating important equipment.
Power waterway	The power waterway will consist of: • an approximately 660 m deep, 5.1 m diameter vertical pressure shaft • an approximately 250 m concrete and steel lined high-pressure headrace tunnel • three or more approximately 80 m long penstock tunnels • three or more approximately 120 m long draft tube tunnels • an approximately 1,825 m long concrete lined tailrace tunnel.
Transmission connection works	
Connection works	The connection works will consist of: • an approximately 15 km long transmission alignment comprising, at a maximum, double circuit single tower 330 kV overhead infrastructure and single circuit single tower 132 kV overhead infrastructure connecting to TransGrid Line 965 • up to 25 transmission tower sites (approximately 50 m x 50 m) containing the 132 kV and 330 kV infrastructure • a transmission easement width of a maximum of approximately 105 m. Note: The upgrade of existing Line 965 will be the subject of a separate application.
Sub-station	Construction of a substation and associated connection infrastructure of up to 330 kV rating.
Switchyard	A high voltage connection linking the connection transmission lines to the cables exiting the underground power station complex. The outdoor air insulated switchyard will likely include: • switchgear and control room • cable potheads • disconnector/earth switches • capacitive voltage transformer (VT) • lightning protection • security fencing, lighting and surveillance • surge arrestor.
Ancillary development (construction and operation)	
Access roads, access tracks and bridge	A variety of road works to improve existing access, and construction of new permanent roads to enable construction access, temporary establishment and use of construction sites, and general access to the Project area including transmission line infrastructure.
	The proposed main access will be via the construction of a new unsealed two-lane access road located to the east of the site (the Eastern Access Road (EAR)). The main access road will interface with the existing Kempsey Armidale Road and will require the construction of one new single or two lane low-level bridge crossing over the Macleay River. A temporary bridge may be utilised prior to the construction of the permanent bridge.

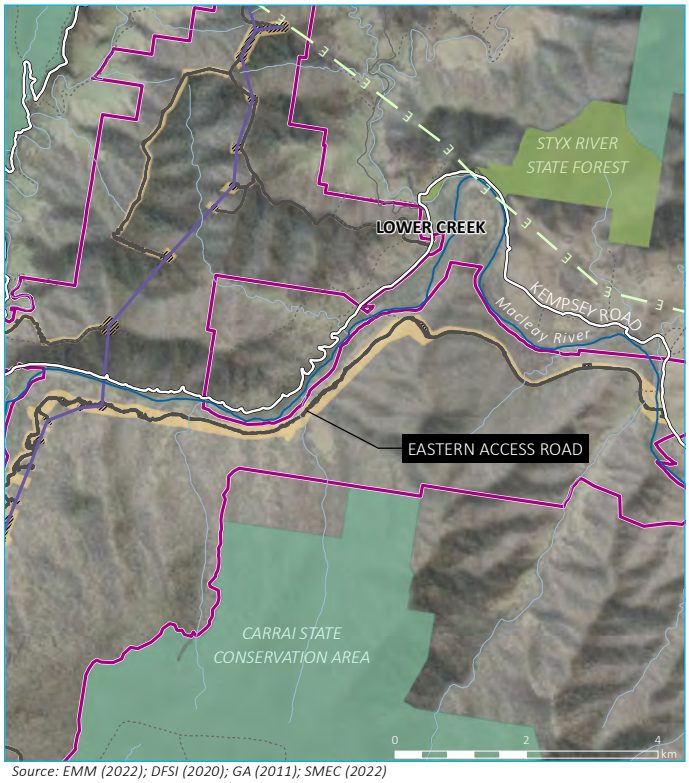
Table 2.1 Key Project elements

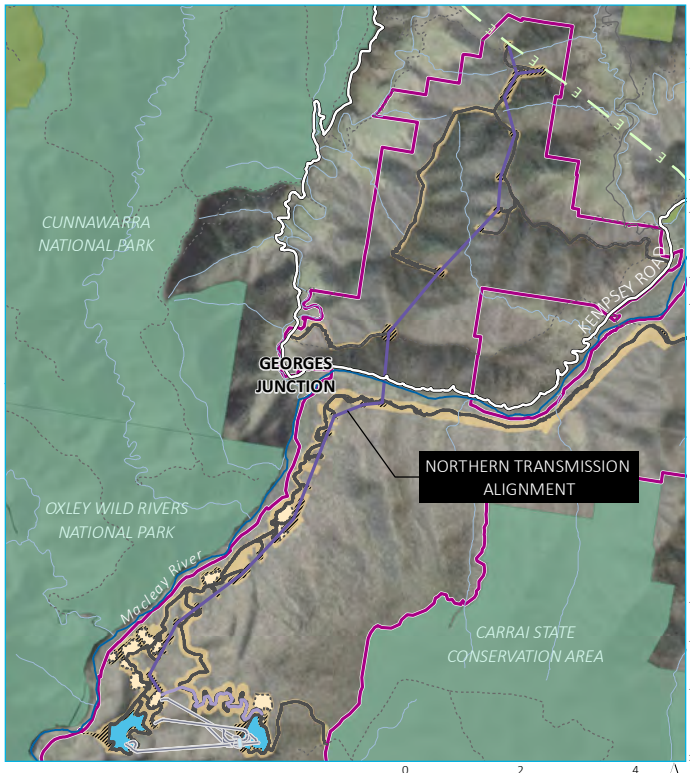
Project element	Description
	There will be approximately 40 km of permanent roads connecting the dams, surface works, portals, transmission assets and spoil sites. Some of these roads are existing roads, however approximately 25 km will be newly constructed roads. The key road components include: • Main Access Road (approximately 4.7 km) • EAR (up to approximately 11. 4 km) • Lower Dam Access Road (approximately 3.6 km) • Upper Dam Access Road (approximately 7.1 km) • access to portals and underground works • Upper Dam Emergency Egress Road (approximately 2.2 km). Access to the transmission infrastructure north of the Macleay River will be via two roads accessed from the Kempsey Armidale Road. These two roads include the: • Northern Transmission Access Road (approximately 15 km) • Transmission Tower 8 Access Road (approximately 2.3 km). To support access along the transmission line easement south of the Macleay River and to each of the tower sites, a network of interconnecting access and maintenance tracks will be constructed, to a large extent utilising existing access tracks.
Surface works pads and facilities	There are four main construction pads in addition to surface portals which will be used temporarily during construction for different services (accommodation camp, construction site offices, workshop area, and laydown storage).
	Construction works will require the establishment of the following ancillary support infrastructure and areas: • main accommodation camp(s), which will temporarily accommodate the majority of workers as required workers as required throughout the construction period • temporary or fly camps, that may be required in addition to the main accommodation being constructed • two works areas including Works Area 1 and Works Area 2, which will contain ancillary facilities such as CBPs, mechanical and electrical workshops, a laboratory and various water treatment and wash areas • spoil emplacement areas • staging area • stockpiling areas • temporary site offices to be used during construction.
Communications	Communication infrastructure such as fibre optic cables are required for the operation of the Project and will be located: • on an overhead line linking the upper and lower dams and reservoirs (in conjunction with the electrical line) • buried in road corridors. The communication network will also include a communications tower near the upper dam and reservoir.
Utilities during construction	• Construction water will be supplied to water storage systems either via groundwater bores, or via pumping of water from the Macleay River to support camp operations, the CBP, dust suppressions and other activities across the site. • Construction power will be supplied primarily by use of portable diesel generators and supported where possible by leveraging off existing electricity distribution infrastructure running through the generation site.
Utilities for operation	Alignment and length of utilities (electricity, water, etc) will be combined into a single corridor (total length of about 5.4 km).

Table 2.1 Key Project elements

Project element	Description
Water diversion and water treatment facilities	• Site drainage will include a combination of cross drainage culverts, drainage pits and pipe, open channels/open drains (vegetated, rock-lined or concrete), levees/bunds, and detention basins. • Various water treatment plants will be used for construction drainage and water treatment facilities – for the main accommodation camp, temporary or fly camps, CBP, tunnel, etc. • Specific discharge locations are planned for stormwater and surface water runoff and will be determined during detailed design or construction planning.
Laydown/stockpile areas	Temporary laydown/stockpile areas will be utilised across the Project area.
Spoil emplacement areas	To accommodate spoil generated through excavation of the underground caverns and tunnels, three permanent spoil placement locations have been identified with a capacity to store around 2 million cubic metres (Mm^3) of material. Dead storage space within the reservoirs will also be used for spoil placement, with a capacity to store approximately 300,000–400,000 m^3.
Ancillary operational facilities	Primary operation of the Project can be undertaken remotely and will require minimal onsite operational staff, other than for maintenance activities. Operational facilities include maintenance housing, work area, car parking, workshop and storage, control room and switchgear, water treatment plant, office area, heating, ventilation and air conditioning (HVAC), backup generators and Macleay River pump facility.
Other	
Construction	• Construction duration of around four to five years. • Construction workforce of over 600 to approximately 1,000 workers at construction peak.
Rehabilitation	Rehabilitation of areas disturbed during pre-construction and construction will be undertaken progressively where practical during all stages and phases of the Project. Progressive rehabilitation will occur over about 60 ha including spoil emplacement areas and areas used for construction ancillary facilities no longer needed during operation. At the end of the Project's life, 192 ha in total will be rehabilitated to native ecosystem (including native vegetation and rock landscape). Approximately 138 ha will be retained permanently for the water storages and access roads, subject to agreement with relevant landowners/land managers.
Operation	• The Project will provide up to 900 MW of electricity generating capacity and up to eight hours of energy storage at full generating capacity. • Maintenance and operational activities will include power station operations, infrastructure inspections, maintenance to assets, vegetation management, auditing and compliance and other activities. • It is expected that the operation of the new power station will require around 30–50 full-time workers, as well as additional contractors for regular and ad hoc maintenance and repairs.
Hours of operation	• Construction of the Project will be 24/7 and 365 days per year. • Operation of the Project will be 24/7 and 365 days per year.
Project timeline	The Project will involve the construction and operational stages, and numerous phases which are outlined in the Project's EIS.
CIV	Estimated to be a base cost of approximately $1.8 billion (refer to Appendix BB of the Project's EIS).







Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

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KEY

- Project area
- Disturbance footprint
- Construction envelope
- Surface works

Project operational elements

- Underground power station complex
- Power and communications lines
- Transmission overhead lines
- Tunnels, portals, intakes, shafts
- Permanent road
- Reservoir
- Dam wall

Existing environment

- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Vehicular track
- Existing transmission line
- NPWS reserve

Label format

- SURFACE PERMANENT INFRASTRUCTURE
- UNDERGROUND PERMANENT INFRASTRUCTURE
- TEMPORARY INFRASTRUCTURE
- PERMANENT SPOIL EMPLACEMENT

Key Project Elements

Oven Mountain Pumped Hydro Energy Storage Project
Geochemistry assessment
OMPS Pty Ltd
Figure 2.1

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2.3 Project area terminology

Approval for the Project is being sought based on feasibility and concept designs as is common for projects of this size and scale. To accommodate minor changes and amendments to the design as it progresses, a 'Project area', 'construction envelope', 'disturbance footprint' and 'operational footprint' approach is being adopted for the Project. This approach is aimed at ensuring environmental impacts are assessed as accurately as possible, whilst accounting for the current level of design and the likelihood of design refinements occurring as the Project progresses towards construction. The terms are explained below.

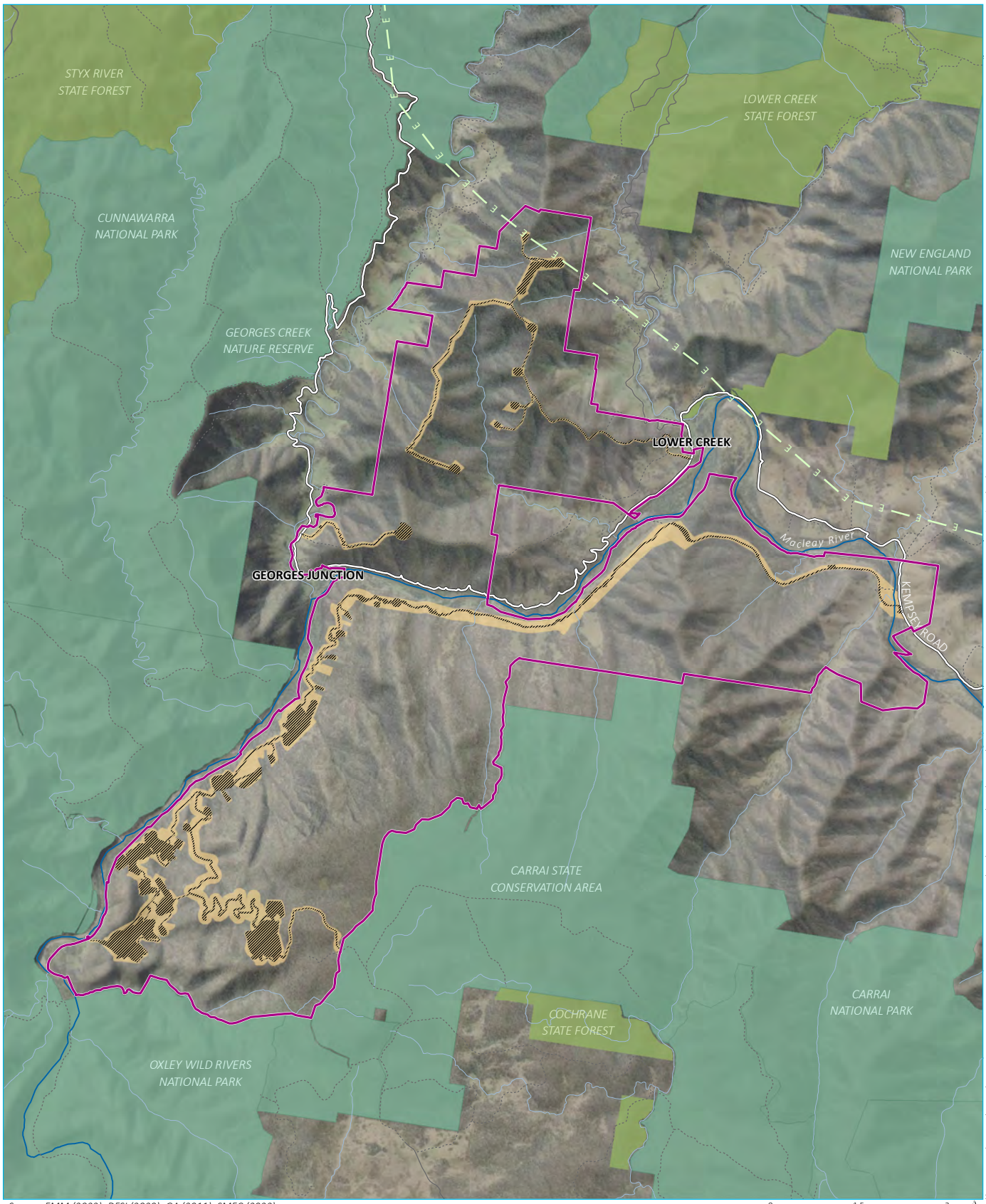
The *Project area* is the broader area within which the Project will be built and operated, and the extent within which direct impacts from the Project are anticipated. Importantly the Project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments. The Project area has been further divided into different areas to facilitate the assessment of direct impacts from the Project.

The *construction envelope* represents the maximum extent of where disturbance may occur during the construction of the Project. In order to derive the construction envelope, buffers have been applied to the key Project elements and infrastructure. The buffers used to derive the final construction envelope area reflect the confidence around the current siting of the asset or infrastructure, and the likelihood that some minor amendments may be required prior to commencing the construction works as a result of the detailed design. The construction envelope for the Project covers an area of around 780 ha.

Located entirely within the bounds of the construction envelope sits the *disturbance footprint*, a smaller area that has been derived directly from the current level of design. The disturbance footprint represents the physical disturbance that can be expected as part of the construction works. As the design is refined, the final siting of the disturbance footprint can move within the construction envelope, subject to the recommended environmental management measures, and provided it does not exceed any limits as defined by the construction envelope. It is proposed that part of the disturbance footprint will be rehabilitated, and land formed at the completion of the Project. However, other parts will be retained after construction which is necessary for the ongoing operation and maintenance of the new power station (operational footprint). The disturbance footprint for the Project covers an area of around 330 ha.

Progressively and at the end of construction, temporary components that are required to support the construction of the Project will be rehabilitated and returned to a state representing their previous use. The exceptions to this are the areas required for the permanent operation of the Project, which would be retained (referred to as the *operational footprint*). The operational footprint of the Project covers an area of around 270 ha. Approximately 60 ha would be progressively rehabilitated during and following the completion of construction.

The Project area, construction envelope and disturbance footprint are shown in Figure 2.2.



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Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

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GDA 1994 MGA Zone 56

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KEY

- Project area
- Disturbance footprint
- Construction envelope

Existing environment

- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Minor road
- Vehicular track
- Existing transmission line

- NPWS reserve
- State forest

Project areas overview

Oven Mountain Pumped Hydro Energy Storage Project
Geochemistry Assessment
OMPS Pty Ltd
Figure 2.2

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3 Project setting

3.1 Land use

Land use within the Project area is predominantly agricultural, comprising agistment based cattle farming on privately owned land including sections of crown land and TSR. Based on the Geological Survey of NSW (GSNSW) mining tenements database (GSNSW, 2022), Pickands Mather & Co International and BHP Minerals Limited have undertaken mineral exploratory works in 1971 and 1974 respectively. Exploratory works were generally concentrated within exploration lease EL9430 (formerly named EL664, refer Figure 3.1). Exploratory sampling and geological works were undertaken to assess the prospectivity for:

- arsenic (As)
- tin (Sn)
- molybdenum (Mo)
- copper (Cu)
- gold (Au)
- tungsten (W).

The extent of the exploration lease is provided in Figure 3.1.

3.2 Geology

The Project lies within the New England Orogen (NEO). The NEO extends approximately 2,000 km along the east coast of Australia from Townsville, QLD (north) to Newcastle, NSW (south), and is bordered by the Sydney-Gunnedah-Bowen Basin to the west (Jessop, Daczko, & Piazolo, 2019). Differing geodynamics in the early Permian to Triassic led to a series of linked pluton structures (known collectively as the New England Batholith) which intruded the sedimentary units of the Permian-aged Parrabel Beds and Carboniferous-aged Pee Dee Beds. The Triassic-aged Carrai Granodiorite; a plutonic structure outcropping over approximately 168 square kilometres (km^2), is the dominant geological unit occurring within the study area and a product of the New England Batholith.

A summary of the stratigraphy within the Project area is provided in Table 3.1. The distribution and extent of the relevant geological units to the study area are mapped and shown on Figure 3.1.

Table 3.1 Project area stratigraphy

Period	Formation	Typical description (Colquhoun, et al., 2022)
Quaternary	Undifferentiated alluvial, colluvial sediments	Well sorted, coarse grained and oversized fractions at the base of the incised valleys and adjacent to the Macleay River. Generally, comprises localised deposits of cobbles and boulders at the base of the incised valleys, becoming more prevalent and continuous within the lower escarpment. Sands to cobbles more frequently observed within the Macleay Valley floodplain.
Triassic	Carrai Granodiorite	Coarse grained, felsic, crystalline igneous rocks including granodiorite, monzogranite and leucogranite. Relatively shallow weathering profile (≤9 m depth) and strength typically increasing with depth. Dominant geology underlying the Project area.

Table 3.1 Project area stratigraphy

Period	Formation	Typical description (Colquhoun, et al., 2022)
Permian	Parrabel Beds	Fine to coarse grained sedimentary rocks including diamictite, conglomerate, sandstone, mudstone, limestone and tuff. Highly metamorphosed within the Project area by the Carrai Granodiorite intrusion, forming an aureole contact of hornfels and meta-sediments. Underlies the western portion of the Project area.
Carboniferous	Pee Dee Beds	Fine to coarse grained sedimentary rocks including slaty siltstone, lithic sandstone and minor diamictite. Likely metamorphosed near the Project area by Carrai Granodiorite intrusion, forming an aureole contact of hornfels and meta-sediments. Underlies a relatively small portion of the Project area.

3.2.1 Geochemistry

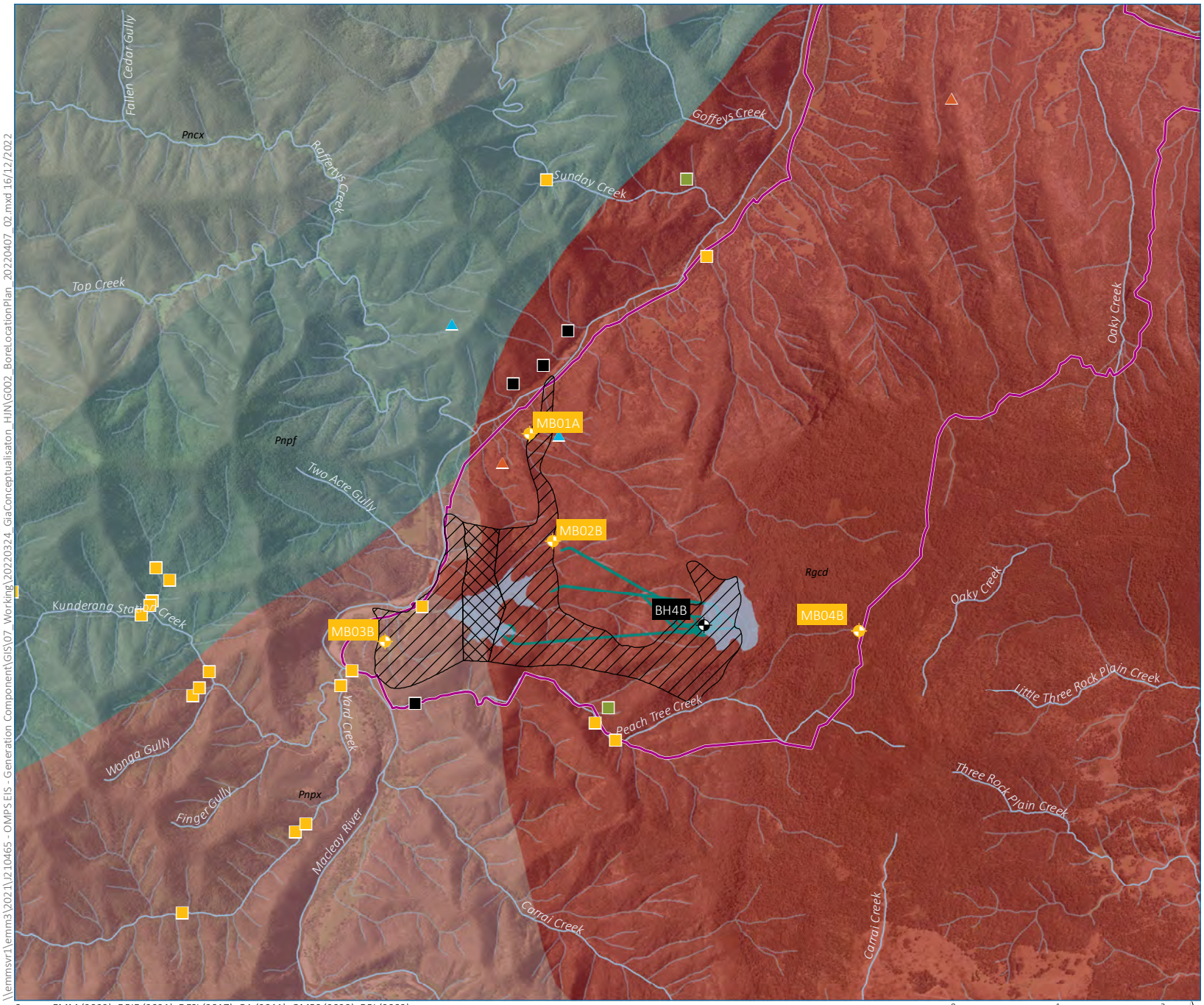
For the purpose of this geochemistry assessment, three geological groups are defined according to the likely geochemistry characteristics, as summarised below:

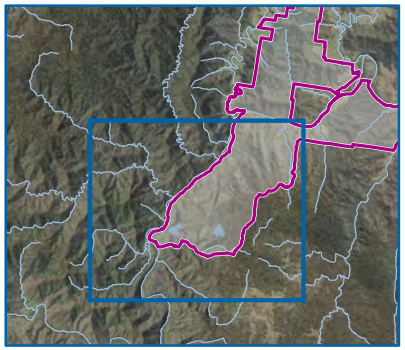
- Granodiorite (associated with the Triassic Carrai Granodiorite), underlying the majority of the Project area (refer to Figure 3.2) and intercepted by the majority of the subsurface infrastructure (tunnels, power cavern etc.) and a portion of the upper reservoir. This unit comprises an intrusive magmatic rock of predominantly quartz and felspar. It is unlikely to contain sulfidic minerals and is unlikely to be reactive or leach heavy metals or metalloids at elevated concentrations in the unaltered state. Alteration and increased quartz content was observed in bore MB01A (observed at 6–12 m and 16–28 m, refer Figure 3.1) which could be interpreted as granodiorite or greisen which comprises 60% or greater quartz, (Streckeiesen, 1974). Greisen is often targeted for mineral exploration due to the enrichment of metal bearing minerals and is considered the highest risk of all identified geological features in the Project area for metal and metalloid leaching. The observed Greisen is located off the Project alignment.

- Hornfels (undifferentiated), forming a contact aureole with Carrai Granodiorite and adjacent sedimentary rocks, observed in the western extent of the Project area and contiguously across the Carrai Plateau (refer to Figure 3.1), intercepted by the shallower portion of the proposed pressure shaft and a portion of the upper and lower reservoirs. Hornfels consists of contact metamorphosed sedimentary rock such as sandstone, shale and diamictite. It is typically a very hard rock that consists of quartz, felspar and mica. Material from this unit is not believed to be reactive or to leach contaminants of potential concern (COPC).

- Metasediments (associated with contact metamorphism of the Permian Parrabel beds), underlying the western extent of the Project area, intercepted by the lower reservoir and minor components of the subsurface infrastructure. This unit consists of varying degrees of metamorphic rock (slate, phyllite, schist and hornfels) from sedimentary protoliths including sandstone, shale and diamictite. Material from this unit is not believed to be reactive or to leach COPCs.

Geological units were identified and presented in Figure 3.1 and Figure 3.2.





KEY

- Project area
- Named watercourse
- Watercourse/drainage line (refer to inset)
- Hydrogeological borehole
- Geotechnical borehole
- Proposed reservoir footprint
- Proposed subsurface infrastructure

Geology (SMEC 2022)

- Hornfels
- Meta-siltstone

Historical data - Commodity detected

- Antimony
- Arsenic

Historical data - Elevated metals

- Antimony
- Copper
- Zinc

Geology 250k period and formation

Permian

- Pnpx - Permian, Parrabel bed
- Rgcd - Permian, Carrai Granodiorite

Carboniferous

- Pncx - Carboniferous
- Pnpf - Carboniferous, Pee Dee bed

Desktop review and sample selection

Oven Mountain Pumped Hdyro Energy Storage
Matarial characterisation
OMPS Pty Ltd
Figure 3.1

\\emmsvr1\emm3\2021\J210465 - OMPS EIS - Generation Component\GIS\07_Working\20220324_GiaConceptualisaton_HJN\G002_BoreLocationPlan_20220407_02.mxd 16/12/2022

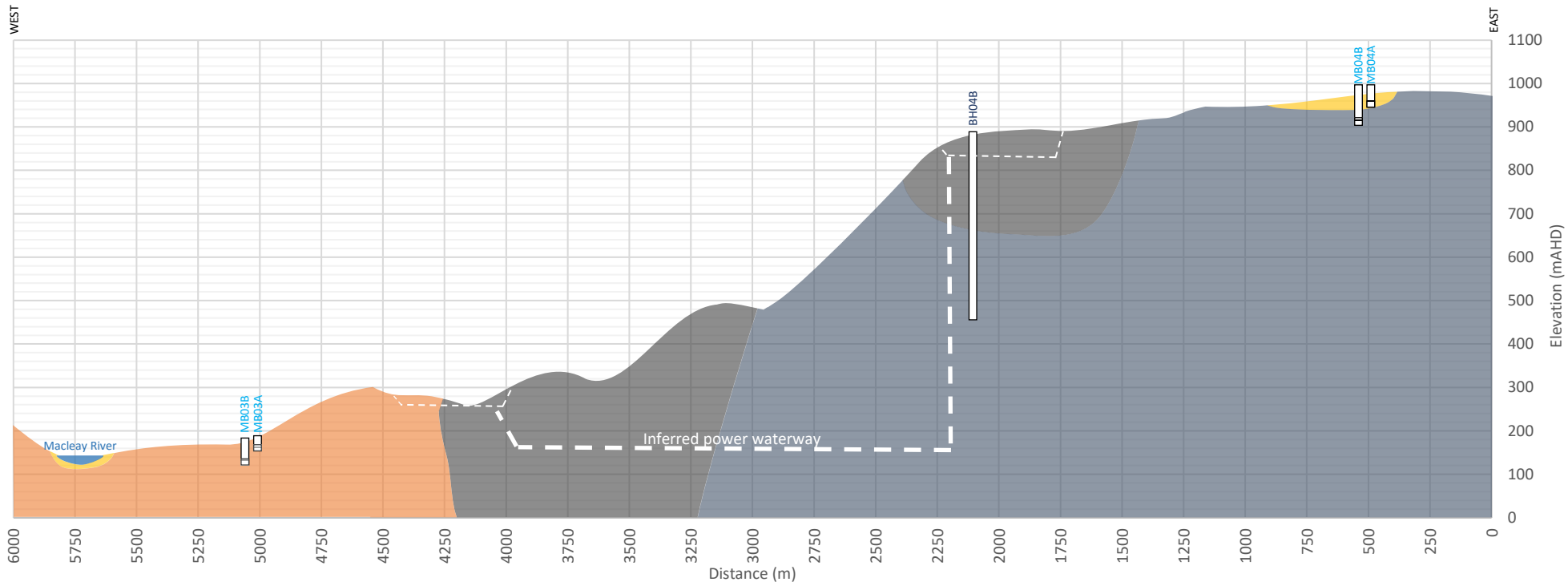
Source: EMM (2022); DPIE (2021); DFSI (2017); GA (2011); OMPS (2020); DPI (2003)

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GDA 1994 MGA Zone 56

N

EMM creating opportunities



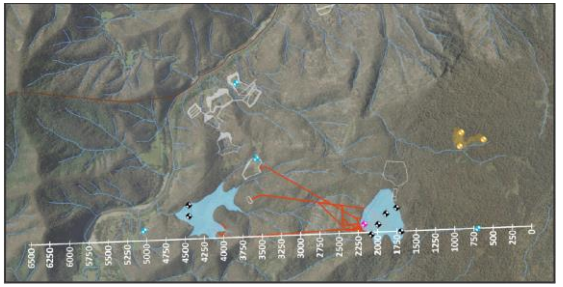
Legend

Inferred geological units

- Carrai Granodiorite
- Hornfels (undifferentiated)
- Parrabel Beds
- Colluvium/alluvium/residual soil

Drilling locations

- MB04A Hydrogeological bores (chip samples)
- BH04B Geotechnical borehole (core samples)



Conceptual geological section – Infrastructure alignment
OMPS Pty Ltd
Material characterisation
Figure 3.2
Not to scale, conceptual only

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4 Geochemistry assessment

4.1 Overview

Characterisation of the geochemistry within the Project area is essential to develop an understanding of risks associated with stockpiling excavated material (spoil). Stockpiling of spoil leads to oxidation of the minerals entrained in the geology which can result in:

- acidic or neutral rock drainage, typically caused by the oxidation of sulphides
- metalliferous drainage, typically caused by rainfall leaching of mobile metals.

The geochemistry assessment aims to understand (and mitigate, if required) the risks associated with mobilising contaminants during spoil stockpiling.

4.2 Assessment methodology

4.2.1 Historical data review

A desktop review was undertaken to provide preliminary characterisation of geological units. The elemental composition of sediment samples collected by BHP Minerals Limited, Pickands Mather and Co International, and PlatSearch NL during prospecting studies (refer Section 3.1) were downloaded from MinView (GSNSW, 2022).

It is understood that samples were collected from sieved stream sediments during mineral exploration in 1974, 1971 and 2010 respectively. The MinView database contained records of historical deposits (Diggers Creek Lode, Haydons Firetrail, Kempsey Armidale Road Prospect and unnamed) containing antimony and arsenic. Historical geochemistry sample locations are identified in Figure 3.1.

4.2.2 Sample collection

For the assessment of geochemistry two geotechnical bores were drilled by SMEC in October 2021 (BH4B) and July 2022 (BH4A). Geological core samples (core) were collected and stored. EMM completed a hydrogeological drilling program between October 2021 and March 2022, installing seven monitoring bores at the site. Geological chip samples (chips) were collected and stored in trays from each borehole.

Borelogs and photographs of the core and chips were reviewed to identify geological units and infer geochemistry characteristics. Borehole locations and sample depths were selected to:

- capture spatial variability across the Project area
- target potentially reactive geological units, as identified from site investigations and the outcomes of the desktop review (refer Chapter 3)
- characterise all identified geological units where significant spoil will be excavated during construction of the Project.

A summary of borehole locations and selection criteria is provided in Table 4.1.

Table 4.1 Borehole location rationale

Borehole	Sampling rationale
BH04B	Geotechnical borehole drilled to 444 metres below ground level (m bgl) and near the proposed pressure shaft. The borehole intersected hornfels and granodiorite with samples collected from both units.
MB01A	Located regionally off the Project alignment and representing potentially altered granodiorite (greisen).
MB02B	Located regionally off the Project alignment and representing a similar depth within the Carrai Granodiorite to the maximum proposed depth of the Project infrastructure.
MB03B	Located within similar geology to the proposed excavation footprint for the lower reservoir.

Samples were selected from the core and chips for analysis, to assess:

- likely waste classification (in accordance with the Waste Classification Guidelines, (EPA, 2014))
- the potential for leachability of contaminants (in accordance with the Waste Classification Guidelines, (EPA, 2014))
- acid rock drainage (ARD) and neutral rock drainage (NRD) properties, referred to collectively as acid based accounting (ABA) analysis.

Seven samples were analysed for waste classification and seven samples for ABA and metal and metalloid leachability properties. All samples were collected from either the core or chip samples and issued to ALS Environmental (Sydney) under chain of custody protocols for analysis.

Samples analysed to enable waste classification in accordance with NSW guidelines were conservatively tested for the full landfill suite, despite the negligible risk that spoil contains anthropogenic contaminants. The extended suite also acts as a baseline, prior to any major construction works. The elemental composition of the sediment samples was also compared to NSW waste class criteria. This provided a background as to what contaminants of potential concern (COPCs) may be present within the spoil, and locations where such elements are elevated within the site area. The locations of the historical sediment samples are presented on Figure 3.1.

The waste classification analytical suite included the below broad suite of analytes. Total elemental concentrations and deionised (DI) water leach testing were included in this investigation to assess the leachability of any contaminants tested. The waste classification suite included the following analytes:

- Metals and metalloids (arsenic, beryllium, chromium (hexavalent), cadmium, molybdenum, lead, mercury, nickel, selenium and silver). Note that the laboratory limit of reporting (LOR) for leachable metals are not appropriate for comparison to regulatory criteria intended for protection of aquatic ecosystems and drinking water.
- Inorganics – chloride, fluoride and sulphate.
- pH, electrical conductivity, alkalinity and moisture content.
- Total recoverable hydrocarbons (TRH).
- Total petroleum hydrocarbons (TPH).
- Chlorinated hydrocarbons.
- Benzene, ethylbenzene, toluene and xylenes (BTEX), semi volatile organic compounds (SVOC) and volatile organic compounds.

- Monocyclic aromatic hydrocarbons (MAHs).
- Organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs) and herbicides.
- Polychlorinated Biphenyls (PCBs).
- Polycyclic aromatic hydrocarbons (PAH) and phenols.
- Cyanide.
- Halogenated benzenes and halogenated hydrocarbons.
- Nitroaromatics and phthalates.
- Solvents and explosives.
- Amino aliphatics, amino aromatics and anilines.
- ASLP DI water leachable metal concentrations of 26 metals (silver, aluminium, arsenic, boron, barium, cadmium, chromium, copper, iron, manganese, molybdenum, nickel, lead, antimony, selenium, strontium, tin, uranium, vanadium, thallium, titanium, cobalt, zinc, gallium, tungsten and thorium).

ABA analysis included the analysis of:

- Net Acid Generation (NAG)
- Acid Neutralising Capacity (ANC)
- total sulphur (by LECO).

A summary of samples selected for analysis is provided in Table 4.2.

Table 4.2 Samples selected for analysis

Borehole	Depth (m bgl)	Rationale	Analysis requested
BH4B	2.39–2.51	Hornfels with hydrothermal vein	Waste Classification
BH4B	6.40–6.52	Hornfels with alteration veins	ARD and NRD
BH4B	22.05–22.30	Hornfels – with different colouring	Waste Classification
BH4B	39.74–39.91	Hornfels	ARD and NRD
BH4B	71.00–71.20	Water strike – potential hydrothermal alteration	ARD and NRD
BH4B	126.27–126.37	Granodiorite	Waste Classification
BH4B	148.17–148.36	Granodiorite – potential hydrothermal alteration	ARD and NRD
BH4B	388.00–388.13	Granodiorite	Waste Classification
BH4B	419.00–419.14	Granodiorite	ARD and NRD
MB01A	26.00–36.50	Granodiorite, with minor hornblende	ARD and NRD
MB02B	0.00–9.00	Residual granodiorite – Sand and sandy gravel	Waste Classification

Table 4.2 Samples selected for analysis

Borehole	Depth (m bgl)	Rationale	Analysis requested
MB02B	178.00–187.00	Granodiorite – with ferruginous staining	Waste Classification
MB03B	7.00–20.00	Mixed metasediment (7–11 m slate, 11–18 m hornfels and 18–20 m slate)	Waste Classification
MB03B	21.00–29.00	Metasediment – slate	ARD and NRD

4.3 Screening guidelines

4.3.1 Waste classification

As per the NSW EPA Waste Classification guidelines (NSW EPA 2014), results were screened against:

- *Contaminant Threshold criteria for General Solid Waste* (GSW) (CT1)
- *Specific Contaminant Concentration criteria for GSW* (SCC1)
- *Toxicity Characteristic Leaching Procedure Threshold criteria for GSW* (TCLP 1).

4.3.2 Acid and neutral rock drainage

Acid base accounting properties were assessed in general accordance with the AMIRA handbook (AMIRA 2002). Results are provided in Section 5.2.

As a comparison and to provide a reference of metal and metalloid concentrations, leachable metal and metalloid concentrations, were compared to:

- 95% species protection level against toxicants in fresh water (ANZG 2018)
- *Australian Drinking Water Guidelines for protection of human health and aesthetic values* (NHMRC 2022)
- OMPS groundwater quality (median and 95th percentile).

5 Results

5.1 Waste classification

- Laboratory results of samples analysed for the waste classification suite indicated that all reported results were below the contaminant threshold criteria for general solid waste (CT1).
- All reported results were below the specific contaminant concentration criteria for general solid waste (SCC1).
- All reported results were below the toxicity characteristic leaching procedure threshold criteria for general solid waste (TCLP 1).

5.2 Acid and neutral rock drainage

The seven samples tested for ARD and NRD properties were analysed for common acid base accounting (ABA) parameters and leachable metals and metalloids. The results of these analyses are tabulated in Table 5.1 and Table C and D (in Attachment B) attached and summarised in accordance with AMIRA (2002) guidance below. Table 5.1 presents the median and range in brackets of the results.

Table 5.1 Summary of acid base accounting results

Geology	Number of samples	Sulphur content (%)	Maximum Potential Acidity [MPA] (kg H2SO4/t)	Acid Neutralising Capacity [ANC] (kg H2SO4/t)	Minimum ANC/MPA ratio
Hornfels	3	0.05 (0.03–0.18)	1.5 (0.92–5.5)	14.8 (9.5–17.8)	2.7
Granodiorite	3	0.03 (0.005–0.91)	0.92 (0.15–27.8)	43.3 (7.2–59)	2.1
Parrabel Beds	1	0.16	4.9	18.7	3.8

The following summarises the results of the ABA testing:

- All samples were analysed for total percent sulphur (%S) with the maximum concentration reported to 0.91%.
- Acid neutralisation capacity (ANC) ranged from 7.2–59 kg H_2SO_4/t based on the laboratory reported total sulphur content.

A higher ANC/MPA ratio indicates a sample that is likely to be more acid consuming than producing, while a lower ratio indicates a sample that is likely more acid producing than consuming. An ANC/MPA ratio of 1.0 indicates that the maximum potential acidity equals the acid neutralisation capacity of the sample.

The ANC/MPA ratio was greater than two for all samples, indicating that all samples contain at least two times the acid neutralisation capacity compared to their maximum potential acid generation capacity. All samples are therefore considered to be non-acid forming (NAF). This is shown in Figure 5.1 and Figure 5.2.

- Net acid generation (NAG) testing includes reacting a soil or rock sample with peroxide to oxidise all sulphide minerals. At the end of the test, the pH of the solution is measured. If the oxidised pH is less than 4.5 the sample may generate acidity. The NAG pH for all samples was greater than pH 4.5 (range 4.6–10.6) and the maximum NAG (when back titrating the solution to a pH of 7.0) was reported to 3.5 kg H_2SO_4/t.

- Net acid production potential (NAPP) represents the difference between the amount of acid the sample may generate (MPA) and the sample's ability to neutralise acid (ANC). A positive NAPP value indicates that the sample may generate acidity and a negative NAPP value indicates that the sample's buffering capacity exceeds the acid generation potential. The calculated NAPP value was negative for all samples indicating that the samples are NAF.

Acid base accounting (ABA) classification is based on the calculated NAPP, NAGpH, ANC/APP and sulphur content. Samples are classified as acid consuming (AC), non-acid forming (NAF)-barren, NAF, uncertain (UNC) and potentially acid forming (PAF). The samples were classified according to the criteria presented in Table 5.2.

Table 5.2 Acid base accounting classification criteria

Classification	NAPP (kg H_2SO_4/t)	NAGpH	ANC/APP	%S
AC	<-20	pH >4.5	≥2	<0.1
NAF Barren	<0	pH >4.5	>1	<0.1
NAF	<0	pH >4.5	>1	<1.0
UNC	<0	pH >4.5	>1 and <2	>1.0
	>0	pH ≤4.5	<1	<0.1
	Samples that do not fit into other categories due to the discrepancies between factors			
PAF	>0	pH ≤4.5	<1	>1.0

Notes: Criteria developed with reference to the GARD Guide (INAP 2009) and the AMIRA International ARD Test Handbook (AMIRA, 2002). NAPP denotes net acid production potential, NAGpH denotes net acid generation, ANC denotes acid neutralisation capacity, APP denotes acid production potential, %S denotes total percent sulphur.

The results of the ABA testing are graphically presented in Figure 5.1 to Figure 5.4. The results indicate that all samples either do not generate significant acidity or contain sufficient acid buffering capacity to prevent acid generation. No samples are classified as PAF.

The distribution of the samples in relation to their NAPP and NAGpH is presented in Figure 5.3. NAGpH was also graphed against sulphur (%) in Figure 5.4.

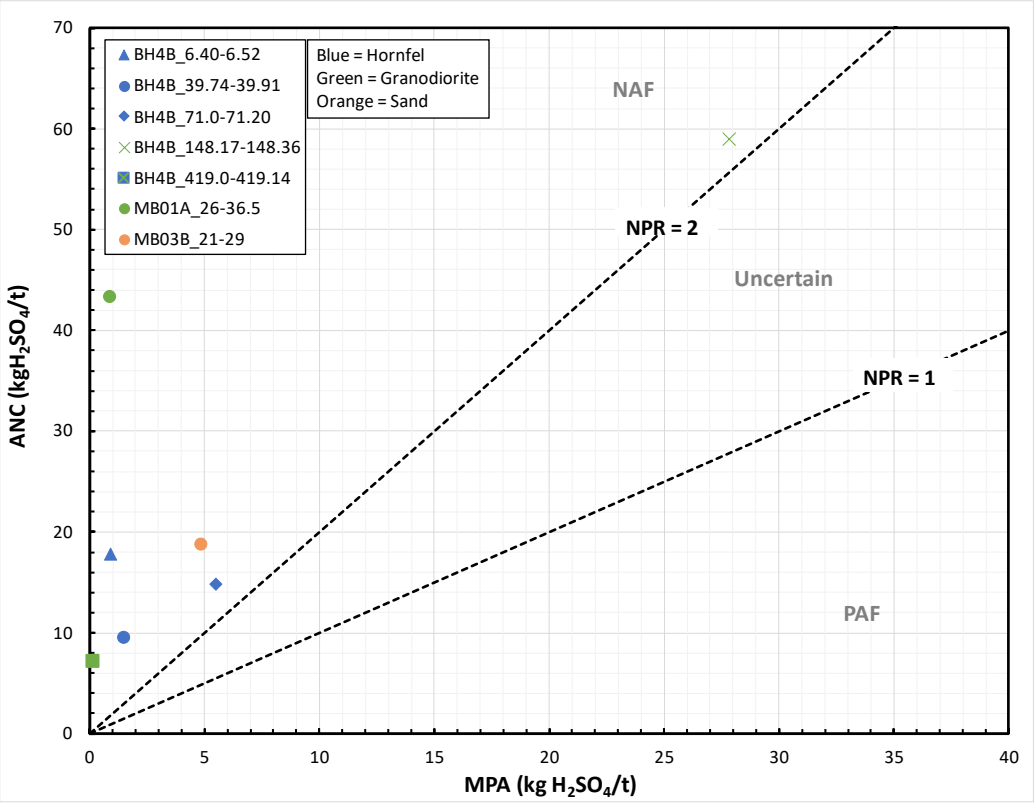


Figure 5.1 Laboratory analysis of ANC and MPA

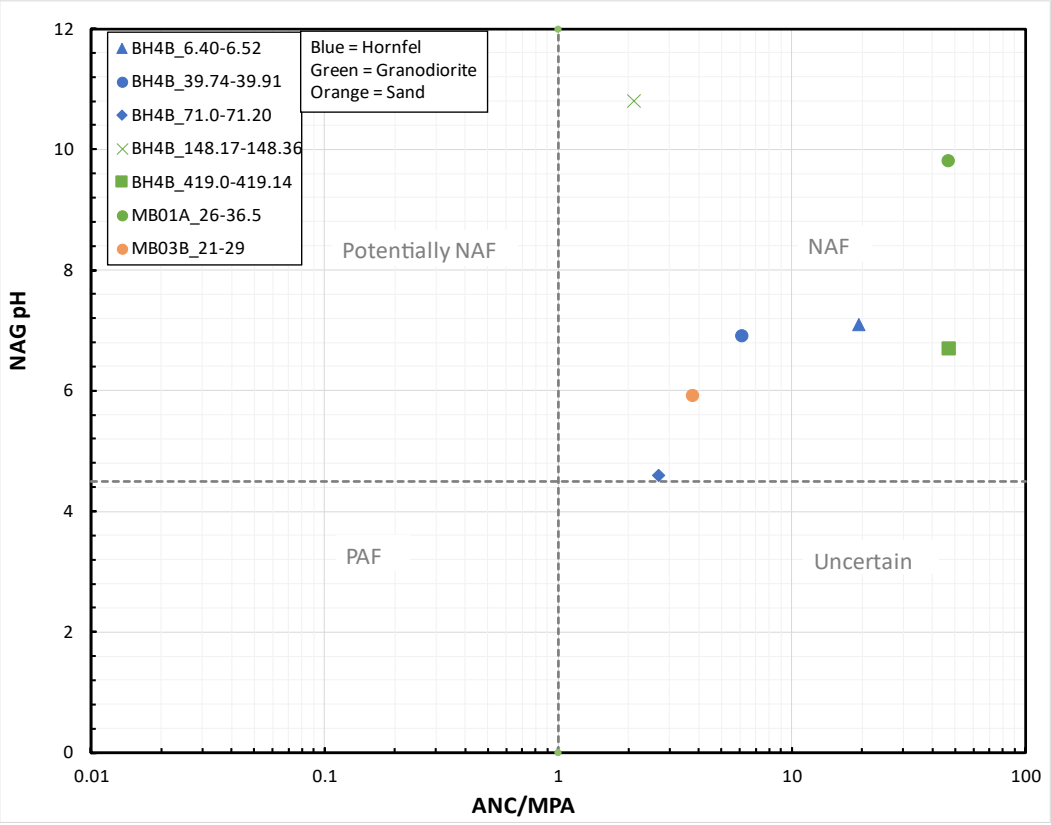


Figure 5.2 Laboratory analysis of ANC/MPA vs NAG pH

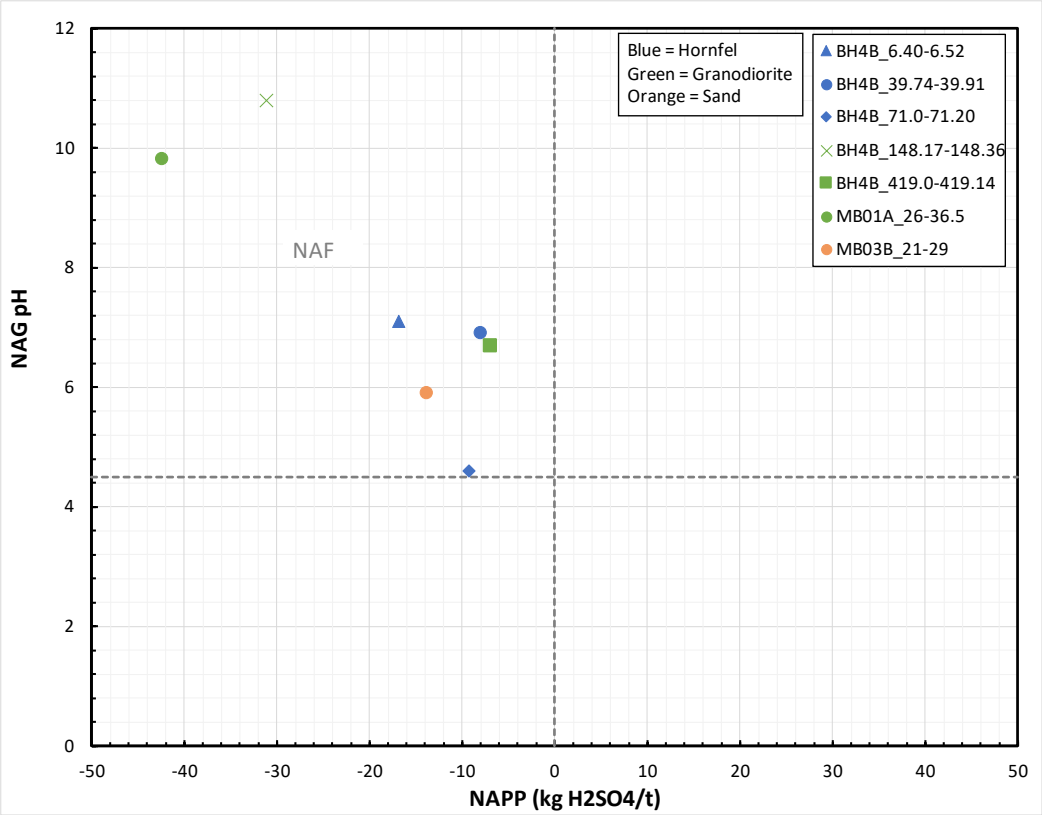


Figure 5.3 Laboratory analysis of NAPP and NAG_{pH}

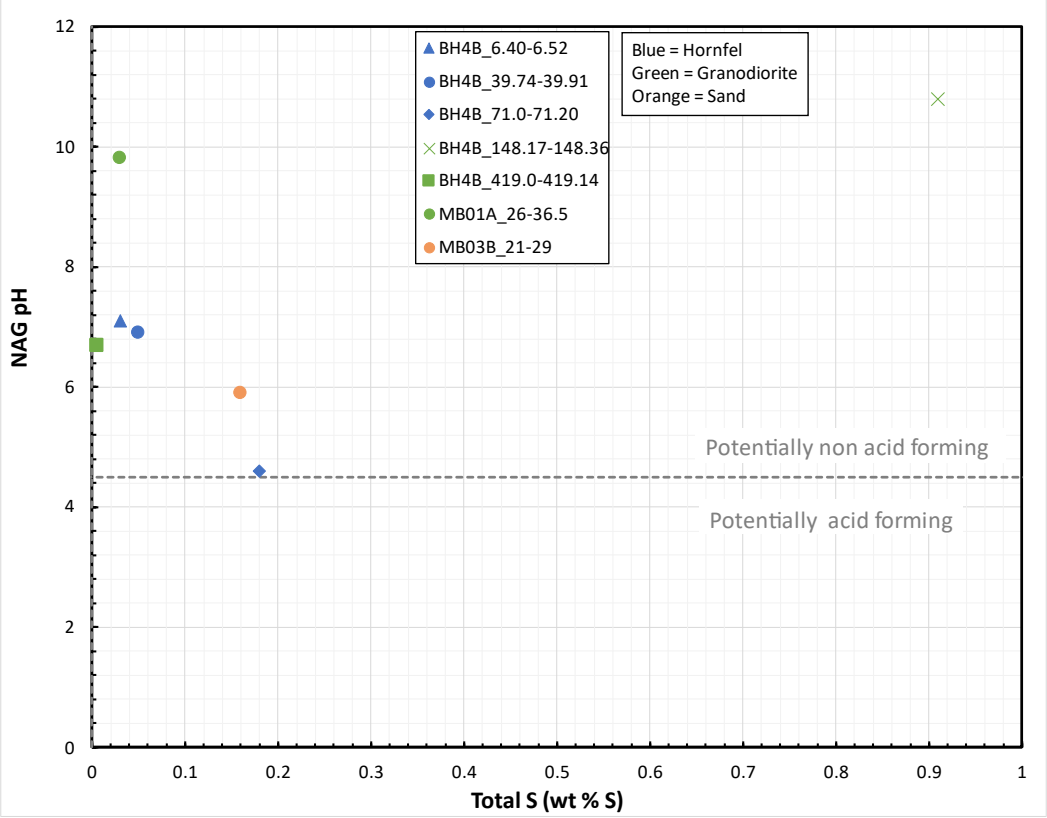


Figure 5.4 Laboratory analysis of NAG_{pH} and sulphur

5.3 Metalliferous rock drainage

Leachable metalloid concentrations from rock samples were compared against 95% species protection level against toxicants in fresh water, Australian Drinking Water Guidelines for protection of human health and aesthetic values, and OMPS groundwater quality data acquired prior to Project construction (see Attachment B, Table D). 95% freshwater guidelines are particularly conservative and were only used as a comparison. For some analytes the leachate LORs exceed the freshwater guidelines, therefore interpretation is being made within the limits of the analytical results. Pre-construction groundwater concentrations also exceed these freshwater guidelines for some analytes.

Leachate samples exceeded groundwater 95th percentile concentrations for aluminium, iron and one antimony sample. Elevated aluminium is likely due to the type of rock being analysed and iron is not toxic and doesn't have associated freshwater, health or aesthetic guidelines. The antimony concentration is only marginally above the 95th percentile groundwater value. Leachate results for all other metals and metalloids, including arsenic, antimony (except one sample) and zinc, reported concentrations within the range recorded in groundwater; groundwater concentrations were also above 95% freshwater guidelines, which suggests that some groundwater is more concentrated in these analytes and it is therefore unlikely that metals leached from rock material will impact the receiving groundwater onsite.

Some samples exceeded the freshwater guidelines for aluminium, arsenic, thallium, uranium, antimony, cobalt, cadmium, lead, silver, selenium, vanadium and zinc; health guidelines for arsenic and antimony, and aesthetic guidelines for manganese. These guidelines are particularly conservative and as some pre-construction groundwater samples already exceed some of these guidelines, it is not expected that these leachable concentrations will create an added risk onsite. It should also be noted that no leachable metals results exceeded NSW TCLP 1 waste classifications guidelines.

6 Summary and recommendations

6.1 Waste classification

Based on the field observations and analytical results evaluated herein, classification of spoil generated by the Project is provided in Table 6.1 below. The samples are considered to meet the NSW waste classification guideline's definition of virgin excavated natural material because the material does not consist of waste, and chemical testing indicates that the material does not leach metals or metalloids in excess of criteria for general solid waste.

Table 6.1 Waste classification

Steps	Category	Comment
Is the waste special waste?	Clinical and related waste present?	None observed
	Asbestos waste present?	None observed
	Waste tyres present?	None observed
Is the waste liquid waste?		No
Is the waste pre-classified waste?	Hazardous Waste	No
	General Solid Waste (putrescible)	No
	General Solid Waste (non-putrescible)	No
Does the waste possess hazardous characteristics?		None observed
Determining a waste's classification using chemical assessment:		Virgin excavated natural material
Is the waste putrescible or non-putrescible?		Non-putrescible
Overall waste classification:		**Virgin excavated natural material**
Estimated Volume		**5,500,000 m^3 ***

* Sample density was not selected based on the estimated excavation volume. Further sampling may be considered to confirm management strategies during construction phase.

6.2 Acid and neutral rock drainage

Based on the results presented in Section 5.2, all samples analysed for ABA properties were assessed as either acid consuming (one sample) or non-acid forming (six samples) with four of the samples containing less than 0.1% sulphur, indicating that those samples are barren of sulphur. These results indicate that there is a low risk that the spoil excavated will be acid generating.

A summary of the sample classifications is presented in Table 6.2.

Table 6.2 Core and chip classification

Borehole	Depth	Classification
BH4B	6.4–6.5	NAF Barren
BH4B	39.7–39.9	NAF Barren
BH4B	71.0–71.2	NAF
BH4B	148.2–148.4	NAF
BH4B	419.0–419.1	NAF Barren
MB01A	26.0–36.5	AC
MB03B	21.0–29.0	NAF Barren

Concentrations of leachable metals from rock samples are considered low and are generally below pre-construction groundwater conditions onsite. The risk of increasing metal concentrations through leaching is considered low.

Laboratory certificates of analysis are provided as Attachment C.

6.3 Closing

While the testing results are considered suitable for waste classification and for assessing geochemical risk of the bulk material expected to be encountered during construction of the Project, a monitoring program is recommended to be included in the water management plan to identify material that may contain concentrated metals, e.g. greisen. The number of samples analysed was not based on the volume of spoil that will be excavated during construction. It is estimated the spoil volume during construction to be approximately 5,500,000 bank cubic metres (BCM) (SMEC, 2022).

References

AMIRA 2002, ARD Test Handbook – Project P387A Prediction and Kinetic Control of Acid Mine Drainage, Ian Wark Research Institute and Environmental Geochemistry International, Pub. By AMIRA International Limited Melbourne, Australia

Australian and New Zealand guidelines for fresh and marine water quality, 2018, 95% species protection, freshwater default guideline values. Available at: https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/search

Colquhoun, G. P., Hughes, K. S., Deyssing, L., Ballard, J. C., Folkes, C. B., Phillips, G., . . . Fitzherbert, J. A. (2022). *Seamless Geology dataset, version 2.2 [Digital Dataset].* Department of Regional NSW. Maitland, NSW: Geological Survey of New South Wales

DJPR. (2020). *Soil and landform mapping.* Retrieved 06 29, 2022, from https://vro.agriculture.vic.gov.au/dpi/vro/neregn.nsf/pages/ne_soil_detailed_soil_survey

DoI. (2018). *Guidelines for controlled activities on waterfront land—Riparian corridors.* NSW Department of Industry.

DPE. (2022). *Planning Secretary's Environmental Assessment Requirements.* Planning Secretary's Environmental Assessment Requirements, Energy Assessments, Department of Planning and Environment, Parramatta.

DPI. (2013). *Policy and guidelines for fish habitat conservation and management.* NSW Department of Primary Industries.

DPIE. (2021). *Australian Soil Classification (ASC) Soil Type map of NSW.* Retrieved 06 29, 2022, from https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU

EMM. (2022). *Oven Mountain pumped energy storage - Stage one hydrogeological drilling and testing report.* Factual report, EMM Consulting Pty Ltd, Sydney.

EMM. (2022a). *Oven Mountain Pumped Hydro Energy Storage - Surface Water Impact Assessment.* Sydney: EMM Consulting Pty Ltd.

EMM. (2022b). *Oven Mountain Pumped Hydro Energy Storage - Biodiversity Development Assessment Report.* Sydney: EMM Consulting Pty Ltd.

EMM. (2022c). *Oven Mountain Pumped Hydro Energy Storage - Rehabilitation and closure strategy.* Sydney: EMM Consulting Pty Ltd.

EPA. (2014). *Waste Classification Guidelines – Part 1: Classification of waste.* Guidelines, NSW Environment Protection Authority, State of NSW, Sydney.

Fairfull, S., & Witheridge, G. (2003). *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings.* Cronulla: NSW Fisheries.

GSNSW. (2022). *Geological Survey of New South Wales.* Retrieved 08 11, 2022, from https://search.geoscience.nsw.gov.au/

Jessop, K., Daczko, N. R., & Piazolo, S. (2019). Tectonic cycles of the New England Orogen, eastern Australia: A Review. *Australian Journal of Earth Sciences, 66*(4), 459–496.

SMEC. (2022). *Oven Mountain Pumped Hydro Energy Storage Project - 15% Design.* Design report, SMEC Holdings Limited, North Sydney.

Streckeiesen, A. (1974). Classification and nomenclature of plutonic rocks recommendations of the IUGS subcommission on the systematics of Igneous Rocks. *Geologische Rundschau, 63*(2), 773–786.

Attachment A

Geological logs

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SMEC INTERNAL REF. 30018018

Geotechnical Investigation Report

Oven Mountain Pumped Hydro Energy Storage Project

Client Reference No. 30018018
Prepared for OMPS Pty Ltd
01 September 2022

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1 Introduction

1.1 General

This report presents the results of the geotechnical investigation carried out by SMEC Australia Pty Ltd (SMEC) for OMPS Pty Ltd (OMPS) at the proposed site location for the Oven Mountain Pumped Hydro Energy Storage Project (The Project).

The work was undertaken pursuant to the Consultancy Agreement for Engineering Services for the Oven Mountain Pumped Hydro Energy Storage Project between OPMS and SMEC dated 5 July 2021. SMEC was engaged by OMPS to complete a 15% Design for the Project and the geotechnical investigations are intended to inform that 15% design.

This report provides a Geotechnical Investigation Report (GIR) for the works completed at the proposed site under this engagement.

Rev.03 includes preliminary design parameters to support

1.2 Background

The Project is a 7,200 MWh 'off river' development located near the Macleay River, approximately 60 km southeast of Armidale and 70 km northwest of Kempsey in New South Wales. As part of the 15% Design, OMPS has commissioned SMEC to undertake site investigations at the proposed development site.

The site investigation services include onsite enabling and access works, geophysical testing, geotechnical and hydrogeological investigations (comprising borehole drilling, monitoring bore construction and monitoring), offsite laboratory testing, geological mapping and reporting.

SMEC has engaged EMM Consulting Pty Ltd (EMM) to assist with hydrogeological investigations by providing management, technical and supervisory resources required to plan, design, execute and document the Hydrogeological Investigation works.

The objectives of the site investigations were:

- To undertake investigations including geotechnical and hydrogeological drilling, geological mapping, geophysical surveys and laboratory testing;
- To provide geological, geotechnical and hydrogeological information to enable the preparation of relevant models to inform the 15% design of The Project and the Environmental Impact Statement (EIS);
- To install and test a series of groundwater monitoring bores across The Project area;
- To produce a Preliminary Geological Model for the site, as well as a Geotechnical Investigation Report (GIR) summarising the investigations. The Preliminary Geological Model is contained within the Geological Mapping Report.

Site Plan with investigation locations are shown on the plans provided in Appendix A.

1.3 Scope of Works

The geotechnical investigation at "The Project" site, was undertaken by SMEC, acting as Principal Contractor, and its sub-contractors. The scope of completed work comprised of the following activities:

- Preparation of the following management plans:
    - Construction Environmental Management Plan (completed by SMEC);
    - Drilling and Testing Plan (completed by SMEC);

  - Health Safety and Emergency Management Plan (completed by SMEC);
  - Site Access Plan (completed by SMEC);
- Landholder Access enabling works, including but not limited to:
  - Regulatory and environmental approvals for the investigations (completed by OMPS);
  - Landholder consultation and approvals (completed by OMPS);
  - Environmental surveys (completed by OMPS);
  - Cultural Heritage surveys (completed by EMM);
  - Vegetation clearances;
  - Temporary workers camp establishment;
  - Temporary access track, river crossing and drilling pad construction;
- Drilling, logging, and sampling of one (1) vertical geotechnical borehole;
- Drilling of one (1) vertical cored borehole to support the Hydrogeological Investigation Program (HIP)
- Water pressure (packer) tests in the hydrogeological borehole
- Downhole orientation and deviation survey of the geotechnical borehole;
- Laboratory testing and analysis of selected rock core samples;
- Five (5) Seismic Refraction Tomography (SRT) profiles;
- Factual reporting of the geotechnical investigation methodology and results.

2 Site Geology and Previous Studies

2.1 Previous Site Investigation

Between November and December 1996, SMEC carried out geological and geotechnical investigations at The Project site focussing on an earlier upper reservoir layout and the lower reservoir. The field program comprised the following activities:

- Field mapping and aerial photo interpretation, including production of detailed geological mapping of the upper and lower dam sites and quarry areas;
- Four (4) boreholes to 50 m located along the approximate centreline of one of the possible upper reservoir sites;
- One (1) borehole to 30 m investigating a potential granite quarry site;
- Two (2) boreholes to 50 m in the potential lower reservoir site;
- Permeability and groundwater measurements;
- Rock strength testing, petrographic studies and laboratory testing of potential aggregate and rockfill sources.

Three different geological units were found in the 1996 geotechnical investigation: Carrai Granodiorite, Hornfelsed Nambucca Beds sediments and metamorphosed sedimentary units of Nambucca Beds. The rock was generally of very good quality in terms of strength, weathering and defect prevalence and characteristics. Localised zones of deformation and alteration exist but are isolated and have little impact on the surrounding rockmass quality.

Full details of the geotechnical investigation, borehole logs, photos and test results can be found in*: Report on Geological Investigations* of the main Oven Mountain Pumped Storage Review report, dated January 1997 and previously issued to the client.

In February 2020 a site inspection was completed by SMEC personnel and memorandum was distributed to the client in a Geological Technical Note Memorandum. The intention was to gain an appreciation of the geology in the proposed project site and provide advice on different upper reservoir locations and proposed lower reservoir location.

2.2 Regional Geology

The Project is located within the Nambucca Block of the New England Orogenic Province. The Nambucca Block is a three to four kilometre thick sequence of Early Permian to Late Carboniferous sedimentary rocks, with minor felsic and mafic volcanic, and rare calcareous horizons (Gilligan et al. 1992). The Nambucca Block has undergone multiple phases of deformation, and thermal metamorphism. Regional Departmental mapping, by the Geological Survey of New South Wales (GSNSW) indicates predominantly orthogonal regional faults striking north-northwest to south-southeast, and west-southwest to east-northeast. There are, however, no major faults mapped within the project area (GSNSW, 2019). Limited detailed geophysical information is available for the area. Additionally, lithological contacts are not evident in regional geophysical surveys.

The project site is located on the western slope of the Carrai Plateau, which is underlain by a middle Triassic aged granodiorite intrusion. This intrusion was emplaced within the surrounding Late Permian metasedimentary strata and country rock of the Nambucca Beds Group. The top of the intrusion forms a relatively flat tableland, surrounded by deeply incised creeks and tributaries associated with the Macleay River. The Carrai Plateau is part of a chain of northwest- southeast trending belt of intrusive I-type granitoid bodies, located between Wauchope and Round Mountain (Gilligan et al. 1992).

2.3 Geological Units

The site geological mapping from 1996 has been reproduced in Figure 2-1 and Figure 2-2 below and overlayed mapping from the current investigation.

Geological units observed in the investigation are as follows:

- Carrai Granodiorite: pale grey to dark grey, fine to medium grained, porphyritic and equigranular, hornblende-biotite high to very high strength granodiorite.
- Hornfels: dark grey to brown, very fine to fine grained, weakly foliated, very high strength.
- Metasiltstone: dark brown to dark grey, generally slightly weathered and of high strength. More defects were observed in the meta-siltstone compared to the hornfels; most notably the increase in possible faults. These features could be interpreted as faults, indicated by zones of closely spaced joints and accessory joints that could imply shear movement or strain accommodation structures.

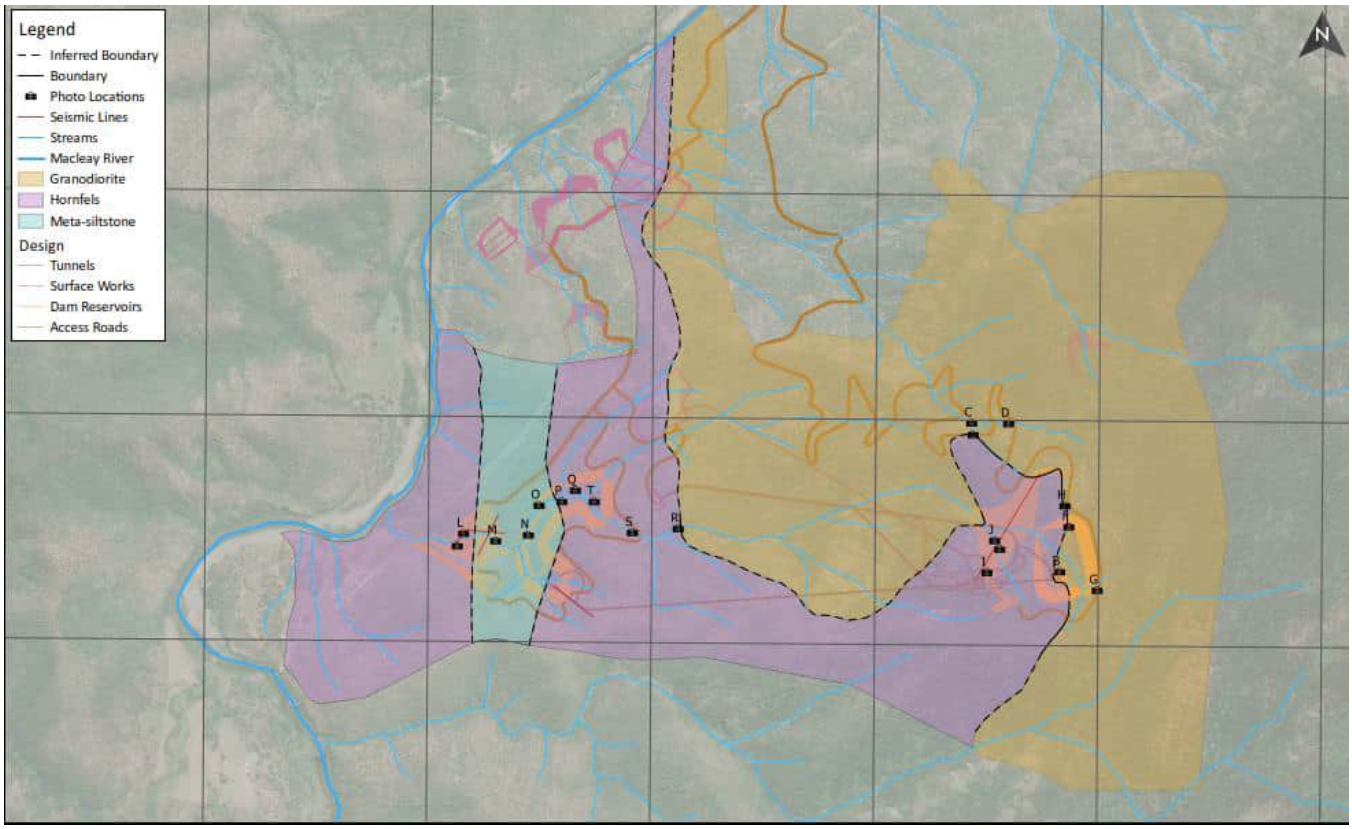


Figure 2-1: Regional geology of Oven Mountain (extracted from Appendix F)

3 Investigation Methodology

3.1 Geotechnical Scope of Works

The geotechnical investigation at the proposed project site, which is the subject of this report, was undertaken by SMEC, acting as Principal Contractor, and its sub-contractors.

The scope of completed work compiled within this report comprised of the following activities:

- Preparation of the following management plans:
    - Construction Environmental Management Plan;
    - Drilling and Testing Plan;
    - Health Safety and Emergency Management Plan;
    - Site Access Plan;
- Access enabling works, including but not limited to:
    - Site reconnaissance;
    - Regulatory and environmental approvals for the investigations (by OMPS);
    - Landholder consultation and approvals (by OMPS);
    - Environmental surveys;
    - Cultural Heritage surveys;
    - Vegetation clearances;
    - Temporary workers camp establishment;
    - Temporary access track, river crossing and drill pad construction;
- Drilling of one dedicated geotechnical boreholes (BH4B) and one combined geotechnical and hydrogeological borehole (BH4B);
- In-situ testing including:
    - Water pressure (Packer) testing in BH4A;
    - Verticality survey of BH4B
- Surface geological mapping;
- Surface geophysical investigations along five traverses (Seismic Refraction Tomography);
- Onsite storage of soil samples and rock core;
- Geotechnical and groundwater laboratory testing and reporting;
- Preparation of a Preliminary Geological Model and Geotechnical Investigation Report (GIR).

Investigation locations are shown on the plans provided in Appendix A.

3.2 Standards and Conventions

The site investigation and planned laboratory testing was undertaken with reference to the following standards:

- Standards Australia AS 1726-2017 Geotechnical site investigations (AS 1726);
- Standards Australia AS 1289 Methods of Testing of Soils for Engineering Purposes (AS 1289);
- Standards Australia AS 4133 – Methods of Testing Rocks for Engineering Purposes (AS4133);
- ASTM International, ASTM D5777-18 Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation (ASTM D5777-18);

- SMEC's internal logging guidelines and field procedures (Refer to SMEC Explanatory Notes – Appendix B).

3.3 Geotechnical Logging and Documentation

Borehole logging was completed by Engineering Geologists. Data was acquired electronically using Slate, SMEC's in-house logging software. This field data was exported from Slate for processing and import into Bentley System's gINT (version V10), with Datgel DGDT5, for graphic presentation.

All descriptions were recorded in accordance with Australian Standard AS 1726-2017 and SMEC's field logging standards. The draft geotechnical logs, core photos and explanatory notes are provided within Appendix B.

3.4 Investigation Sub-contractors

Specialist sub-contractors were engaged by SMEC to complete elements of the geotechnical investigation programme and are as follows:

- EMM Consulting: Hydrogeological Subconsultant
- Mulligan Geotechnical: Drilling Contractor
- Numac Drilling: Drilling Contractor
- Scurbat Geophysics: Geophysics Contractor
- Mining and Exploration Consulting (M&EC): Site supervision and Engineering geologist contractor
- Macquarie Geotechnical: Geotechnical Laboratory Testing
- Turnbull Industries (TI): Earthworks Contractor.

Each sub-contractor was inducted into the project Health, Safety and Environmental Management Plan prior to commencing work on site.

3.5 Site Access Enabling Works

Based on the current scope of work, various enabling works were required to facilitate safe access to investigation locations for personnel, plant, equipment and vehicles. The scope of enabling works includes:

- Upgrades to existing access tracks;
- Establishment of new access tracks;
- Vegetation clearing for new access tracks;
- Drill site construction;
- Establishment of temporary camp sites.

TI was sub-contracted by SMEC to supply and operate the machinery to perform the site access enabling works. After the reconnaissance works and ecological assessment by EMM, TI has performed the track clearance and improvement to BH4B between 30 September and 6 October 2021 and to BH1 and BH2 on 18 October 2021.

3.5.1 Existing Track Upgrades

Existing site access tracks were utilised as much as practicable with minor improvements undertaken throughout the program.

Site access to the lower reservoir area was via the George's Junction Camping Ground, Macleay River Trail and existing tracks within the private property.

Site access to the upper reservoir in the eastern side of The Project area was via Cochranes Fire Trail and then Peach Tree Creek Trail and the existing bush fire trail and old forestry trails.

From these two site access points, the existing access tracks within the investigation envelope were used as far as practicably possible. Minor disturbance to existing access tracks was required to facilitate safe site access for workers. Examples of any disturbance includes:

- Removal of soft, wet or boggy areas
- Placement of clean fill material (including geofabric separation) across drainage depressions to enable vehicles to safely cross 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
- Widening some sections of the existing track to provide enough clearance for the various types of machinery and vehicles required for the geotechnical investigation. This included clearing of some trees and vegetation close to the edges of the track.

3.5.2 New Access Track Construction

The establishment of new access tracks from where existing tracks finished was required in some areas to provide access to the borehole locations (BH1, BH2 and BH4). The final location of these new access tracks was determined within the investigation envelope.

A section of new access track was constructed from the Peach Tree Creek Trail, approximately 3m wide and was established by:

- Clearing mid-storey and ground vegetation where necessary;
- Using a bulldozer (D6 type dozer) and 20t excavator to clear the access track;
- Surface grading and placing gravel fill over a geofabric layer in some sections to assist with trafficability for vehicles, particularly for wet weather conditions and sandy soils.

These access tracks were required to provide access for drilling and support equipment to ensure safe and reliable access during the work, as well as for ongoing access to monitoring installations after completion of drilling.

A temporary laydown area was located adjacent to the new access track for storage of vehicles, water tanks and drilling supplies.

The access track from Peach Tree Creek Trail to BH1, BH2 and BH4B, comprises a section of improved existing track which was connected to a new cleared track, providing access to the borehole locations.

3.5.3 Temporary Camp Construction

A temporary worker's camp was established to accommodate geotechnical investigation personnel for the duration of site works. The camp was located at Cochrane Firetrail, Carrai NSW, in private property and measured approximately 50 m wide by 150 m long.

Prior to commencing any camp construction activities, the camp site was prepared by trimming long grass and setting up boundaries with flagging tape.

The camp construction was completed by 26 October 2022 and involved mobilisation of trailers and equipment and connection of ancillary services (power, plumbing, etc.). The temporary camp included the following infrastructure:

- Accommodation trailers and caravans;
- Toilets and laundry facilities;
- Storage container for equipment;

- Diesel generator;
- Self-bunded diesel storage;
- Potable and non-potable water supply;
- Telecommunications booster.

3.5.4 Drilling Pad Construction

A drilling pad was constructed for BH4B and is about 15 m wide by 15 m long. A Komatsu D65 bulldozer was used to clear vegetation within the area and level the ground surface. Figure 3-1 presents the drill rig set up for BH4 after drilling pad construction.



Figure 3-1: Drilling pad set up at BH4 location

3.6 Investigation Locations Set Out

Borehole locations were set out by the SMEC Field Supervisor using handheld GPS devices using both the GPS and GLONASS systems, and were typically considered accurate to ±5 m, depending on satellite coverage at the time. Where multiple GPS devices were available, the borehole location was triangulated from the average central position between devices. After borehole locations were set, elevations were extracted from Lidar dataset supplied by client.

3.7 Geotechnical Drilling Investigation

3.7.1 Borehole Details

The geotechnical drilling program at the Upper Reservoir was undertaken by SMEC between the 19 October 2021 and 26 February 2022, with drilling services provided by SMEC sub-contractor Mulligan Geotechnical. BH4b was drilled from 0m to 136.93m using a track-mounted Boart Longyear DB520 and swapped out with a track-mounted Alton MD600.The proposed BH4b site was originally situated on a very steep hill with difficult access. To avoid extensive cut and filling to access the site, the borehole was repositioned approximately 95m south on a level site. To target the machine hall of the project, a revised inclination of the borehole was determined prior to drilling.

Drilling methods utilised by the drilling contractors on site with borehole coordinates and grouting details are summarised in Table 3-1 and Table 3-2, respectively. Coordinates are provided in MGA2020 Z56/AHD. Borehole location plans are presented in Appendix A.

Table 3-1: Summary of drilling methods utilised during Oven Mountain site investigation.

Borehole ID	From (m)	To (m)	Easting (m)[1]	Northing (m)[1]	Elevation (m)[2]	Method	Drilling Contractor
BH4 B	0.00	444.31	421495	6591280	883.80	HQ3 Coring	Mulligan Geotechnical
BH4A	0.00	77.8	421495	6591273	883.80	PQ Coring	Mulligan Geotechnical

Note: (1) Easting and Northing from handheld GPS
(2) Elevation from Lidar

Table 3-2: Summary of grouting borehole BH4 B.

Borehole ID	Date	Top of grout level (m)	Bottom of grout level (m)	Total grouted section (m)	Estimated grout loss in fracture (L)[1]
BH4 B	23/10/2021	92.30	99.70	7.40	56.00
BH4 B	28/10/2021	135.50	136.93	0.43	77.00
BH4 B	08/11/2021	202.50	206.94	4.44	108.00
BH4 B	17/11/2021	208.48	231.08	22.60	54.00
BH4 B	18/02/2022	43.00	67.00[2]	24.00	0.00
BH4 B	19/02/2022	NA	110.00[2]	NA	Plug failed
BH4 B	20/02/2022	207.00	234.00[2]	27.00	50.00
BH4 B	26/02/2022	417.00	444.00	27.00	Not measured[3]

Note: (1) Rounded to nearest litre unit.
(2) Van Ruth plug set at referred depth.
(3) Not measured due to site evacuation

3.7.2 Drilling and Sampling

Borehole drilling was supervised on a full-time basis by either SMEC Engineering Geologists and/or a sub-consultant Engineering Geologist. The Engineering Geologist supervisor was responsible for logging encountered strata, collecting samples for testing, boxing, recording observations regarding drilling and groundwater levels.

Strata descriptions and observations were recorded using SMEC's in-house logging sheet and transferred to a logging software (Slate).

The primary drilling fluid utilised was water, however additives (biodegradable polymers) were utilised for the recovery of drill cutting and to improve penetration rates and borehole stability. The additives included:

- Haliburton POLYBORE: Borehole Stabilising Dry Polymer
- Baroid PENETROL: Non-ionic Wetting Agent

- AMC LIQUI POL: Borehole Stabilising Liquid Polymer.

The estimated volume of drilling fluid loss was recorded whilst drilling. Fluid loss indicates fractured/permeable zones in the rock mass. Total loss of circulation was experienced in BH4B and depths were recorded. Grouting within the fractured rock sections was carried out in order to minimise the water loss as much as possible. The grout mix consisted of Portland (GP) cement and water.

3.7.3 Point Load Testing

Point load index strength tests were undertaken on representative samples of rock core from BH4B only on site in general accordance with Australian Standard AS 4133.4.1. The testing frequency was usually one test (axial and diametral) per meter or if difference in weathering/strength was noticed. The test results are shown on the borehole logs and reports with test details are provided in Appendix C.

The core boxes were labelled, photographed (with colour standard and scale), and transferred to a temporary storage at the Camp Site, before being transferred to a more permanent storage location in Kempsey.

3.8 Laboratory Testing

A program of laboratory testing was prepared for rock samples obtained during the geotechnical site investigation from BH4B, to classify and assesses the engineering characteristics of the encountered materials. Samples were dispatched to Macquarie Geotechnical NATA-accredited laboratory in Alexandria, NSW, for testing. Summary of the scheduled testing for rock samples is presented in Table 3-3.

The tests results NATA accredited laboratory test certificates are included in Appendix D.

Table 3-3: Summary of geotechnical laboratory testing on rock core samples from BH4B.

Depth From (m)	Depth To (m)	Unconfined Compression Strength	Unconfined Compression Strength with Young's Modulus, Poisson's Ratio / and Sonic Velocity	Tensile Strength	Multi-Stage Direct Shear on Rock Defects (Peak Only)	Slake Durability Index	Petrographic Analysis	Cerchar Abrasion	Sievers J Number	Abrasion Value Cutter and Cutter Life Index	Goodrich Drillability and Wear Number	Acid Rock Drainage NAPP, NAG	XRF Testing	Durability / Aggressivity Suite (pH, EC, CL, S04)	Total Arsenic and Antimony	Wet / Dry Strength Variation
5.00	5.26					✔										
9.56	9.90	✔														
16.15	16.40	✔														
18.00	18.14						✔						✔			
4.85	5.00													✔	✔	
14.29	14.57											✔				
46.01	46.27	✔														
66.00	66.36		✔													
89.00	89.36	✔														
94.64	94.86						✔						✔			
98.00	99.00					✔		✔	✔	✔	✔					
129.10	129.31	✔														
126.00	126.27		✔													

93.41	93.77				✓										
97.86	98.00										✓		✓	✓	
64.19	66.00					✓		✓	✓	✓	✓				✓	
134.62	135.00	✓													
173.62	174.00	✓													
182.77	183.00			✓											
200.00	200.85							✓	✓	✓	✓	✓			
200.85	201.00	✓													
213.00	213.17						✓						✓		
264.00	264.20	✓													
268	270	✓													✓
300	300.16													✓	✓
301.00	302.00	✓	✓	✓											
327.00	327.11													✓	✓

3.9 Verticality Survey

Two (2) verticality surveys were performed in BH4B by SMEC's sub-contractor, M&EC, who completed these surveys under the direct supervision of a SMEC representative. The results of the performed surveys are summarised in Table 3-4 and reports are presented in Appendix E.

Table 3-4: Summary of verticality survey in BH4B

Borehole ID	Date	Ground level (m)	Bottom level (m)	Mean deviation (degrees)
BH4 B	04/11/2021	0	135.99	1.24 to N80.45
BH4 B	03/12/2021	0	229.99	1.42 to N86.31

3.10 Geological Mapping

The results of the supplementary geological mapping undertaken by SMEC are presented in Appendix F.

3.11 Geophysical Seismic Survey

3.11.1 Field operations

Seismic Refraction Tomography (SRT) data acquisition was undertaken by SMEC's geophysical sub-contractor, Scurbàt Geophysics and Projects Pty Ltd (Scurbàt) between 14 and 28 September 2021.

Fieldwork was carried out in the presence of an experienced geophysicist and seismic field manager. Daily operations and data acquisition were managed by Scurbàt. All reasonable measures were undertaken to ensure the acquisition of good quality data that was adequate for analysis and interpretation. In general, these measures included:

- Daily assessment and monitoring of short term and long-term weather forecasts;
- Adherence to QA procedures and QC checks on all acquired seismic data;
- Monitoring of local hazards including terrain, access and bushfire threats.

3.11.2 Seismic Refraction Fieldwork Methodology

The SRT investigation was carried out in accordance with ASTM D5777-18. The seismic data was acquired with a 48-channel digital seismograph system (Geometrics Geodes) with an array of geophones placed at the ground surface at intervals of 5 m. Geophones were rigidly coupled with the ground by pressing 75 mm tapered spikes on each geophone base into the soil or using a triple tip rock-plate mounting over rocks. A two-geophone overlap was used between adjoining seismic spreads with source locations positioned at nominally 10 m to 20 m intervals. A minimum of two offsets off each end source positions were located of the end of each spread to provide full reversed coverage over an anticipated rock refractor.

A total of 1335 m of seismic refraction lines (7 spreads and 158 seismic shots) were acquired during the survey. Table 3-5 summarises the locations and statistics from the seismic refraction survey, with coordinates in MGA2020 Zone 56.

Table 3-5: Summary of seismic refraction traverse locations and statistics.

Line ID	Easting Start	Northing Start	Easting End	Northing End	No. Spreads	No. Shots	Line length (m)
SR01	421449.6	6591287.9	421734.3	6591762.7	3	62	575
SR02	419739.9	6591112.6	419564.3	6591249.0	1	22	235
SR03	419222.9	6591382.1	419311.4	6591562.7	1	31	235
SR04	419104.9	6591418.9	419179.0	6591499.1	1	18	115
SR05	419177.4	6591493.7	419341.1	6591482.6	1	25	175

SRT investigation lines were proposed by SMEC concurrent to the geotechnical investigations that had occurred prior to the commencement of the geotechnical drilling. During this time, start and end positions were located using stakes placed at the ground surface by handheld GPS capable of accuracies better than 1 m. Seismic field crew checked the start and end positions with handheld positioning systems and commenced field surveying between the survey stakes located in the field. The SRT was performed along the seismic line until obstruction or where survey geometries required lines to be extended, truncated, or adjusted in consultation with the SMEC team.

The levels along the seismic lines were recorded using a laser level relative to the line start and end positions. Elevation information from temporary benchmarks were used to adjust the levels to elevations in Australian Height Datum (m AHD).

A sledgehammer of 8 kg was used as an energy source for the survey. Following each energy shot an assessment of the seismic P-wave first-arrivals were observed on the digital display of the seismograph field computer prior to storing the files.

3.11.3 Data Processing, Analysis and Results

The recorded seismic data was transferred from the field and reviewed on daily basis by a SMEC Senior Geophysicist for quality purposes. The data was assessed to be of good quality and adequate for analysis and interpretation.

The software used to process the seismic data included:

- Seismodule Controller Software (SCS) acquisition software was used to record the seismic data.
- Rayfract v4.02 seismic processing software was used to preliminary pick the first breaks of the seismic records, with signals filtered where needed using filtering frequency band-pass and Fast Fourier Transformation (FFT) band pass filtering.
- Rayfract v4.02 tomographic software was used for inversion of the seismic data.

The Tomographic SRT results are presented in PDF format in Appendix G.

3.12 Hydrogeological Investigation Program

SMEC engaged EMM on behalf of OMPS to undertake the fieldwork component of the Hydrogeological Investigation Program (HIP).

The results of the HIP drilling and testing program are presented in Appendix H.

3.13 Water Pressure Tests

The in-situ permeability of the rock mass within BH4A was assessed by way of water pressure (Lugeon or packer) tests. The methodology and results from the water pressure tests are presented in Section 4.3. Generally, water pressure tests were undertaken at 6.0 m intervals within the boreholes across the length of the rock intersection. Water pressure tests were undertaken by Mulligan Geotechnical under the direct supervision of a SMEC Geotechnical Engineer or Engineering Geologist.

Results of water pressure tests are presented in Appendix I.

4 Investigation Results

Results of the investigation are provided in the subsections below. EMM has prepared a separate report for the hydrogeological investigations, which is presented in Appendix H.

4.1 Geological Units

Based on the available data from the most recent geotechnical investigation in BH4B and BH4A, soil and rock units have been classified into multiple Unit ID's. These include one soil unit (Unit 1) and three bedrock units (Units 2A, 2B and 3). The preliminary geological unit system is summarised in Table 4-1.

Table 4-1: Geological soil and rock units of BH4B.

Unit ID	Geological Unit	Description
1	Residual soil	Silty clay of medium plasticity with fine to coarse grained, sub-rounded to angular weathered hornfels gravel, very stiff to hard
2A	Metamorphic rock: Hornfels	Hornfels, highly to slightly weathered, low to medium strength
2B	Metamorphic rock: Hornfels	Hornfels, slightly weathered to fresh rock, high to very high strength
3	Igneous rock: Carrai Granodiorite	Granodiorite, fresh rock, very high strength
4	Metasediments*	Meta-Siltstone; Dark brown to dark grey and blue in some locations. Generally slightly weathered and of high strength. More defects were observed in the meta-siltstone compared to the hornfels; most notably the increase in possible faults.

* Not encountered within BH4B and BH4A but observed during geological mapping and in previous investigations. Reference should be made to the geological mapping report presented in Appendix F for further detailed information on geological units encountered across the project site.

4.1.1 Description of defects and structures

Most granodiorite defect surfaces observed in BH4B were planar and rough. Hornfels joints were generally planar and smooth or slickensided. Both rock types had joint coatings consisted of chlorite, quartz and pyrite, although many were clean.

Detailed analysis of defects and structure encountered within BH4A has not been undertaken as the purpose of the borehole was to construct a groundwater monitoring bore as part of the hydrogeological investigation program.

BH4A was cored using PQ coring methods due to the difficulties in mobilising an air compressor to the drill location to undertaken air percussion drilling at that location.

4.2 Laboratory Testing

The following subsections summarise the laboratory test results of site materials.

4.2.1 Point Load Tests

A summary of results for the completed Point load Tests (PLTs) on BH4B core samples is provided in Table 4-2 and graphically presented in Figure 4-1 for each of the two defined rock groups. Test results presented are those which failed through intact rock only. To allow assessment of any strength anisotropy, axial and diametral test results are also shown separately. When reviewing the results, the number of completed tests should be considered. Testing has mostly been completed on slightly weathered to fresh rock.

Table 4-2: Summary of PLT results

Rock Group	Test count	AS1726 Average Strength Term	PLT Is50 (MPa)	
			Min	Max (1)
All tests				
Hornfels	105	Very High	0.51	5-7
Granodiorite	110	Very High	0.1	5-7
Diametral tests only				
Hornfels	85	Very High	0.51	5-7
Granodiorite	90	Very High	0.96	5-7
Axial tests only				
Hornfels	20	Very High	0.55	NA (2)
Granodiorite	20	Very High	0.98	NA (2)
No failure (>20kN)				
Hornfels	60	Very High	5-7	NA (3)
Granodiorite	102	Very High	5-7	NA (3)

Notes: (1) Maximum Is50 strength from point load tests was not obtained because the testing unit is only safely rated to 20kN, giving an Is50 of between 5-7MPa.
(2) Axial tests were not undertaken on samples were diametral tests did not reach failure.
(3) Maximum PLT Is50 cannot be determined with samples do not reach failure.

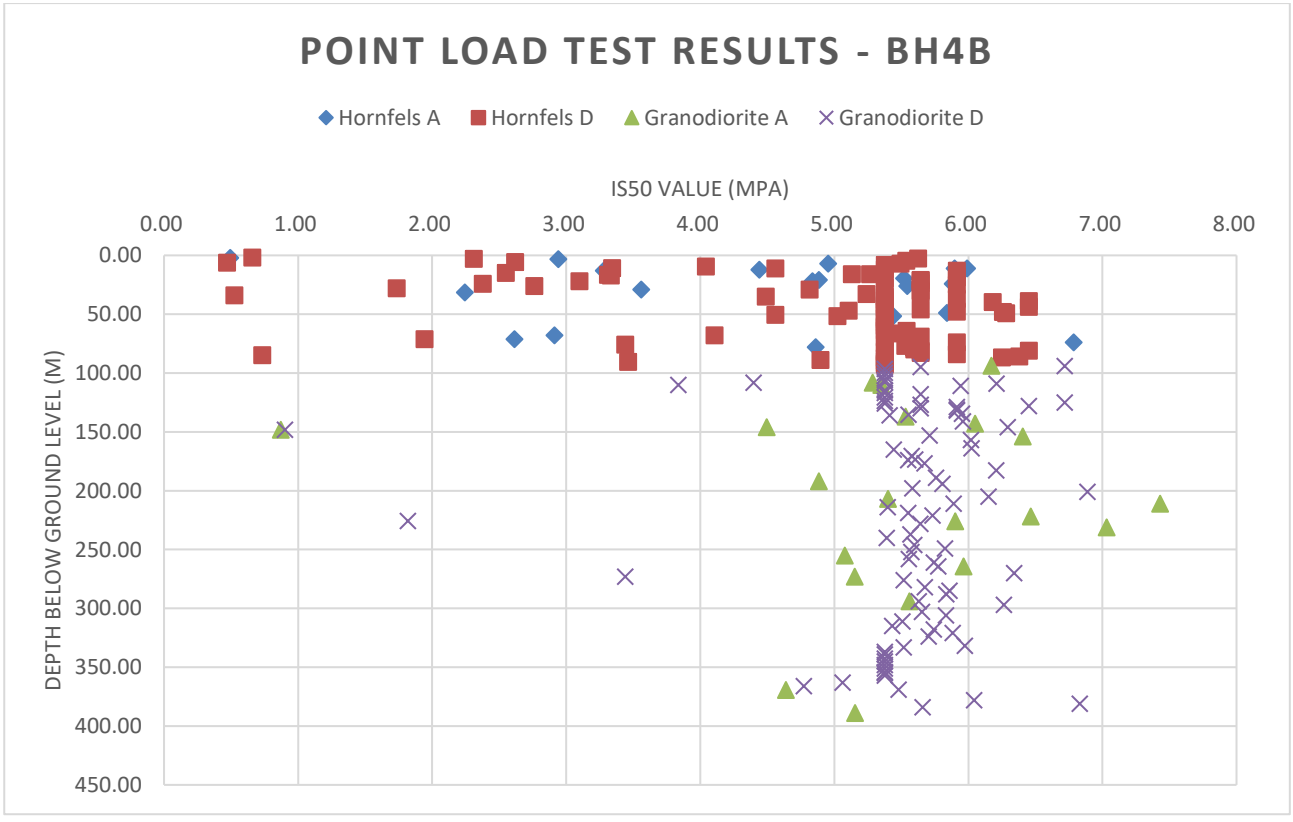


Figure 4-1: Point Load Results for BH4 B

The information shows the following intact rock strengths, for slightly weathered to fresh rock:

- Hornfels – typically very high intact strength.
- Granodiorite - typically very high intact strength.

Test results are considered consistent with published literature for similar rock types, and also qualitative field strength estimates.

No evidence for significant anisotropy has been identified by the PLTs, but the limited testing should be noted.

Limited testing has been completed on weathered rock. The limited PLT completed on weathered rock suggests highly weathered rock is of very low to medium strength, dependent on the degree of weathering and rock fabric and structure.

4.2.2 Unconfined Compressive Strength Testing

Limited UCS testing has been completed on selected samples from BH4B only. The results of the UCS tests are shown in Table 4-3, together with other geomechanical properties of the rock recorded as part of the testing. Again, results are considered representative of slightly weathered to fresh rock and are representative of intact rock properties. Figure 4-2 represents them graphically.

Table 4-3: Summary of UCS test results (BH4B) – including other geotechnical properties of the intact rock

Rock Group	BH4B Depth (m)	NMC (%)	Dry density (t/m3)	Wet density (t/m3)	UCS (MPa)	Young Modulus (GPa)		Poisson Ratio	
						Tangent	Secant	Tangent	Secant
Hornfels	9.56 -9.90	0.2	-	-	142	-	-	-	-
Hornfels	16.15-16.40	0.2	-	-	121	-	-	-	-
Hornfels	46.01-46.27	0.1	-	-	113	-	-	-	-
Hornfels	66.00-66.36	0.0	2.70	2.70	143	73.3	76.6	0.13	0.13
Hornfels	89.00-89.36	0.1			173				
Granodiorite	126.00-126.27	0.0	2.64	2.65	126	83.2	83.6	0.12	0.10
Granodiorite	129.10-129.31	0.4	-	-	123	-	-	-	-
Granodiorite	134.62-135	0.2	-	-	103	-	-	-	-
Granodiorite	173.62-174.00	0.4	-	-	163	-	-	-	-
Granodiorite	200.85-201.00	0.5	-	-	221	-	-	-	-
Granodiorite	264.00-264.20	0.4	-	-	148	-	-	-	-
Granodiorite	268.00-268.31	0.3	-	-	118	-	-	-	-
Granodiorite	301.00-301.30	0.0	2.60	2.61	209	133.0	83.8	0.24	0.24
Granodiorite	301.60-302.00	0.4	-	-	176	-	-	-	-

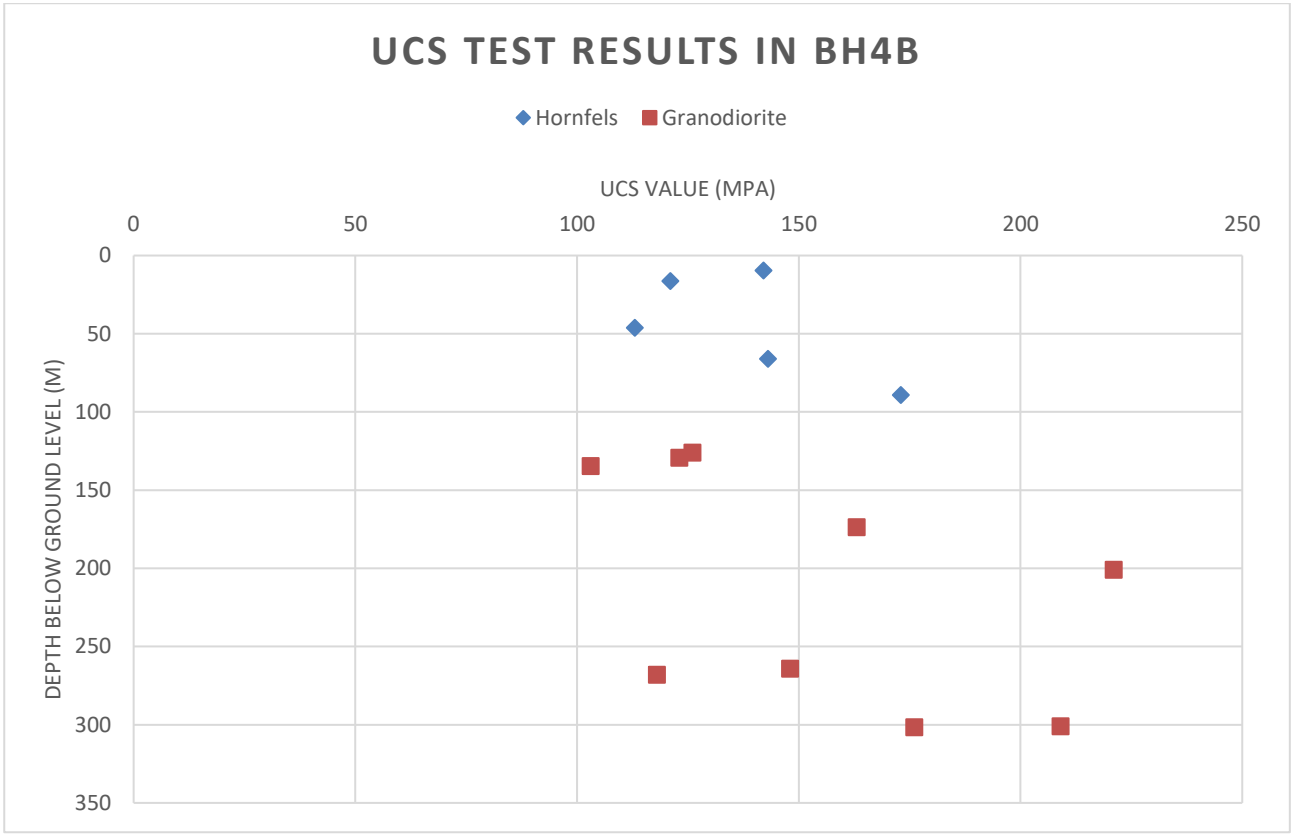


Figure 4-2: UCS test results for BH4 B

4.2.3 Rock Quality Designation (RQD)

Rock Quality designation (RQD) can provide an indication if defect spacing less 0.1m is present in a sample area. The general classification of RQD for BH4B is shown in Figure 4-3. RQD has not been analysed for BH4A.

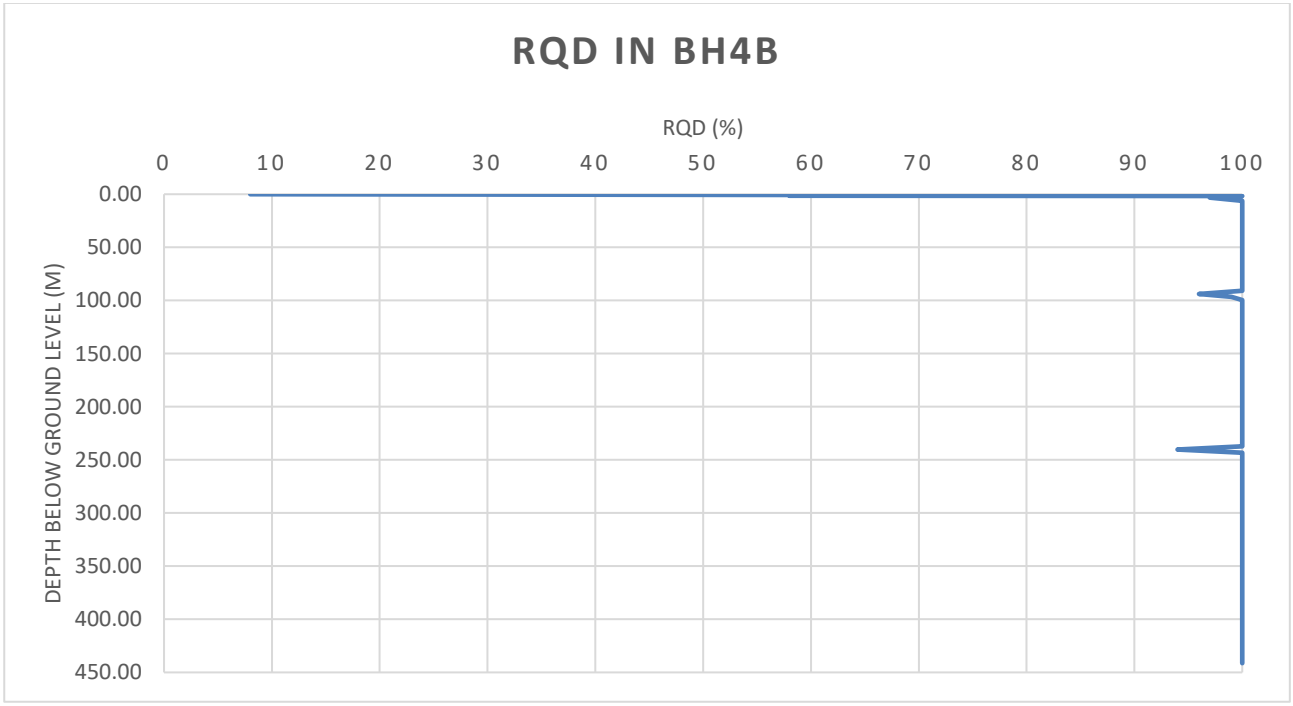


Figure 4-3: RQD values for BH4 B

The logged RQD values suggest:

- Logged RQD is generally greater than 90%, representing an excellent rock mass quality.
- RQD of less than 90% only occur within the upper 1.5 m bgl.

4.2.4 Drilling Fluid Loss

Information on permeability of the rock mass and individual defect characteristics can be obtained from reviewing drilling fluid observations. Drilling fluid losses for BH4 B are plotted as Figure 4-4. Open defects around the depths of significant fluid loss have also been plotted for comparison.

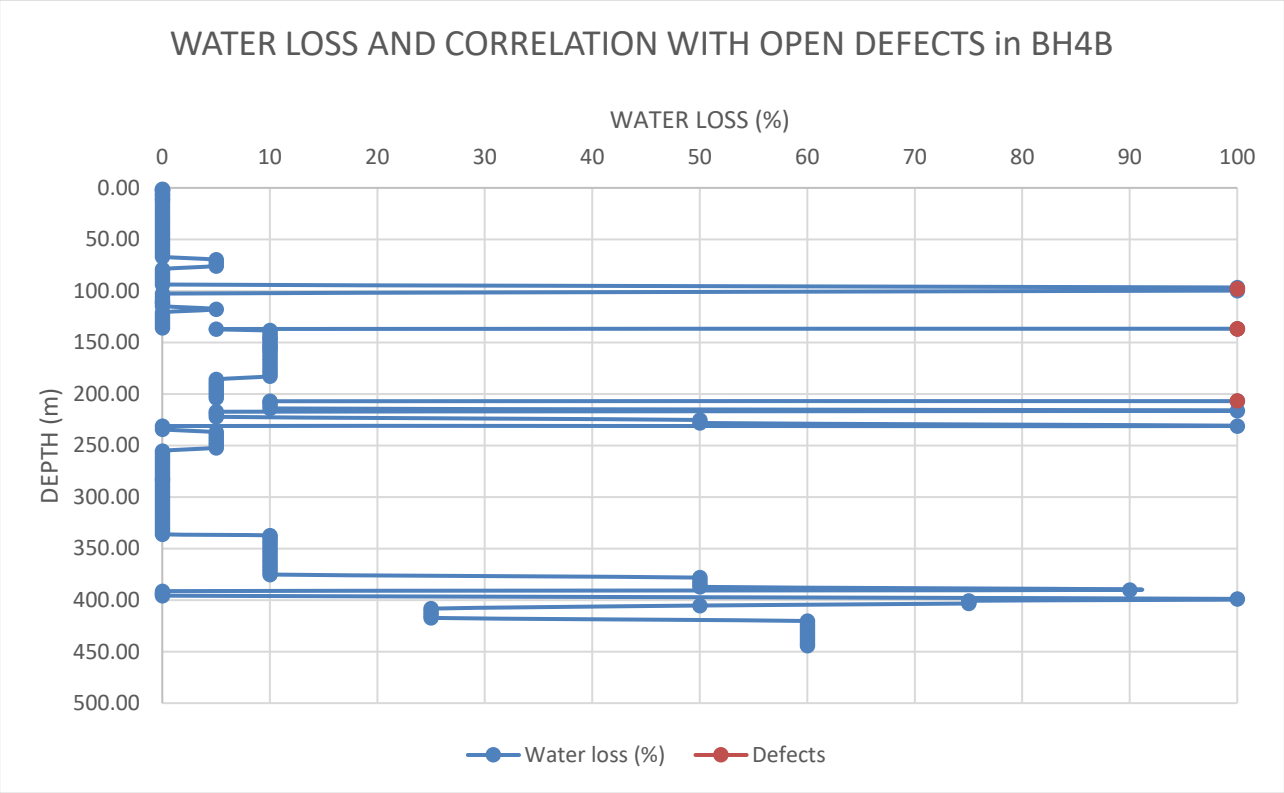


Figure 4-4: Drilling Fluid Loss for BH4 B

4.2.5 Direct Shear Testing

Direct shear testing has been completed for assessment of potential failure mechanisms and shear strengths within the contact of Hornfels and Granodiorite. The testing that has been completed for BH4B is shown in Table 4-4.

Table 4-4: Summary of Direct shear test results – including other geotechnical properties of the intact rock

Rock Group	BH4B Depth (m)	NMC (%)	Wet density (t/m3)	Residual Results			Peak Results		
				Shear Angle (o)	Cohesion (kPa)	R2	Shear Angle (o)	Cohesion (kPa)	R2
Granodiorite	93.41 – 93.71	0.1	2.60	51.4	954.6	0.937	46.4	2884.3	0.999

4.2.6 Sound Velocity by Ultrasonic Pulse Transmission Technique

The ultrasonic evaluation of rock properties was carried out in selected samples for preliminary prediction of static properties. The test method is useful for evaluating the effects of uniaxial stress and water saturation on pulse velocity. These properties are in turn useful in engineering design. Table 4-5 summarises P and S wave velocity of the selected rock samples.

Table 4-5: Summary of Sound Velocity by Ultrasonic Pulse Transmission Technique Report test results

Rock Group	BH4B Depth (m)	Wet density (t/m3)	P- wave velocity (m/s)	S- wave velocity (m/s)
Hornfels	66.00-66.36	2.70	5871	3640
Granodiorite	126.00-126.27	2.65	5671	3708

4.2.7 Slake Durability Index Testing

The Slake Durability Index measures the resistance of a rock sample to weakening and disintegration resulting from a standard cycle of drying and wetting. The main purpose of this test is to evaluate the weathering resistance of the rock. Limited testing has been completed on selected samples and summarised in Table 4-6.

Table 4-6: Summary of Slake Durability Index test

Rock Group	BH4B Depth (m)	Slake durability index 1st cycle (%)	Slake durability index 2nd cycle (%)
Hornfels	5.00-5.26	99.8	99.6
Granodiorite	98.00-98.31	99.9	99.8
Granodiorite	64.19-64.61	99.8	99.7

4.2.8 Splitting Tensile Strength Testing

Limited splitting tensile strength testing has been completed for assessment of potential failure mechanisms and tensile strengths. The testing that has been completed in the selected samples is shown in Table 4-7.

Table 4-7: Summary of Splitting tensile strength test results

Rock Group	BH4B Depth (m)	Split tensile strength (MPa)
Granodiorite	182.77-183.00	6.49
Granodiorite	301.30-301.60	7.41

4.2.9 Cerchar Abrasive Index and Sievers J-Value Testing

Selected samples were tested for assessment of abrasivity and hardness. The testing that has been completed is shown in Table 4-8.

Table 4-8: Summary of Abrasive Index and Sievers J-Value (SJ) test results

Rock Group	BH4B Depth (m)	Cerchar Abrasivity Index (CAI) ± 0.1	Sandvik Mining Test Classification of CAI (2007)	ASTM D7625-10 Classification of CAI (2010)	Mohs Hardness (Approximate)	Sievers J-Value (SJ)	Classification of rock surface hardness, or resistance to indentation (Dahl et. al. 2012)
Hornfels	64.19-66.00	4.3 ± 0.1	Highly Abrasive	Extreme Abrasiveness	5.2	18 ± 2.9	Medium
Granodiorite	98.00-99.00	6 ± 0.1	Extremely Abrasive	Extreme Abrasiveness	5.6	9 ± 1.2	Medium

Granodiorite	200.00 - 200.85	5.7 ± 0.1	Extremely Abrasive	Extreme Abrasiveness	5.6	7 ± 0.2	Medium

4.2.10 Abrasion Value Steel, Goodrich Drillability and Cutter Life Index Testing

Additional abrasion and hardness evaluation of selected rock samples was carried out and summarised in Table 4-9.

Table 4-9: Summary of Abrasion Value Steel, Goodrich Drillability and Cutter Life Index test results

Rock Group	BH4B Depth (m)	Classification of rock abrasion or the ability to induce wear on cutter steel (Dahl, Bruland, Jakobsen, Nilsen, Grøv 2012)	Goodrich Drillability and Classification	Goodrich Wear Number and Classification	Goodrich (Drillability)/(Wear Number) and Classification	Cutter Life Index and Classification
Hornfels	64.19-66.00	Very Low	21±12 Low	9.6±2.6 Medium	3.5±2.8 Medium	32.2 High
Granodiorite	98.00-99.00	Low	2±0 Extremely Low	14.4±0.3 High	0.1±0 Extremely Low	13.2 Medium
Granodiorite	200.00 - 200.85	Low	2±0 Extremely Low	16.4±0.8 High	0.1±0 Extremely Low	13.2 Medium

4.2.11 Petrographic Testing

Petrographic testing was performed in selected samples to perform a detailed description of the rock. Individual minerals and free silica content of the tested rock samples are summarised in Table 4-10and

Table 4-11.

Table 4-10: Summary of Petrographic test results in Hornfels

Rock Group	BH4B Depth (m)	Hard durable minerals (%)					Weak, soft or deleterious minerals (%)				Free silica content (%)
		Quartz	Feldspar	Cordierite	Hornblende	Epidote, opaque oxide	Biotite	Chlorite	Sericite	Pyrite	
Hornfels	18.00-18.14	41	24	3	1	trace	21	5	4	1	41

Table 4-11: Summary of Petrographic test results in Granodiorite

		Primary minerals (%)	Secondary minerals (%)	Free silica

Rock Group	BH4B Depth (m)	K-feldspar	quartz	plagioclase feldspar	biotite	opaque oxide	zircon	chlorite	Sericite / muscovite	pyrite	epidote	content (%)
Granodiorite	94.64 – 94.86	40	33	19	3	<1	trace	3	2	<1	trace	33
Granodiorite	213.00 – 213.17	47	32	15	4	<1	trace	2	<1	trace	trace	32

4.2.12 X-Ray Fluorescence Testing

Geochemistry analysis of limited rock samples were carried out and summarised in Table 4-12.

Table 4-12: Summary of X-Ray Fluorescence test results

Rock Group	BH4B Depth (m)	Aluminium oxide (%)	Barium Oxide (%)	Calcium oxide (%)	Chromium oxide (%)	Ferric Oxide (%)	Potassium Oxide (%)	Magnesium Oxide (%)	Manganese (II) oxide (%)	Sodium Oxide (%)	Phosphorus Pentoxide (%)	Sulphur Trioxide (%)	Silicon Dioxide (%)	Strontium Oxide (%)	Titanium Dioxide (%)
Hornfels	18.00-18.14	15.73	0.07	1.87	0.01	6.33	3.51	2.62	0.1	3.11	0.15	0.29	63.91	0.04	0.78
Granodiorite	94.64 – 94.86	12	0.03	0.83	<0.01	1.46	4.98	0.44	0.03	2.75	0.04	0.22	77.09	0.01	0.2
Granodiorite	213.00 – 213.17	12.24	0.03	0.54	<0.01	2	5.05	0.23	0.03	3.21	0.02	0.04	76.45	0.01	0.11

4.2.13 Chemical Testing

Table 4-13: Summary of chemical test results

Rock Group	BH4B Depth (m)	pH	Sulphate, SO4 (mg/Kg)	Chloride, Cl (mg/Kg)	Electrical Conductivity (µS/cm)	Arsenic (mg/Kg)	Antimony (mg/Kg)	Moisture (%)
Hornfels	4.85-5.0	6.2	84	<10	64	15	<7	<0.1
Hornfels	54.19-66.0	-	-	-	-	12	<7	<0.1
Granodiorite	97.86-98.0	7.3	<10	<10	13	<4	<7	0.2
Granodiorite	327.0-327.11	18.6	<10	<10	13	<4	<7	0.3
Granodiorite	300.0-300.16	8.3	<10	<10	12	<4	<7	0.4

4.2.14 Wet Dry Strength Testing

Table 4-14: Summary of wet dry strength testing

Rock Group	BH4B Depth (m)	Dry Strength (kN)	Wet Strength (kN)	Variation (%)
Granodiorite	268-270	185	169	9

4.3 Water pressure testing

4.3.1 Test methodology and results

The in-situ permeability of the rock mass within BH4A was assessed by way of water pressure (Lugeon or packer) tests. Water pressure tests were completed in accordance with the method described in Houlsby (1976), with the analysis of the data completed using the methods described in:

- Houlsby, A.C.,1976, Routine Interpretation of the Lugeon Water-Test, and
- Burgess, Peter J., 1983, In-situ permeability testing in soil and rock.

Both calculated Lugeon values are provided to indicate a range of likely permeability.

Fell et al (2005) provide a range of Lugeon values as an indication of likely rock mass permeability, with an indication of the expected joint conditions associated with these values. These values are presented in Table 4-14 a colour code has been assigned to these values which has then been applied in Table 4-15 presents the results of the lugeon testing with depth down the borehole.

Table 4-15: Lugeon values and expected foundation condition (Fell, MacGregor, Stapledon, & Bell, 2005)

Lugeon Value	Colour code (utilised in	Permeability Range	Rock Mass Condition
< 1		Low	Joints tight
1 – 5		Low to Moderate	Small joint openings
5 – 50		Moderate to High	Some open joints
> 50		High	Many open joints

Table 4-16: Interpreted Lugeon test results displayed by depth interval in BH4A

Test Depth Interval (m)	Lugeon Value and Behaviour	
	Houlsby	Burgess
17.13-23.23	0.11 (Dilation)	0.64 (Void Filling)
23.15-29.32	2.44 (washout)	2.19 (Excess Pressure)
29.32-35.32	0	0
35.32-44.39	0	0
44.39-53.70	0.01 (Dilation)	0.13 (Void Filling)
53.70-62.70	0.01 (Void Filling)	0.01 (Void Filling)
60.70-71.70	0.04 (Dilation)	0.85 (Excess pressure)
71.70-77.80	0.04 (Dilation)	0.07 (Void Filling)

The results of the Lugeon testing presented in Table 4-15 indicate the majority of the rock mass encountered in BH4a is low permeability. It is noted that Lugeon results less than one are considered unreliable and should be treated as indicative of low permeability only (i.e., not converted directly to permeabilities).

The test undertaken from 23.15 to 29.32 returned Lugeon values indicative of low to medium permeability. Review of the borehole log and core photos indicate three joints are present in this interval at depths of 27.63m, 28.14m and 28.70m. Aperture of these joints is not indicated on the logs indicating the joints are likely relatively tight (i.e. no measurable aperture in-situ). The rock mass within this increment displays zones of leaching of varying severity. The geological age of leaching and jointing is unknown and the leaching may have occurred prior to jointing (i.e., leaching is not related to current permeability). The core photo from the likely zone of higher permeability is shown in Figure 4-5.



Figure 4-5: Core photographs in zone of higher permeability

4.3.2 Check for Pressure Exceedances

Application of excessive pressures during testing can lead to dilation (jacking) and / or degradation of the rock mass and lugeon results from such tests should not be utilised for design. The results of the testing indicate that dilation of the rock mass may have occurred in five of the eight tests undertaken. To determine if jacking or dilation was possible the utilised pressures from the water pressure test were checked against the overburden load by calculating the difference (net load) between effective stress and the applied pressure.

The following equations were utilised:

$$\text{Effective Stress } (\sigma_v') = (\gamma \times z) - (\gamma_w \times (z - h_{wt}))$$

$$\text{Applied head } (u_{applied}) = u_g + (h_{wt} + h_g) \times \gamma_w$$

$$\text{Net Load} = \sigma_v' - u_{applied}$$

Where:

$\gamma = Saturated\ unit\ weight\ of\ rock = 25\ kN/m^3$

$Z = Depth\ to\ top\ of\ testing\ increment\ (m)$

$\gamma_w = Unit\ weight\ of\ water = 9.81\ kN/m^3$

$h_{wt} =\ Depth\ to\ water\ table\ (m)$

$h_g = Height\ of\ pressure\ gauge\ (m)$

$u_g = Gauge\ pressure\ (kN/m^2\ \ or\ kPa)$

The difference between saturated and dry unit weight of rock at the site is likely to be minimal and therefore the same unit weight of rock has been adopted for rock above and below the water table.

It is noted that density testing of retrieved rock core samples from BH4A was not undertaken and the calculation of effective stress is reliant on the selected unit weight of the bedrock. Typical unit weights for bedrock presented in Burt Looks *Handbook of Geotechnical Investigation and Design Tables* indicates slightly weathered or better metamorphic rocks have an estimated unit weight of 25 to 28 kN/m^3.

Based on the above formulas and adopting a unit weight of 25kN/m^3, none of the tests undertaken exceeded the effective unit weight and therefore should not have caused jacking or dilation of the rock mass. It is noted that if the unit weight of the rock mass is in fact 22kN/m^3 (typical adopted lower bound value for competent bedrock) then jacking of the rock mass may have occurred in six of the eight tests.

5 Preliminary Geotechnical Design Parameters

5.1 Defect Characteristics and Rock Strength

5.1.1 Defect Sets

SMEC 1997 report and SMEC 2020 Geological Memorandum were reviewed to combine the previous identified defect orientations with the recent data obtained from BH4B, resulting in:

- Three plus random defect set for the granodiorite and the metasediments;
- Three plus random defect for the hornfels.

Downhole acoustic and optical imaging will assist in further refining in-situ defect properties.

5.1.2 Defect Spacing

Defect spacing has been interpreted from site observations during SMEC's site inspection in February 2020, data provided in Section 8.2 of the 1997 Report on Geological Investigations and geotechnical drilling during the 2021/2022 investigations.

Although most defect sets have been described to present spacings in excess of 2m in slightly weathered and fresh rock, borehole data has identified that swarms of closely spaced defects may exist. This has been taken into consideration during the rock mass classification calculations.

Assigned defect spacings for each rock unit in BH4B are presented in Table 5–1 below.

5.1.3 Roughness

Granodiorite defects are generally rough, while the Hornfels defects are generally smooth to slickensided.

5.1.4 Infill

Open defects logged in BH4B have generally been described as having pyrite, quartz, iron oxide or chlorite stains to veneers. Weathered hornfels occasionally have clay veneer or coats. Shears can have apertures of 1-5mm and filled with clay to sand and gravel material.

5.1.5 Shape

Most defects observed in BH4B are generally planar. Table 5–1 below presents a summary of the main defect parameters used in the current assessment based on all sources of information.

5.1.6 Rock Strength

Rock strengths assumed for each rock unit are presented in Table 5–1 below. UCS tests were not conducted on MW-HW Hornfels as the unit was only 0.2m thick. A UCS value of 100MPa has been assumed for this rock based on engineering judgement.

Table 5–1: Preliminary Geotechnical Design Parameters

Unit	Weathering	Approx. UCS (MPa)	Number of Joints	Spacing	Roughness	Infill	Shape
Granodiorite	FR	150	3+ Random	400mm to 2m	Rough	Clean to Py/Qtz Stain	Planar to Curved
	SW	100				Iron/Ch/Py Stain	
	MW-HW	65				Stained with some clay	
Hornfels	FR	158	3 + Random	200mm to >2m	Smooth to slickensided	Clean to Ch/Py/Qtz stain	Planar
	SW	131		60mm to 2m		Iron/Ch/Py/Qtz stain	
	MW-HW	100		50mm to 200mm		Stain to clay veneer or coat	
Metasediments	FR	200	3+ Random	>2m	Smooth to Rough	Clean	Undulated to Stepped
	SW	200		>1m		Iron/Ch/Py Stain	
	MW-HW	150		20 mm to 400 mm		Stain with some clay	

The above preliminary design parameters may be used for assessment of rock mass classification rating systems including the Rock Mass Rating (RMR) system after Bieniawski 1989, and the Q system after Burton 1993.

6 Recommendations

6.1 General Commentary on Additional Investigations

Extensive additional investigations will be required to progress the 15% design to the next stage of design. Those additional investigations will need to focus on, not least towards:

- Dam foundations including rock mass and permeability and excavation characteristics
- Earthworks and materials management
- Slope stability
- Foundations for surface structures
- Roads and utilities

6.2 Specific Recommendations and Findings

The supplementary geological mapping undertaken by SMEC in 2022 identified several geological features and potential geo-hazards that will require further investigation in subsequent phases of project design and development. This list is not exhaustive and additional geological features and or geohazards may be identified during subsequent phases of investigation. These are listed below.

Table 6-1: Specific Recommendations and Findings for future studies

Geological Feature or Geohazard ID	Description / Observation	Requirements for Future Investigations and Design Stage
001	Borehole BH4B currently does not extend to elevation of machine hall	Future investigations should target the machine hall elevations and below any tunnel invert levels
002	Currently no investigations target tunnel alignments and elevations	Future investigations will need to include drilling along all tunnel alignments
003	Upper Reservoir Dam Foundation	Detailed geotechnical investigations required for next stage of design
004	Lower Reservoir Dam Foundation	Detailed geotechnical investigations required for next stage of design
005	Areas of potential slope instability referred to in Geological Mapping Report	Further detailed geological mapping, aerial photo interpretation and intrusive investigations may be required
006	Upper Reservoir – mapping has identified some sub-horizontal defects that may influence dam stability	Further detailed mapping, intrusive investigations and interpretation required
007	Potential faults and structures identified during 2022 mapping at both Upper and Lower Reservoirs	Further detailed mapping, intrusive investigations and interpretation required at next stage of design

008	Incorporation of hydrogeological data into the overall geological and geotechnical model for the project	Further studies and interpretation required
009	Petrographic analysis of hydrogeological borehole samples	Future studies should include petrographic analysis of rock chips obtained from the HIP to confirm lithology and rock type
010	Bedding thickness in sedimentary rock sequences	Require further investigation during subsequent phases of investigation / project development
011	Insitu rock stresses	Undertake insitu rock stress testing

7 Closure

SMEC has undertaken geotechnical investigations at the proposed Oven Mountain Pumped Hydro Energy Storage Project site in accordance with the Consultancy Agreement for Engineering Services for The Project between OMPS Pty Ltd and SMEC dated 5 July 2021.

This Geotechnical Report satisfies the requirements of the Technical Brief completed under this engagement.

We trust this report addresses your requirements. Your attention is drawn to the report Limitations in Section 9 of this document. Should you require clarification on the matters reported herein please contact you SMEC project representative.

8 References

- ASTM International, ASTM D5777-18 Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation (ASTM D5777-18)
- Bienawski TZ, *Engineering Rockmass Classifications*, Jon Wiley and Sons, 1989.
- Geological Survey of New South Wales (Colquhoun G.P., Hughes K.S., Deyssing L., Ballard J.C., Phillips G., Troedson A.L., Folkes C.B. & Fitzherbet J.A). 2019. New South Wales Seamless Geology dataset, version 1.1 [Digital Dataset]. Geological Survey of New South Wales, NSW Department of Planning and Environment, Maitland.
- Snowy Mountains Engineering Corporation (SMEC), January 1997, Oven Mountain Pumped Storage Project Review – Report on Geological Investigations.
- Snowy Mountains Engineering Corporation (SMEC), May 2020, TECHNICAL NOTE - Oven Mountain Pumped Storage, preliminary geological assessment.
- Snowy Mountains Engineering Corporation (SMEC), March 2022, Oven Mountain Pumped Hydro Energy Storage Project, 15% Design.
- SMEC's internal logging guidelines and field procedures
- Standards Australia AS 1726-2017 Geotechnical site investigations (AS 1726)
- Standards Australia AS 1289 Methods of Testing of Soils for Engineering Purposes (AS 1289)
- Standards Australia AS 4133 – Methods of Testing Rocks for Engineering Purposes (AS4133)
- Using the Q-System, Rock mass classification and support design - handbook, Norwegian Geotechnical Institute, https://www.ngi.no/eng/Publications-and-library/Books/Q-system, 2015.

9 Limitations

9.1 General

We have prepared this report in accordance with the brief. The contents of the report are for the sole use of OMPS Pty Ltd. No responsibility or liability will be accepted to any third party. Data or opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement with SMEC.

The recommendations in this report are based on data collected at specific locations using suitable investigation techniques. Only a finite amount of information has been collected to meet the specific financial and technical requirements of the brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it must be appreciated that actual conditions could vary from the extrapolated model.

Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the provided factual data. They should perform any additional tests as necessary for their own purposes. Subsurface conditions, such as groundwater levels, can change over time and this should be borne in mind, particularly if the findings and/or recommendations contained within this report are used after a protracted delay.

It is strongly recommended that any plans and specifications prepared by others and relating to the content of this report, or any amendments to the original plans and specifications, are reviewed by SMEC to verify that the intent of our recommendations is properly reflected in the design. During construction, we request the opportunity to review our interpretations if the encountered site conditions are significantly different from those inferred in this report.

If this report is reproduced, it must be in full. Should there be any queries concerning this report please do not hesitate to contact the author.

9.2 Notes Relating to Geotechnical Reports

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, and previous work, and is supplemented by knowledge of the local geology and experience of the range of properties that may be exhibited by the materials present. For this reason, geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (e.g., design of a three-storey building), the information and interpretation may not be appropriate if the design is changed (e.g., a twenty-storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by SMEC in the light of the new proposal.

Every care is taken with the report content; however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken
- Changes in policy or interpretation by statutory authorities
- The actions of contractors responding to commercial pressures.

If these occur, SMEC would be pleased to resolve the matter through further investigation, analysis or advice.

9.3 Unforeseen Conditions

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, SMEC should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

9.4 Subsurface Information

Logs of a borehole, recovered core, test pit, excavated face, or surface mapping are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling/observation spacing's and the ground conditions. It is not always possible or economic to obtain continuous high-quality data. It should also be recognised that the volume of material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils, groundwater may not seep into an excavation or bore in the short time it is left open
- A localised perched water table may not represent the true water table
- Groundwater levels vary according to rainfall events or season
- Some drilling and testing procedures mask or prevent groundwater inflow
- The installation of piezometers and long-term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

10 Appendices

Appendix A Investigation Site Plan

LEGEND

- Borehole Location
- Monitoring Borehole Location
- Seismic Locations
- Boundary
- Approximate Boundary
- Design
- Full Supply Level
- Carrai Granodiorite
- Nambucca Beds, Hornfels

Top Creek
Macleay River
BICENTENNIAL NATIONAL TRAIL
EAST KUNDERANG ROAD
Kunderang Station Creek
Peach Tree Creek
N
MB01A
MB01B
MB02A
MB02B
MB03A
MB03B
MB04A
MB04B
BH4A
BH4B
SR01
SR02
SR03
SR04
SR05

FIG NO. 1	**FIGURE TITLE** Site Investigation Plan	**DATE** 05/08/2022	0 75 150 300 450 600 750 1:15,000 Meters	**PAGE SIZE** A3
PROJECT NO. 30018018	**PROJECT TITLE**: Oven Mountain	**CREATED BY** FA13847	**SOURCES** Imagery: © Department of Customer Service 2020, Roadnet MDS 2020, Geology provided by client from Lendlease Infrastructure Map	**COORDINATE SYSTEM** GDA 1994 MGA Zone 56

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Location: V:\Projectz\30018018 - Oven Mountain PSP\Maps\SI Plan\30018018_F0001_SI_Plan.mxd

Last updated by: FA13847 on 5/08/2022 at 12:23

LEGEND

- Borehole Location
- Monitoring Borehole Location
- Design
- Seismic Locations
- Boundary
- Approximate Boundary
- Full Supply Level
- Carrai Granodiorite
- Nambucca Beds, Hornfels

MB02A
MB02B
BH4A
BH4B
SR01
SR02
SR03
SR04
SR05
L TRAIL
Beech Tree Creek

FIG NO. 2	**FIGURE TITLE** Site Investigation Plan	**DATE** 05/08/2022	0 50 100 200 300 400 500 Meters 1:10,000	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 56
PROJECT NO. 30018018	**PROJECT TITLE**: Oven Mountain	**CREATED BY** FA13847	**SOURCES** Imagery: © Department of Customer Service 2020, Roadnet MDS 2020, Geology and SI Plan provided by client		

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Last updated by: FA13847 on 5/08/2022 at 12:23

Appendix B Borehole Geotechnical Logs and SMEC Explanatory Notes

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global experience

Explanatory Notes of Abbreviations and Terms

Used on Borehole and Excavation Logs

General

The “Geological and Engineering Log” presents data from drilling or excavation operations where material recovery is soil and or rock. Data presented is a combination of material recovered, regular sampling and in-situ testing. Excavations may present data obtained on the subsurface profile from observations of natural or man-made excavations. Logs may contain scaled graphical presentations, photography, or downhole imagery results. Logs may not contain all data types presented in these notes.

The “Non Core Drill Hole Engineering Log” presents data from drilling operations where a core barrel has not been used. The material is penetrated using methods other than those designed to recover core and is commonly soil or extremely to highly weathered. The “Cored Drill Hole Engineering Log” presents data from drilling operations where a core barrel has been used. The “Excavation - Geological Log” presents data obtained on the subsurface profile from observations of excavations, either natural or anthropogenic.

As far as is practicable, the data contained on the log sheet is factual. Some interpretation is inevitable with respect to the:

a. assessment of material boundaries in areas of partial sampling and recovery,

b. location of areas of core loss,

c. description and classification of material,

d. estimate of field strength, and

e. identification of drilling induced fractures.

Material description and classification is generally based on AS1726-2017 (as amended).

Drilling Method

Code	Description
ADT	Auger drilling with TC-bit
ADV	Auger drilling V-bit
AS	Auger screwing
AT	Air track
CA	Casing advancer
CC	Concrete core
CTR	Cable tool rig
DB	Wash bore drag bit
HA	Hand auger
HAND	Hand methods
HF	Hollow flight auger
HMLC	Diamond core 63.5 mm diameter
HQ / HRQ	Wire line core barrel 63.5 mm diameter
HQ3	Wire line core barrel 61.1 mm diameter
NDD	Non destructive drilling
NMLC	Diamond core 51.9 mm diameter
NQ	Wire line core barrel 47.6 mm diameter
NQ3	Wire line core barrel 45.1 mm diameter
PT	Continuous push tube
PQ	Wire line core barrel 85.0 mm diameter
RAB	Rotary air blast
RC	Reverse circulation
RD	Rotary blade or drag bit
RR	Rock roller
RT	Rotary tricone bit
SD	Sonic drilling
TBX	Tube-X
VC	Vibro-core drilling
WB	Wash bore drilling

Drilling Penetration

Ease of penetration in non-core drilling

Term	Description
VE	Very easy
E	Easy
F	Firm
H	Hard
VH	Very hard

Support and Casing

Code	Description	Code	Description
C	Casing	Hw	114.3 mm
M	Mud	Nw	88.9 mm
W	Water	PVC 150	150 mm

Core Run

Core lifts are identified by a line and depth with core loss per run as a percentage. Core loss is shown in the core run unless otherwise indicated.

Defect Spacing

The average distance between defects is measured parallel to the core axis in mm and may be expressed as a range or average.

Angle / Orientation

Angle from horizontal and orientation to magnetic north.

For inclined cored boreholes the Alpha and Beta angles are presented for orientated core. Alpha (α) is measured relative to the core axis, whilst Beta (β) is measured clockwise from the reference line looking down the core axis in the direction of drilling.

Excavation Method

Term	Definition
N	Natural exposure
X	Existing excavation
BB	Tractor mounted backhoe bucket
EX	Hydraulic excavator
EH	Hydraulic excavator with hammer
B	Bulldozer blade
R	Ripper

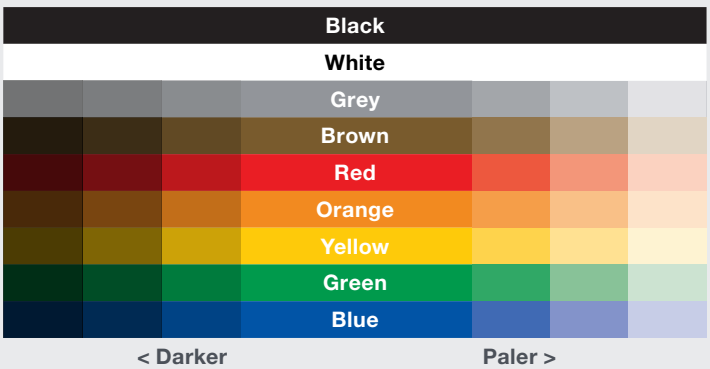
Water / Drilling Fluid

The drilling fluid used is identified and loss of return to the surface is estimated as a percentage, generally of each core lift.

Symbol	Description
	Water inflow
	Water outflow
	Water level: during drilling or immediately after completion of drilling
	Groundwater level with date observed prior to introduction of fluids or after standpipe construction
Not observed	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole / test pit.
Not encountered	The borehole / test pit was dry soon after excavation, however groundwater could be present in less permeable strata. Inflow may have been observed had the borehole / test pit been left open for a longer period.

Colour

The colour of a soil or rock is described in a moist/wet condition using simple terms, such as black, white, grey, red, brown, orange, yellow green or blue. These are modified as necessary by 'pale', 'dark' or 'mottled'. Borderline colours are described as a combination of these colours (e.g. orange-brown). Where a soil or rock consists of a primary colour with a secondary mottling it is described as (primary colour) mottled (first colour) and (secondary colour). Where colour is described outside of the material description it is for the interval.



Description of Soil

vi. Soil name (BLOCK LETTERS)

vii. Plasticity or particle size of soil

viii. Colour (i.e. dominant colour of material)

ix. Secondary soil components names & estimated proportions, including their plasticity / particle characteristics, colour

x. Minor soil components name, estimated proportions, including their plasticity / particle characteristics, colour

xi. Other minor soil components

xii. Moisture condition

xiii. Consistency / density

xiv. Structure of soil, geological origin

xv. Additional observations

Particle Size

Term		Grain Size
Clay		< 2 µm
Silt		2 – 75 µm
Sand	Fine	0.075 – 0.21 mm
	Medium	0.21 – 0.6 mm
	Coarse	0.6 – 2.36 mm
Gravel	Fine	2.36 – 6.7 mm
	Medium	6.7 – 19 mm
	Coarse	19 – 63 mm
Cobbles		63 – 200 mm
Boulders		> 200 mm

Fine Grained and Coarse Grained Soils

Term	Description
Fine Grained Soil (cohesive)	More than 35% of the material less than 63 mm is smaller than 0.075 mm (silts and clays)
Coarse Grained Soil	More than 65% of the material less than 63 mm is larger than 0.075 mm (sands, gravels and cobbles)

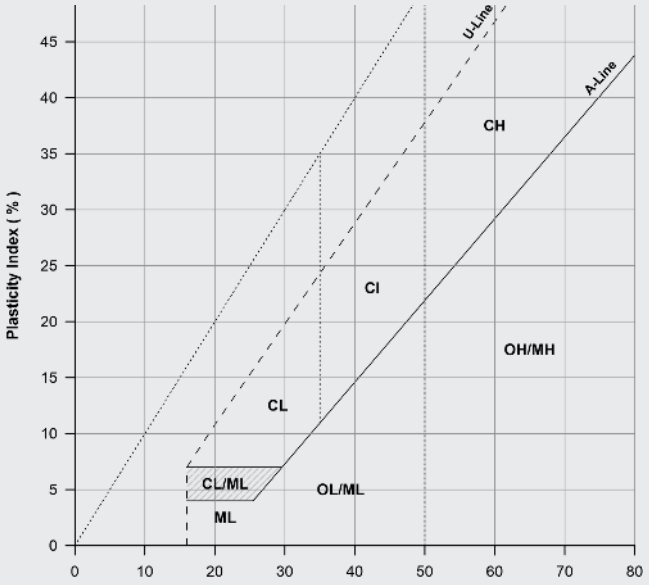
Descriptive Terms for Secondary and Minor Components

Designation of Components	In coarse grained soils				In fine grained soils	
	% Fines	Terminology	% Accessory coarse fraction	Terminology	% Sand / Gravel	Terminology
Minor	≤5	trace	≤ 15	trace	≤ 15	trace
	> 5, ≤ 12	with	> 15, ≤ 30	with	> 15, ≤ 30	with
Secondary	> 12	prefix	> 30	prefix	> 30	prefix

Plasticity – Fine Grained Soils

Liquid Limit (LL) %	Description
≤ 35	Low plasticity (L)
> 35 to ≤ 50	Medium plasticity (I)
> 50	High plasticity (H)

Plasticity Chart– Fine Grained Soils



Consistency Terms – Fine Grained Soils

Term	Undrained shear strength (kPa)	Indicative SPT (N) Blow Count	Field Guide to Consistency
Very Soft (VS)	< 12	0 – 2	Easily penetrated several centimetres by fist, exudes between fingers when squeezed in fist
Soft (S)	12 – 25	2 – 4	Easily penetrated several centimetres by thumb, easily moulded by light finger pressure
Firm (F)	25 – 50	4 – 8	Can be penetrated several centimetres by thumb with moderate effort, and moulded between the fingers by strong pressure
Stiff (St)	50 – 100	8 – 15	Readily indented by thumb but penetrated only with difficultly. Cannot be moulded by fingers
Very Stiff (VSt)	100 – 200	15 – 30	Readily indented by thumb nail, still very tough
Hard (H)	> 200	> 30	Indented with difficulty by thumb nail, brittle
Friable (Fr)	-		Can be easily crumbled or broken into small pieces

Density Terms – Coarse Grained Soils

Term	Density Index (%)	SPT (N) Blow Count
Very Loose (VL)	< 15	0 – 4
Loose (L)	15 – 35	4 – 10
Medium Dense (MD)	35 – 65	10 – 30
Dense (D)	65 – 85	30 – 50
Very Dense (VD)	> 85	> 50

Particle Characteristics – Coarse Grained Soils

Term	Description
Well graded	Having good representation of all particle sizes
Poorly graded	With one or more intermediate size poorly represented
Gap graded	With one or more intermediate sizes absent
Uniform	Essentially of one size

Angularity – Coarse Grained Soils

	Rounded
	Sub-rounded
	Angular
	Sub-angular

Origin of Soil

Fill	Formed by anthropogenic activity
Aeolian	Formed by wind
Alluvial	Formed by streams and rivers
Colluvial	Formed on slopes (talus)
Estuarine	Formed in marine environments
Lacustrine	Formed in lakes
Residual	Formed by weathering insitu

Soil Moisture

	Term	Code	Description
Coarse Grained	Dry	D	Looks and feels dry and free running
	Moist	M	Soil feels cool, darkened in colour, soils tend to stick together, soil grains do not run freely through fingers and no visible free water
	Wet	W	Soil feels cool, darkened in colour, soils tend to stick together, free water on remoulding
Fine Grained	Moist, Less than Plastic Limit	W < PL	Hard and friable or powdery, moisture content well below Plastic Limit
	Moist, Near Plastic Limit	W ≈ PL	Soil feels cool, darkened in colour, can be moulded, near Plastic Limit
	Moist, Wet of Plastic Limit	W > PL	Soil feels cool, dark, usually weakened, free water, moisture content well above Plastic Limit
	Wet, Near Liquid Limit	W ≈ LL	Soil exudes easily
	Wet, Wet of Liquid Limit	W > LL	Soil behaves as a liquid

Boundary Classifications

Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.

Graphic Symbols

	Asphalt		MH
	CH		ML
	CI		OH
	CL		OL
	Concrete		PT
	Fill		SC
	GC		SM
	GM		SP
	GP		SW
	GW		Topsoil

Soil Classification

Soils are described in general accordance with AS1726-2017 as shown below.

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)						GROUP SYMBOL	PRIMARY NAME
COARSE GRAINED SOILS More than 65% of the material is less than 63 mm and is larger than 0.075 mm	A particle size of 0.075 is about the smallest size distinguishable to the naked eye	**GRAVELS** More than half of coarse fraction is larger than 2.36 mm	**CLEAN GRAVELS** (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		GP	GRAVEL
			GRAVELS w/ FINES (Appreciable amount of fines)	'Dirty' materials with excess of non-plastic fines, none to medium dry strength; ≥ 12% silty fines		GM	SILTY GRAVEL
				'Dirty' materials with excess of plastic fines, medium to high dry strength; ≥ 12% clayey fines		GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	**CLEAN SANDS** (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		SW	SAND
				Predominantly one size or a range of sizes with more intermediate sizes missing, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		SP	SAND
			SANDS w/ FINES (Appreciable amount of fines)	'Dirty' materials with excess of non-plastic fines, none to medium dry strength; ≥ 12% silty fines		SM	SILTY SAND
				'Dirty' materials with excess of plastic fines, medium to high dry strength; ≥ 12% clayey fines		SC	CLAYEY SAND
FINE GRAINED SOILS More than 35% of the material less than 63 mm is less than 0.075 mm		**IDENTIFICATION PROCEDURES ON FRACTIONS** < 0.075 mm					
		SILTS AND CLAYS Liquid Limit < 50%	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**	**GROUP SYMBOL**	**PRIMARY NAME**
			None to low	Slow to rapid	Low	ML	SILT
			Medium to high	≥ 12% clayey fines	Medium	CL, CI*	CLAY
			Low to medium	Slow	Low	OL	ORGANIC SILT
		SILTS AND CLAYS Liquid Limit > 50%	Low to medium	None to slow	Low to medium	MH	SILT
			High to very high	None	High	CH	CLAY
			Medium to high	None to very slow	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS: readily identified by colour, odour, spongy feel and frequently fibrous texture						PT	PEAT

* CL is low plasticity clay, CI is medium plasticity clay

Description of Rock

i. Rock name (BLOCK LETTERS)
ii. Grain size and mineralogy
iii. Colour (i.e. dominant colour of material)
iv. Fabric and texture
v. Features, inclusions, minor components, moisture content and durability
vi. Strength
vii. Weathering and/or alteration
viii. Rock mass properties – discontinuities and structure of rock
ix. Interpreted stratigraphic unit
x. Additional observations including geological structure

Simple rock names are used to provide a reasonable engineering description, rather than a precise geological classification. The rock name is chosen by considering the nature and shape of the grains or crystals, the texture and fabric of the rock material, the geological structure and setting, and information from the geological map of the area. Further guidance on the naming of rocks can be found in AS1726-2017, Tables 15, 16, 17 and 18. Typical rock types are described below, though subject to site specific variations.

Rock Type	Description	Example of Rock Name
Sedimentary	Formed by deposited beds of sediments, have grains that are cemented together and often rounded. Significant porosity	COMMON: Conglomerate, Breccia, Sandstone, Mudstone, Siltstone, Claystone ≥90% CARBONATE: Limestone, Dolomite, Calcirudite, Calcarenite, Calcisiltite, Calcilutite PYROCLASTIC: Agglomerate, Volcanic Breccia, Tuff
Igneous	Formed from molten rock and have a crystalline texture. Typically massive and low porosity. Rock types are from coarse to fine grained.	HIGH QUARTZ CONTENT: Granite, Microgranite, Rhyolite MODERATE QUARTZ CONTENT: Diorite, Microdiorite, Andesite LOW QUARTZ CONTENT: Gabbro, Dolerite, Basalt
Metamorphic	Formed when rocks are subject to heat and/or pressure and have typically have directional fabric. Typically have low porosity and crystalline structure. Rock types are from coarse to fine grained	FOLIATED: Gneiss, Schist, Phyllite, Slate NON-FOLIATED: Marble, Quartzite, Serpentinite, Hornfels
Duricrust	Formed as part of a weathering profile and show evidence of being cemented in situ. Cementation is typically irregular and exhibits replacement textures.	Ferricrete (Iron oxides and hydroxides) Silicrete (Silica) Calcrete (Calcium carbonate) Gypcrete (Gypsum)

Note: ( ) denotes dominant cementing mineralogy

Grain Size

Terms describing dominate grain size in sedimentary rocks.

Term	Grain size
Coarse	Mainly 0.6 mm to 2.0 mm
Medium	Mainly 0.2 mm to 0.6 mm
Fine	Mainly 0.06 mm (just visible) to 0.2 mm

Terms describing dominate grain size in igneous and metamorphic rocks

Term	Grain size
Coarse	Mainly greater than 2 mm
Medium	0.06 mm to 2 mm
Fine	Mainly less than 0.06 mm (just visible) to 0.2 mm

Texture and Fabric

Sedimentary rocks

Thickness	Bedding Term
< 6 mm	Thinly laminated
6 – 20 mm	Laminated
20 – 60 mm	Very thinly bedded
60 – 200 mm	Thinly bedded
0.2 – 0.6 m	Medium bedding
0.6 – 2 m	Thickly bedded
> 2 m	Very thickly bedded

Igneous rocks

Term	Definition
Amorphous	Indicates that the rock has no obvious crystalline structure
Crystalline	A regular molecular structure, showing crystal structure and symmetry.
Cryptocrystalline	The texture comprises crystals that are too small to recognise under an ordinary microscope. Indistinctly crystalline.
Porphyritic	Indicates the presence of phenocrysts (relatively large crystals in a fine grained ground mass) in igneous rocks.
Flow banded	Indicates visible flow lines in volcanic rocks and some intrusive rocks
Glassy	Entirely glass like. No crystalline units and without crystalline structure.
Vesicular	A texture of volcanic rocks that indicates the presence of vesicles (small gas bubbles). Where the vesicles are filled with a mineral substance they are termed Amygdales and the texture is Amygdaloidal.

Metamorphic

Term	Definition
Foliation	The parallel arrangement of minerals due to metamorphic process, which shall be defined by the terms in weak, moderate and strongly foliated.
Porphyroblastic	A texture indicating the presence of porphyroblasts (larger crystals formed by recrystallization during metamorphism, such as garnet or staurolite in a mica schist).
Cleavage	A type of foliation developed in fine grained metamorphic rocks such as slates.

Bedding and Fabric Development

Type	Definition
Massive	No obvious development of bedding – rock appears homogeneous
Poorly Developed	Bedding is barely obvious as faint mineralogical layering or grain size banding, but bedding planes are poorly defined.
Well Developed	Bedding is apparent in outcrops or drill core as distinct layers or lines marked by mineralogical or grain size layering.
Very Well Developed	Bedding is often marked by a distinct colour banding as well as by mineralogical or grain size layering.
Indistinct Fabric	There is little effect on strength properties
Distinct Fabric	The rock may break more easily parallel to the fabric

Rock Strength

Term (Code)	UCS (MPa)	$Is_{(50)}$ (MPa)	Field Guide to Strength
Very Low (VL)	0.6 - 2	> 0.03 to ≤ 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low (L)	2 - 6	> 0.1 to ≤ 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blow of the pick point; has dull sound under hammer. A piece of core 150 mm long 50 mm in diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium (M)	6 - 20	> 0.3 to ≤ 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm in diameter can be broken by hand with difficulty.
High (H)	20 - 60	> 1 to ≤ 3	A piece of core 150 mm long by 50 mm in diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High (VH)	60 - 200	> 3 to ≤ 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High (EH)	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Rock strength is assessed by laboratory Uniaxial Compressive Strength (UCS) testing and/or Point Load Strength Index (PLT) testing to obtain the $Is_{(50)}$ the strength table implies a 20 times correlation between $Is_{(50)}$ and UCS used for classification. Note however, multiplier may range from 4 (e.g. some carbonated and low strength rocks) to 40 (e.g. some igneous rocks and/or some high strength rocks). A site specific correlation based on testing, previous investigation or literature may be used where available. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considered weaker due to the effect of rock defects.

Visual Log

A diagrammatic plot of defects showing type, spacing and orientation in relation to the core axis.

- Defects open in situ or clay sealed
- Defects closed in-situ
- Drill induced fractures or handling breaks
- Infilled seam

Rock Weathering and or Alteration Classification

Term (Code)		Definition	
Residual soil (RS)		Soil developed on extremely weathered rock. The rock mass structure and substance fabric are no longer evident but the soil has not been significantly transported.	
Extremely weathered (XW) Extremely altered (XA)		Rock is weathered to such an extent that it has 'soil' properties, i.e, it either disintegrates or can be remoulded in water, but the texture of original rock is still evident.	
Highly weathered (HW) Highly Altered (HA)	Distinctly weathered (DW)*	Whole rock material is discoloured usually by extent that iron staining or bleaching and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original rock substance is no longer recognisable	*Where is it not practical to distinguish between 'HW' and MW'. Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores
Moderately weathered (MW) Moderately Altered (MA)	Distinctly Altered (DA)	Whole rock material is discoloured usually by staining that original colour of the fresh rock is no longer recognisable	
Slightly weathered (SW) Slightly altered (SA)		Rock is slightly discoloured but shows little or no change of strength from fresh rock	
Fresh rock (FR)		Rock shows no sign of decomposition or staining.	

Rock Core Recovery

TCR = Total Core Recovery (%)

$$\frac{\textbf{Length of Core Recovered}}{\textbf{Length of Core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$\frac{\textbf{Sum Length of Cylindrical Core Recovered}}{\textbf{Length of Core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$\frac{\textbf{Sum Length of Sound Core Pieces > 100mm in length}}{\textbf{Length of Core run}} \times 100$$

Types of Defects

Term		Code	Description
Parting		PT	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (i.e. cleavage). May be opened or closed.
Joint		JT	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or sub-parallel to layering or to planar anisotropy in the rock material. May be open or closed.
Sheared Surface		SR	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.
Sheared Zone		SZ	Zone of rock material with roughly parallel, near planar, curved, or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.
Crushed Zone [a]		CZ	A zone of broken and disturbed ground containing more than one identifiable Crushed Seam.
Fracture Zone [a]		FZ	A zone of broken ground with parallel to opposing boundaries dominated by abundant, extremely closely to closely spaced defects, which may be intact or open, and planar, curved, undulating, irregular, or stepped, resulting in a dissected rock mass of angular trapezoidal, triangular or rectangular fragments.
Seam (SE)	Sheared Seam	SS	Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.
	Crushed Seam	CS	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.
	Infilled Seam	IS	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.
	Extremely Weathered Seam	XS	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.
Fault [b]		FT	A fracture (defect) or fracture zone along which there has been an observable amount of displacement.
Vein [c]		VE	Any fracture that contains mineralized material. Veins can display either crack-normal extension or shear displacement coupled with crack-normal extension.
Vugh [a]		VG	An open void with secondary crystallisation which may be coated, partly or nearly completely filled.
Void [a]		VO	An open space created through natural or anthropogenic processes, including, but not limited to, caves, kettles, tunnels, mines, pipes, piping, landslides, faulting, shearing, dissolution, & erosion.
Mechanical Break		MB	A fracture or break induced or created by the sampling process (i.e. drilling (DB) handling (HB), drill lift (DL), excavation, or blasting).

All definitions as per AS1726-2017, except:

[a] SMEC Field Manual,
[b] British Standard BS 5930:2015, and
[c] Glossary of Geology (Fifth Edition - revised) (2011), American Geosciences Institute.

Defect Planarity

Code	Description
CR	Curved – A defect with a gradual change in orientation
IR	Irregular – A defect with many sharp changes in orientation
PL	Planar – Defect forms a continuous plane without variation in orientation
ST	Stepped – A defect with distinct sharp steps or step
UN	Undulose – A defect with undulations

Defect Roughness

Code	Description
RO	Rough – Many small surface irregularities generally related to the grain size of the parent rock
SM	Smooth – Few or no surface irregularities related to the grain size of the parent rock
PO	Polished – Planes have a distinct sheen or a smoothness
SL	Slickensided – Planes have a polished, grooved or striated surface consistent with differential movement of the parent rock along the plane
VR	Very rough – many large surface irregularities, amplitude generally more than 1mm

Type of Structures

Term	Code	Description
Bedding	BD	A layered arrangement of minerals parallel to the surface of deposition which has caused planar anisotropy in the rock substance.
Cleavage	CV	An alignment of fine grained minerals caused by deformation.
Schistosity	SH	A layered arrangement of minerals to each other
Foliation	FO	A planar alignment of minerals caused by deformation.
Void	VO	A completely empty space
Dyke	DK	Sheet-like bodies of igneous rock that cut across sedimentary bedding or foliations in rocks. They may be single or multiple in nature
Sill	SL	A sill is an intrusion of magma that spreads underground between the layers of another kind of rock
Contact	CX	A contact between intrusive and stratigraphic units.
Boundary	BN	A distinct boundary between two stratigraphic units
Vugh	VG	An open void with crystalisation

Note: Drill breaks (DB) and handling breaks (HB) are not included as natural discontinuity.

Discontinuity Spacing

Spacing (mm)	Description
> 6000	Extremely Widely Spaced
2000 - 6000	Very Widely Spaced
600 - 2000	Widely Spaced
200 - 600	Medium Spaced
60 - 200	Closely Spaced
20 - 60	Very Closely Spaced
< 20	Extremely Closely Spaced

Infill Material

Code	Name	Code	Name
Ap	Apatite	Ga	Galena
Ca	Calcite	Gp	Gypsum
Ch	Chlorite	Mn	Manganese
Cl	Clay	MnO	Manganese Oxide
Co	Coal	MS	Secondary mineral
Ep	Epidote	Py	Pyrite
Fe	Limonite/ Ironstone/ Goethite	Um	Unidentified mineral
FeO	Iron oxide	Qz	Quartz
Fs	Feldspar	X	Carbonaceous
		Ze	Zeolite

Discontinuity Observation

Term	Code	Description
Clean	CN	No visible coating or infill
Stain	SN	No visible coating or infill but surfaces are discoloured by mineral staining
Veneer < 1 mm	VN	A visible coating or soil or mineral substance but usually unable to be measured. If discontinuous over the plane, patchy veneer.
Coating > 1 mm to < 10 mm	CT	A visible coating or infilling of soil or mineral substance. Describe composition and thickness.
Filling (Filled) > 10 mm	FD	A visible filling of soil or mineral substance. Describe composition and thickness.

Discontinuity Orientation

Code	Description
VT	Vertical
HO	Horizontal
RL	Top right to bottom left
LR	Top left to bottom right

Samples and Field Tests

Code	Description
B	Bulk disturbed sample
BLK	Block sample
C	Core sample
CBR	CBR Mould Sample
CPT_u	Cone Penetration Test (with pore pressure)
DT	Dilatometer
DS	Small disturbed sample
ES	Soil sample for environmental testing
EW	Water sample for environmental testing
FP	Pressuremeter
G	Gas sample
H	Hydraulic fracturing
HP	Hand penetrometer test
I	Impression device
$Is_{(50)}$	Point Load Index
K	Permeability
LB	Large bulk disturbed sample
N	Standard penetration test result (N* denotes SPT sample recovery)
O	Core orientation
P	Piston sample
PID	Photoionisation detector reading in ppm
PP	Penetrometer
R	Hammer bouncing / refusal
SPT	Standard Penetration Test
U	Undisturbed push in sample
UCS	Uniaxial Compressive Strength
U50	Undisturbed tube sample (50 mm diameter)
U75	Undisturbed tube sample (75 mm diameter)
U100	Undisturbed tube sample (100 mm diameter)
VS	Vane shear test
● (A)	Axial Test
○ (D)	Diametral Test
□	Irregular Lump test

Laboratory Tests

Code	Description
ACM	Asbestos Containing Material
CD	Consolidated Drained
CU	Consolidated Undrained
LL	Liquid Limit
LS	Linear Shrinkage
MC	Moisture Content
MDD	Maximum Dry Density
OMC	Optimum Moisture Content
PBT	Plate Bearing Test
PI	Plasticity Index
PL	Plastic Limit
PSD	Particle Size Distribution
ρ_b	Bulk Density
ρ_p	Particle Density
ρ_d	Dry Density
UU	Undrained Unconsolidated

Backfill / Standpipe Detail

Symbol	Description	Symbol	Description
	Cement seal		Filter pack: sand filter
	Grout backfill GP -Cement BE - Bentonite Cement		Filter pack: gravel filter
	Un-slotted pipe		Bentonite seal
	Slotted pipe		Cutting – excavated material backfill
	Surface Completion: Monument Above Ground		Surface Completion: Gatic Ground Monument

Completion Details

Type	Description
Collapse	Exploratory hole collapsed before reaching planned depth
Equipment Failure	Boring or excavator equipment operational failure
Flooding	Flooding of excavation
Machine Limit	Limit of machine capability reached
Obstruction	Obstruction preventing further advancement
Operator Limit	Limit of operator limit/safety reached
Possible services	Indication of possible services below
Services present	Services encountered during exploratory hole
Squeezing	Hole squeezing boring equipment
Target Depth	Depth reached as planned
Target Depth (Instrumentation Installed)	Depth reached as planned instrumentation installed
Target Depth (Standpipe Installed)	Depth reached as planned open standpipe constructed
Material Refusal	Material preventing further advancement

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm): 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
					0.00					0.0 883.8			883.80	CORE LOSS 0.70m (0.00-0.70)												BH4A
PQ3	Steel Casing		0 % Loss		R1 2.00m (65%) 6%				06/07/22	0.2 883.6															
										0.4 883.4															
										0.6 883.2			0.70 883.10	HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°.				HW	L - M					NAMBUCCA BEDS - CONTACT METAMORPHISM	
										0.8 883.0															
										1.0 882.8															
										1.2 882.6															
										1.4 882.4															
										1.6 882.2															
										1.8 882.0															
					2.00					2.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

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Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3		0 % Loss	R2 1.70m (100%) 49%				2.0 / 881.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				MW	M						NAMBUCCA BEDS - CONTACT METAMORPHISM	
							2.2 / 881.6																
							2.4 / 881.4																
							2.6 / 881.2																
							2.8 / 881.0																
							3.0 / 880.8																
							3.2 / 880.6																
							3.4 / 880.4								SW	H							
							3.6 / 880.2																
		0 % Loss	R3 1.40m (100%) 100%				3.8 / 880.0																
			3.70				4.0																

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Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

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Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss	R3 1.40m (100%) 100%			4.0 879.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				SW *(cont)*	H *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
							4.2 879.6															
							4.4 879.4															
							4.6 879.2							HA								
							4.8 879.0															
							5.0 878.8															
							5.2 878.6															
							5.4 878.4															
							5.6 878.2															
							5.8 878.0															
			0 % Loss	R4 1.48m (100%) 100%			6.0															

5.10

Observations and Comments

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PQ3			0 % Loss				6.0 / 877.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				SW *(cont)*	H *(cont)*					NAMBUCCA BEDS - CONTACT METAMORPHISM	
							6.2 / 877.6															
							6.4 / 877.4															
			0 % Loss				6.58															
							6.6 / 877.2															
							6.8 / 877.0															
							7.0 / 876.8															7.0
							7.2 / 876.6															
							7.4 / 876.4															
							7.6 / 876.2															
							7.8 / 876.0															
							8.0															

R4 1.48m (100%) 100%
R5 1.55m (100%) 100%

Observations and Comments

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PQ3			0 % Loss				8.0 875.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				SW *(cont)*	H *(cont)*					NAMBUCCA BEDS - CONTACT METAMORPHISM	
							8.2 875.6															
							8.4 875.4															
							8.6 875.2				8.60-9.20: hydrothermal vein/ intrusion, pale grey, white			HA								
			0 % Loss				8.8 875.0															
							9.0 874.8															
							9.2 874.6															
							9.4 874.4															
			0 % Loss				9.6 874.2															
							9.8 874.0															
							10.0															

8.13
R6 1.45m (100%) 88%
9.58
R7 1.53m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
			0 % Loss	R7 1.53m (100%) 100%				10.0 873.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				SW *(cont)*	H *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								10.2 873.6																
								10.4 873.4																
								10.6 873.2																
								10.8 873.0																
PQ3								11.0 872.8																
				11.11				11.2 872.6																
			0 % Loss	R8 1.59m (100%) 100%				11.4 872.4																
								11.6 872.2																
								11.8 872.0																
								12.0																

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Testing: Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss			05/07/22	12.0 / 871.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				SW *(cont)*	H *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				NAMBUCCA BEDS - CONTACT METAMORPHISM	
							12.2 / 871.6																
							12.4 / 871.4																
						08/07/22	12.6 / 871.2																
			12.70				12.8 / 871.0																
							13.0 / 870.8																
							13.2 / 870.6																
			0 % Loss				13.4 / 870.4																
							13.6 / 870.2							SA									
							13.8 / 870.0																
							14.0																

R8 1.59m (100%) 100%

R9 1.43m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
		PQ3	0 % Loss	14.13				14.0 869.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
			0 % Loss	R10 1.47m (100%) 100%				14.2 869.6															
								14.4 869.4															
								14.6 869.2															
								14.8 869.0															
								15.0 868.8															
								15.2 868.6															
								15.4 868.4															
			0 % Loss	15.60				15.6 868.2															
				R11 1.44m (100%) 100%				15.8 868.0															
								16.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Testing: Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				R11 1.44m (100%) 100%	16.0 867.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								16.2 867.6															
								16.4 867.4															
								16.6 867.2															
								16.8 867.0															
								17.0 866.8															
			0 % Loss				R12 3.11m (100%) 100%	17.2 866.6							MA - SA								
								17.4 866.4															
								17.6 866.2															
								17.8 866.0															
								18.0															

17.04

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	PQ3			0 % Loss	R12 3.11m (100%) 100%				18.0 865.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			MA - SA *(cont)*	SW *(cont)*	H *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
									18.2 865.6															
									18.4 865.4															
									18.6 865.2															
									18.8 865.0															
									19.0 864.8				19.10-19.40: hydrothermal alteration vein/ intrusion, pale grey			HA								
									19.2 864.6															
									19.4 864.4							SA								
									19.6 864.2															
									19.8 864.0															
									20.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss	20.15				20.0 / 863.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								20.2 / 863.6															
								20.4 / 863.4															
								20.6 / 863.2															
								20.8 / 863.0															
			0 % Loss	R13 3.08m (100%) 100%				21.0 / 862.8								F	VH						
								21.2 / 862.6															
								21.4 / 862.4															
								21.6 / 862.2															
								21.8 / 862.0															
								22.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss	R13 3.08m (100%) 100%				22.0 / 861.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								22.2 / 861.6															
								22.4 / 861.4															
								22.6 / 861.2															
								22.8 / 861.0															
				23.23				23.0 / 860.8															
								23.2 / 860.6															
			0 % Loss	R14 3.04m (100%) 100%				23.4 / 860.4				23.60: irregular quartz vein 60mm thick											
								23.6 / 860.2				23.72-23.90: hydrothermal alteration, white			HA - F								
								23.8 / 860.0							SA - F								
								24.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				24.0 859.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA - F *(cont)*	F *(cont)*	VH *(cont)*					NAMBUCCA BEDS - CONTACT METAMORPHISM	
							24.2 859.6															
							24.4 859.4															
							24.6 859.2															
							24.8 859.0															
							25.0 858.8															
							25.2 858.6															
							25.4 858.4															
							25.6 858.2															
							25.8 858.0															
							26.0															

R14 3.04m (100%) 100%

SMEC 2.10.15 LIB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 13:10 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Testing: Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				R14 3.04m (100%) 100%	26.0 857.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA - F *(cont)*	F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								26.2 857.6															
								26.27															
								26.4 857.4															
								26.6 857.2				26.60: hydrothermal vein/ intrusion, pale grey, irregular contact			HA								
								26.8 857.0															
			0 % Loss				R15 3.05m (100%) 100%	27.0 856.8							SA - F								
								27.2 856.6															
								27.4 856.4															
								27.6 856.2															
								27.8 856.0															
								28.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Testing: Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				R15 3.05m (100%) 100%	28.0 / 855.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA - F *(cont)*	F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								28.2 / 855.6															
								28.4 / 855.4															
								28.6 / 855.2															
								28.8 / 855.0															
								29.0 / 854.8															
								29.2 / 854.6															
							29.32	29.4 / 854.4															
			0 % Loss				R16 3.00m (100%) 100%	29.6 / 854.2															
								29.8 / 854.0															
								30.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3				0 % Loss	R16 3.00m (100%) 100%				30.0 853.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA - F *(cont)*	F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
									30.2 853.6															
									30.4 853.4															
									30.6 853.2															
									30.8 853.0															
									31.0 852.8															
									31.2 852.6															
									31.4 852.4															
									31.6 852.2															
									31.8 852.0															
									32.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm): 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
		PQ3	0 % Loss	R16 3.00m (100%) 100%				32.0 851.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								32.2 851.6																
			32.32					32.4 851.4																
			0 % Loss	R17 3.00m (100%) 100%				32.6 851.2																
								32.8 851.0																
								33.0 850.8																
								33.2 850.6																
								33.4 850.4																
								33.6 850.2																
								33.8 850.0																
								34.0																

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
										34.0 849.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
										34.2 849.6															
										34.4 849.4															
										34.6 849.2															
										34.8 849.0															
										35.0 848.8							MA								
										35.2 848.6															
										35.4 848.4															
										35.6 848.2															
										35.8 848.0															
										36.0				35.90-36.16: hydrothermal alteration, white			HA								

PQ3

0 % Loss — R17 3.00m (100%) 100% — 35.32

0 % Loss — R18 2.98m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm): 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				36.0 847.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			HA *(cont)*	F *(cont)*	VH *(cont)*					NAMBUCCA BEDS - CONTACT METAMORPHISM	
							36.2 847.6							MA - SA								
							36.4 847.4															
							36.6 847.2															
							36.8 847.0															
							37.0 846.8							HA								
							37.2 846.6				37.16-37.30: hydrothermal alteration, white											
							37.4 846.4															
							37.6 846.2				37.55-37.70: hydrothermal alteration			HA								
							37.8 846.0															
							38.0															

R18 2.98m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
		PQ3	0 % Loss	R18 2.98m (100%) 100%				38.0 845.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								38.2 845.6																
				38.30				38.4 845.4																
			0 % Loss	R19 3.00m (100%) 100%				38.6 845.2																
								38.8 845.0																
								39.0 844.8																
								39.2 844.6																
								39.4 844.4																
								39.6 844.2																
								39.8 844.0																
								40.0																

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	PQ3		0 % Loss				40.0 / 843.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*					NAMBUCCA BEDS - CONTACT METAMORPHISM	
							40.2 / 843.6															
							40.4 / 843.4															
							40.6 / 843.2															
							40.8 / 843.0															
							41.0 / 842.8															
							41.2 / 842.6															
							41.4 / 842.4															
							41.6 / 842.2															
							41.8 / 842.0															
							42.0															

R19 3.00m (100%) 100%

41.30

0 % Loss

R20 3.09m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3				0 % Loss	R20 3.09m (100%) 100%				42.0 841.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
									42.2 841.6															
									42.4 841.4															
									42.6 841.2															
									42.8 841.0															
									43.0 840.8															
									43.2 840.6															
									43.4 840.4															
									43.6 840.2															
									43.8 840.0															
									44.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				44.0 839.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				NAMBUCCA BEDS - CONTACT METAMORPHISM	
							44.2 839.6																
							44.4 839.4																
							44.6 839.2																
							44.8 839.0																
							45.0 838.8																
							45.2 838.6																
							45.4 838.4																
							45.6 838.2				45.70: quartz vein, 20mm thick, sub-parallel to bedding												
							45.8 838.0																
							46.0																

44.39 — R20 3.09m (100%) 100%
44.74 — R21 0.35m (100%) 100%
R22 2.82m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) 20 60 200 600 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									46.0 837.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 46.00-47.65: increase in quartz veining, numerous thin quartz veins, sub-horizonal and dipping 50 to 70 degrees				F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
		PQ3		0 % Loss	R22 2.82m (100%) 100%				46.2 837.6															
									46.4 837.4															
									46.6 837.2															
									46.8 837.0															
									47.0 836.8															
									47.2 836.6															
									47.4 836.4															
				47.56																				
				0 % Loss	R23 3.13m (100%) 100%				47.6 836.2															
									47.8 836.0															
									48.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									48.0 835.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
									48.2 835.6															
									48.4 835.4															
									48.6 835.2															
	PQ3			0 % Loss	R23 3.13m (100%) 100%				48.8 835.0							HA								
									49.0 834.8				49.00: hydrothermal alteration, white 20mm thick, sub-parallel to bedding											
									49.2 834.6															
									49.4 834.4															
									49.6 834.2															
									49.8 834.0															
									50.0															50.0

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				50.0 833.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				NAMBUCCA BEDS - CONTACT METAMORPHISM	
							50.2 833.6				50.26: hydrothermal veins, 20 to 40mm thickness			HA - F									
							50.4 833.4				50.36: hydrothermal veins, 20 to 40mm thickness												
							50.6 833.2																
			50.69				50.8 833.0																
			0 % Loss				51.0 832.8																
							51.2 832.6																
							51.4 832.4																
							51.6 832.2																
							51.8 832.0																
							52.0																

R23 3.13m (100%) 100%

R24 3.01m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Core Loss (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3				0 % Loss R24 3.01m (100%) 100%					52.0 831.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
									52.2 831.6															
									52.4 831.4															
									52.6 831.2															
									52.8 831.0															
									53.0 830.8															
									53.2 830.6															
									53.4 830.4															
									53.6 830.2															
				53.70 1 % Loss R25 2.94m (100%) 100%					53.8 830.0									EH						
									54.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3				1 % Loss	R25 2.94m (100%) 100%				54.0 829.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
									54.2 829.6															
									54.4 829.4															
									54.6 829.2															
									54.8 829.0															
									55.0 828.8															
									55.2 828.6															
									55.4 828.4															
									55.6 828.2															
									55.8 828.0				55.79-55.85: grey-blue 1-3mm cordierite growth is rounded											
									56.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
			1 % Loss	R25 2.94m (100%) 100%				56.0 827.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 56.01-56.60: grey-blue 1-3mm cordierite growth is rounded				F *(cont)*	EH *(cont)*	EH					NAMBUCCA BEDS - CONTACT METAMORPHISM	
								56.2 827.6															
								56.4 827.4															
				56.64				56.6 827.2															
								56.8 827.0															
PQ3								57.0 826.8															
			1 % Loss	R26 3.10m (100%) 97%				57.2 826.6															
								57.4 826.4															
								57.6 826.2															
								57.8 826.0															
								58.0															

Observations and Comments
Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3		1 % Loss	R26 3.10m (100%) 97%				58.0 825.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*	EH				NAMBUCCA BEDS - CONTACT METAMORPHISM	58.8
							58.2 825.6															
							58.4 825.4															
											58.53-58.62: pale blue to grey hydrothermal alteration			HA								
							58.6 825.2															
							58.8 825.0															
							59.0 824.8															59.0
							59.2 824.6															59.2
							59.4 824.4															59.4
							59.6 824.2															59.6
		0 % Loss	59.74 R27 2.88m (100%) 100%				59.8 824.0															59.8
							60.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

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Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									60.0 823.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
									60.2 823.6															
									60.4 823.4															
									60.6 823.2				60.59-60.60: dark blue hydrothermal alteration											
									60.8 823.0															
	PQ3			0 % Loss	R27 2.88m (100%) 100%				61.0 822.8															
									61.2 822.6															
									61.4 822.4															
									61.6 822.2															
									61.8 822.0															
									62.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss				62.0 / 821.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				NAMBUCCA BEDS - CONTACT METAMORPHISM	
							62.2 / 821.6																
							62.4 / 821.4																
							62.6 / 821.2																
			62.62		R27 2.88m (100%) 100%																		
							62.8 / 821.0																
							63.0 / 820.8																
			0 % Loss		R28 3.03m (98%) 76%		63.2 / 820.6																
							63.4 / 820.4																
							63.6 / 820.2																
							63.8 / 820.0																
							64.0																

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 13:11 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520
Site	Site 9	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Testing: Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss		R28 3.03m (98%) 76%		64.0 819.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 64.01-64.15: pale blue to grey hydrothermal alteration			HA - MA *(cont)*	F *(cont)*	EH *(cont)*	EH				NAMBUCCA BEDS - CONTACT METAMORPHISM	64.2
							64.2 819.6															64.4
							64.4 819.4															64.6
							64.6 819.2															64.8
							64.8 819.0															65.0
							65.0 818.8															65.2
							65.2 818.6															65.4
							65.4 818.4															65.6
							65.6 818.2															65.8
			0 % Loss		R29 3.10m (100%) 97%		65.8 818.0															
							66.0															

65.65

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss 70 % Loss 20 % Loss				66.0 817.8 66.2 817.6 66.4 817.4 66.6 817.2 66.8 817.0 67.0 816.8 67.2 816.6 67.4 816.4 67.6 816.2 67.8 816.0 68.0				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 66.18-66.24: pale blue to green hydrothermal alteration			MA	F *(cont)*	EH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000			NAMBUCCA BEDS - CONTACT METAMORPHISM	66.2 66.4 66.6 66.8 67.0 67.2 67.4 67.6 67.8

R29 3.10m (100%) 97%

Observations and Comments
Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			20 % Loss				68.0 / 815.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				NAMBUCCA BEDS - CONTACT METAMORPHISM	
							68.2 / 815.6																
							68.4 / 815.4																
							68.6 / 815.2																
			68.75				68.8 / 815.0																
			0 % Loss				69.0 / 814.8																
							69.2 / 814.6																
							69.4 / 814.4																
							69.6 / 814.2																
							69.8 / 814.0																
							70.0																

R29 3.10m (100%) 97%
R30 3.05m (100%) 100%

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss	R30 3.05m (100%) 100%				70.0 813.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*	EH					NAMBUCCA BEDS - CONTACT METAMORPHISM	
								70.2 813.6															
								70.4 813.4															
								70.6 813.2				70.61-70.82: pale blue to blue hydrothermal alteration, fine grained			HA								
								70.8 813.0															
								71.0 812.8															
								71.2 812.6															
								71.4 812.4															
								71.6 812.2															
			0 % Loss					71.8 812.0			71.80												
								72.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3			0 % Loss		R31 2.97m (100%) 100% RQD		72.0 811.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000				NAMBUCCA BEDS - CONTACT METAMORPHISM	
							72.2 811.6																
							72.4 811.4																
							72.6 811.2																
							72.8 811.0																
							73.0 810.8																
							73.2 810.6																
							73.4 810.4																
							73.6 810.2																
							73.8 810.0																
							74.0																

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3		0 % Loss	R31 2.97m (100%) 100%				74.0 / 809.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*				F *(cont)*	EH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				NAMBUCCA BEDS - CONTACT METAMORPHISM	
							74.2 / 809.6																
							74.4 / 809.4																
		74.77					74.6 / 809.2																
							74.8 / 809.0																
		0 % Loss	R32 2.99m (100%) 100%				75.0 / 808.8																
							75.2 / 808.6																
							75.4 / 808.4																
							75.6 / 808.2																
							75.8 / 808.0				75.78-76.17: pale blue to dark blue hydrothermal alteration, fine grained			HA									
							76.0																

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	05/07/2022	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	05/07/2022	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 9	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4A**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
PQ3		0 % Loss	R32 2.99m (100%) 100%				76.0 / 807.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			HA *(cont)*	F *(cont)*	EH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	76.2 / 76.4 / 76.6 / 76.8 / 77.0 / 77.2 / 77.3 / 77.8
							76.2 / 807.6															
							76.4 / 807.4															
							76.6 / 807.2															
							76.8 / 807.0															
							77.0 / 806.8				76.96-77.01: pale blue to dark blue hydrothermal alteration, fine grained			HA								
							77.2 / 806.6															
							77.4 / 806.4															
			77.76				77.6 / 806.2			77.76												
							77.8 / 806.0			806.04	Hole Terminated at 77.76 m											77.8
							78.0															

Observations and Comments

Borehole competed for groundwater installation. Accordingly, detailed defect logging in accordance with AS1726-2017 not completed.

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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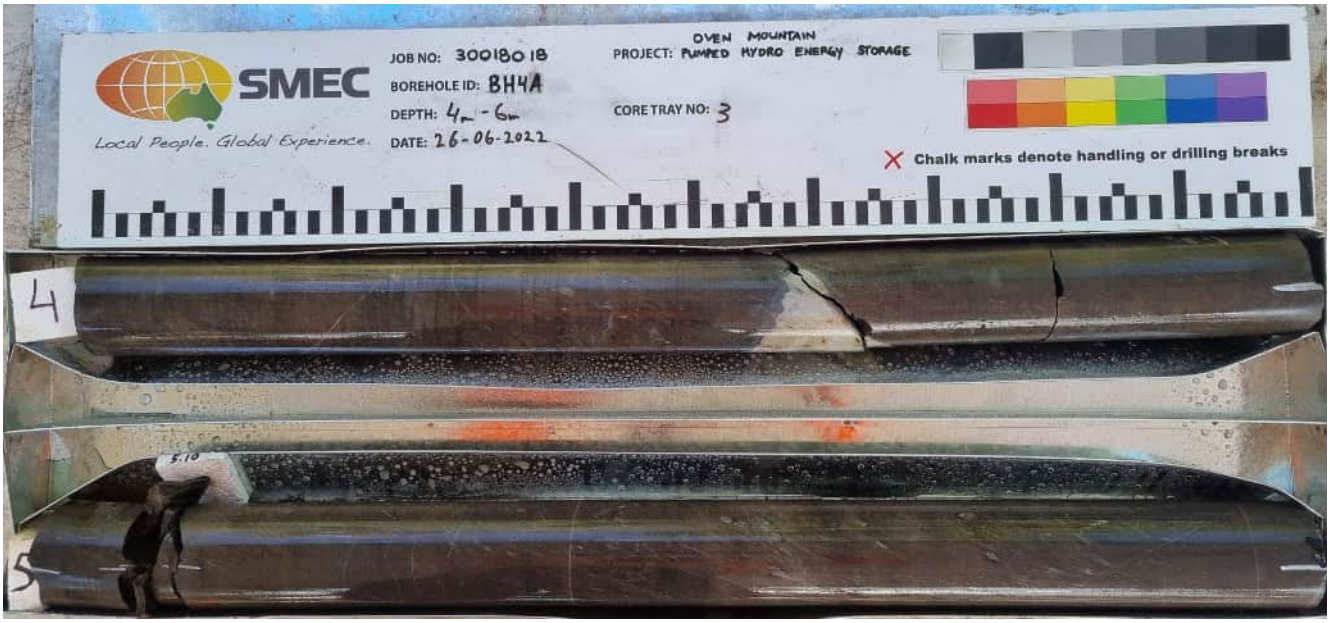
PointID : BH4A Depth Range: 0.00 - 2.00 m



PointID : BH4A Depth Range: 2.00 - 4.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 1/20

SMEC 2.10.15 LIB:GLB GrfcTbl DG:PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 4.00 - 6.00 m



PointID : BH4A Depth Range: 6.00 - 8.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 2/20

SMEC 2.10.15 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 8.00 - 10.00 m



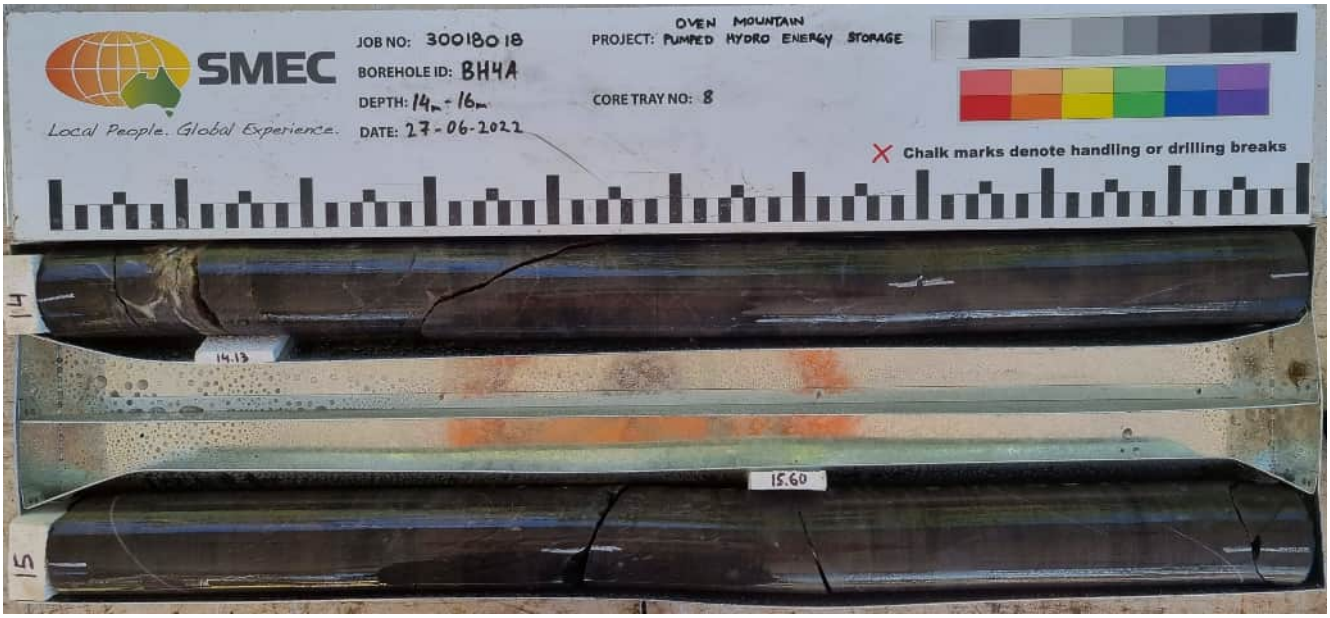
PointID : BH4A Depth Range: 10.00 - 12.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 3/20

SMEC 2.10.15 LIB:GLB GrfxTbl DG:PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 12.00 - 14.00 m



PointID : BH4A Depth Range: 14.00 - 16.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 4/20

SMEC 2.10.15 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 16.00 - 18.00 m



PointID : BH4A Depth Range: 18.00 - 20.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 5/20

SMEC 2.10.15 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 20.00 - 22.00 m



PointID : BH4A Depth Range: 22.00 - 24.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 6/20

SMEC 2.10.15 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC.GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 24.00 - 26.00 m



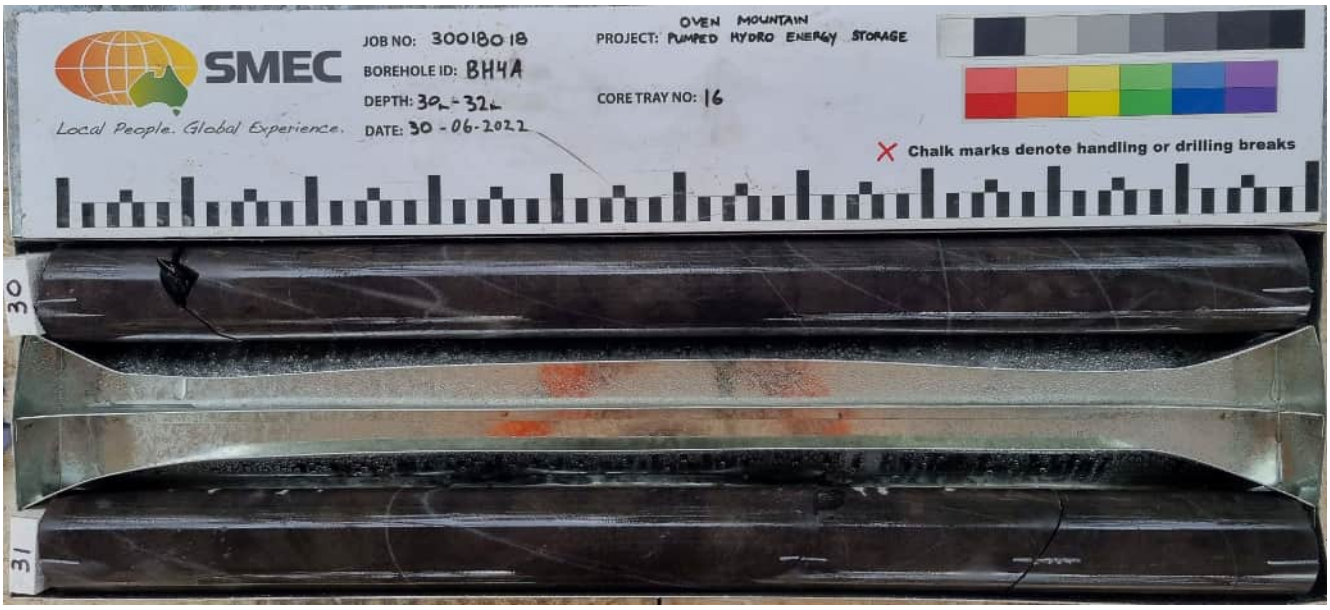
PointID : BH4A Depth Range: 26.00 - 28.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 7/20

SMEC 2.10.15 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



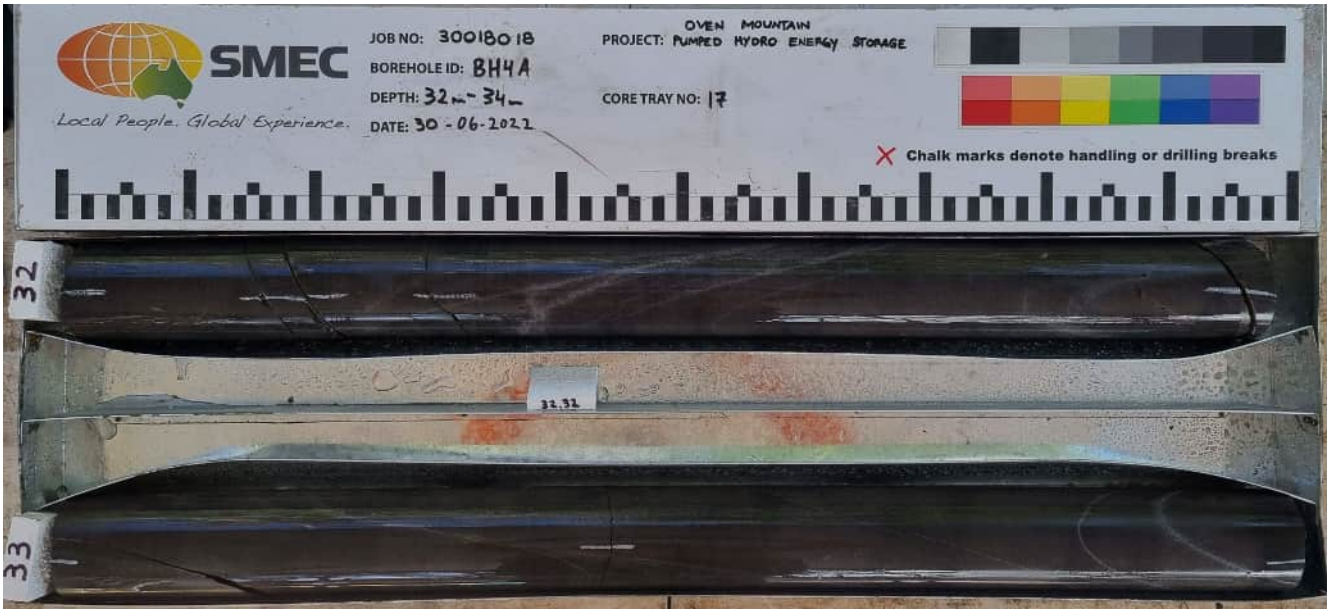
PointID : BH4A Depth Range: 28.00 - 30.00 m



PointID : BH4A Depth Range: 30.00 - 32.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 8/20

SMEC 2.10.15 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:43 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 32.00 - 34.00 m



PointID : BH4A Depth Range: 34.00 - 36.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 9/20

SMEC 2.10.15 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC.GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 36.00 - 38.00 m



PointID : BH4A Depth Range: 38.00 - 40.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 10/20

SMEC 2.10.15 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



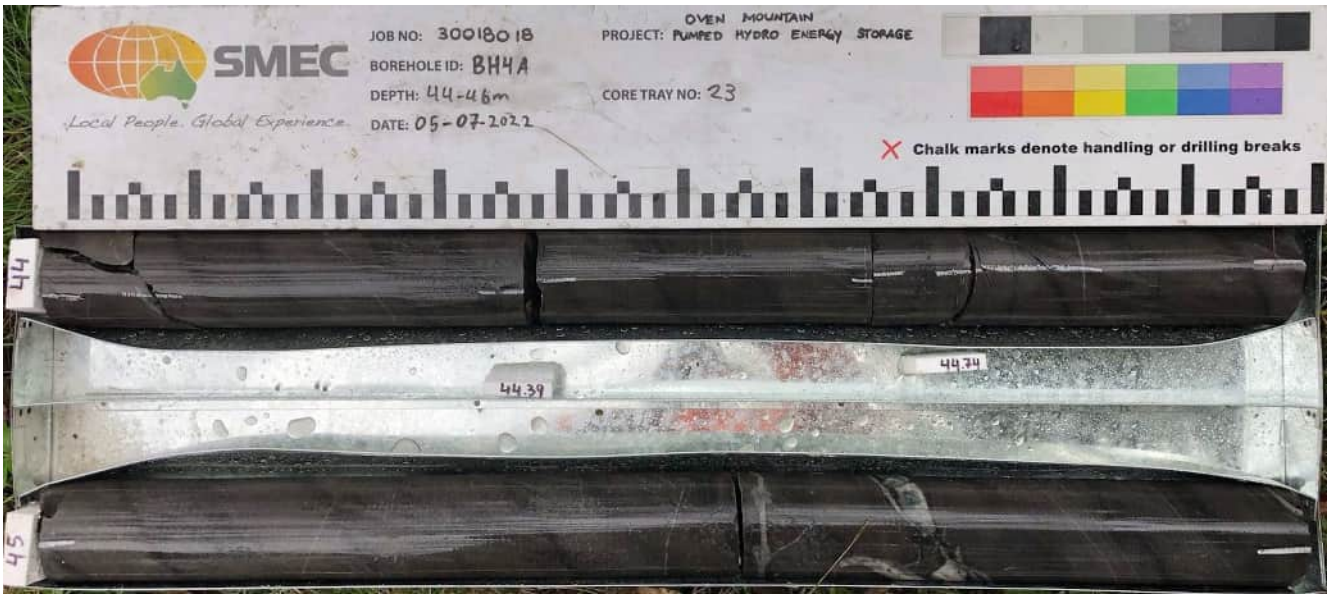
PointID : BH4A Depth Range: 40.00 - 42.00 m



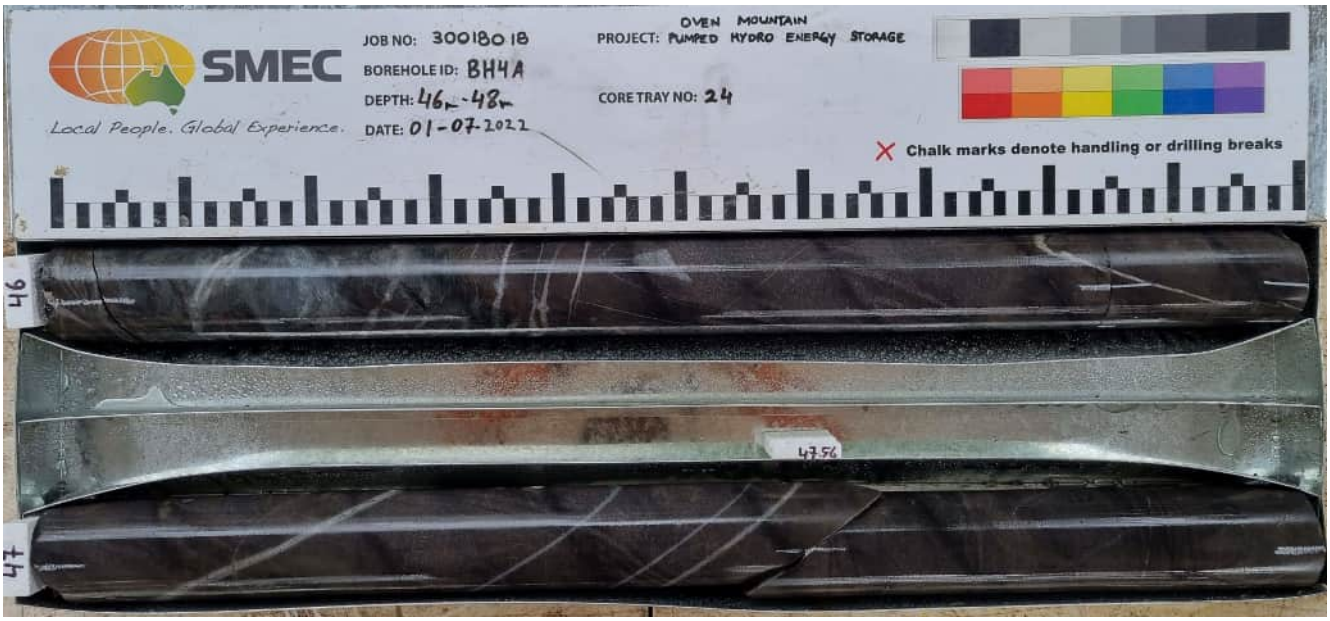
PointID : BH4A Depth Range: 42.00 - 44.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 11/20

SMEC 2.10.15 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC.GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 44.00 - 46.00 m



PointID : BH4A Depth Range: 46.00 - 48.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 12/20

SMEC 2.10.15 LIB:GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



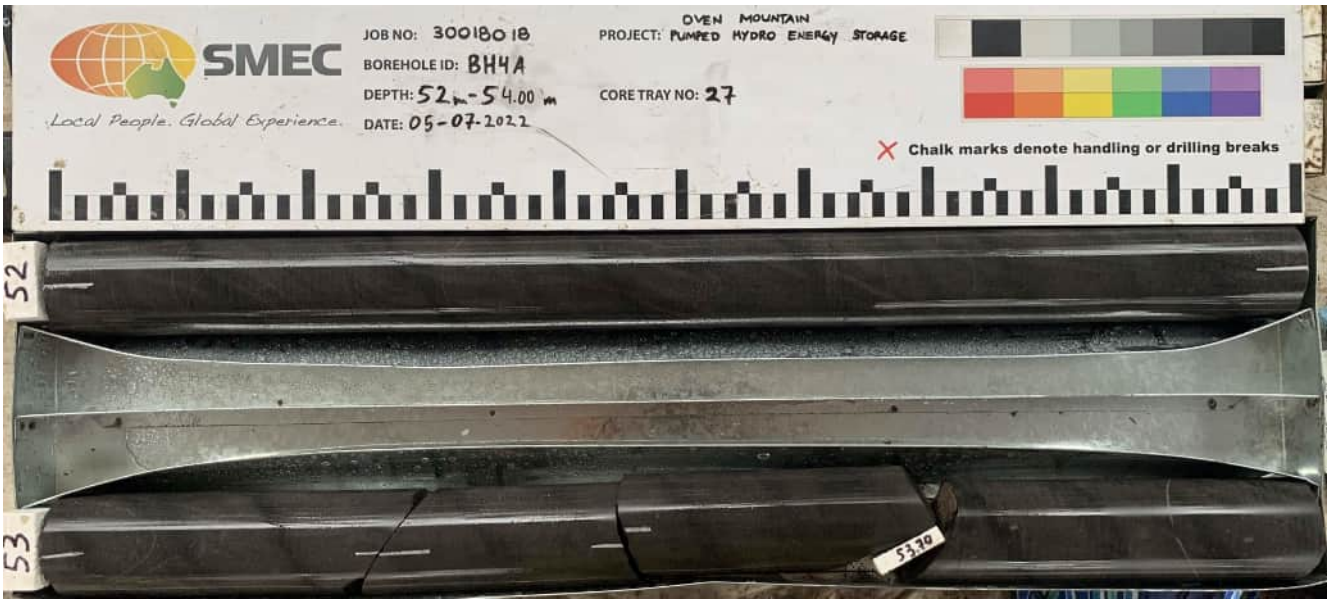
PointID : BH4A Depth Range: 48.00 - 50.00 m



PointID : BH4A Depth Range: 50.00 - 52.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 13/20

SMEC 2.10.15 LIB:GLB GrfcTbl DG:PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 52.00 - 54.00 m



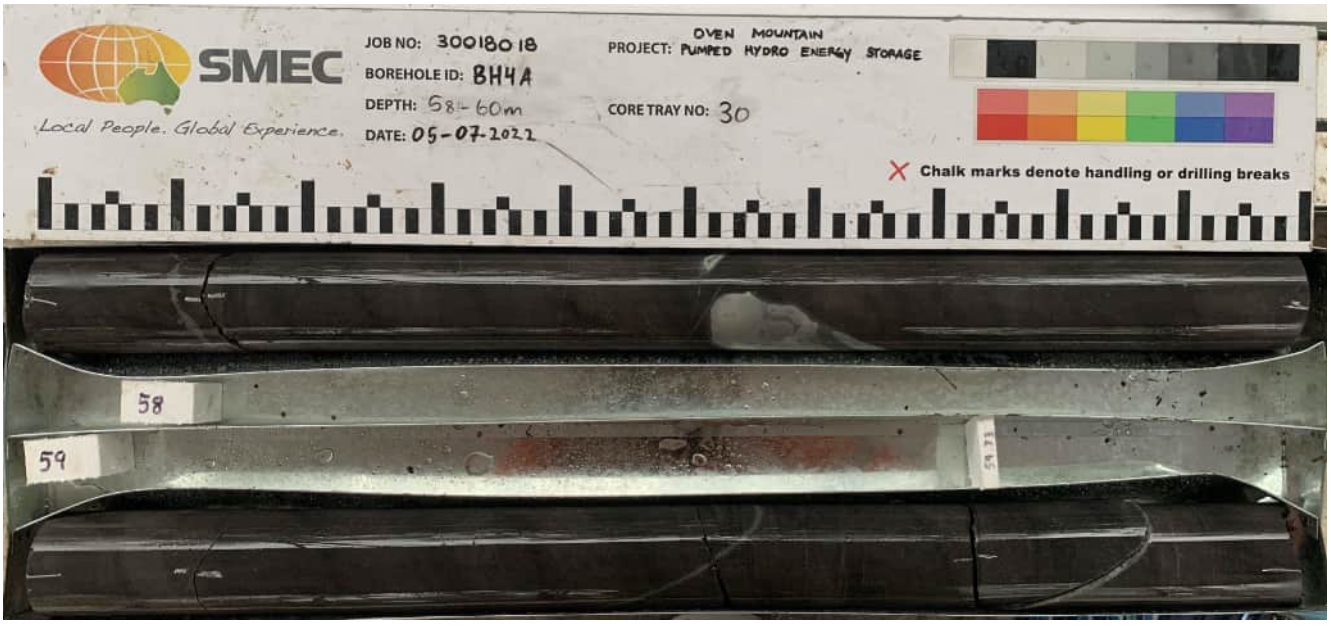
PointID : BH4A Depth Range: 54.00 - 56.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 14/20

SMEC 2.10.15 LIB:GLB GrfcTbl DG:PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 56.00 - 58.00 m



PointID : BH4A Depth Range: 58.00 - 60.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 15/20

SMEC 2.10.15 LIB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 60.00 - 62.00 m



PointID : BH4A Depth Range: 62.00 - 64.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 16/20

SMEC 2.10.15 LIB:GLB GrfxTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 64.00 - 66.00 m



PointID : BH4A Depth Range: 66.00 - 68.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 17/20

SMEC 2.10.15 LIB:GLB GrfcTbl DG:PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



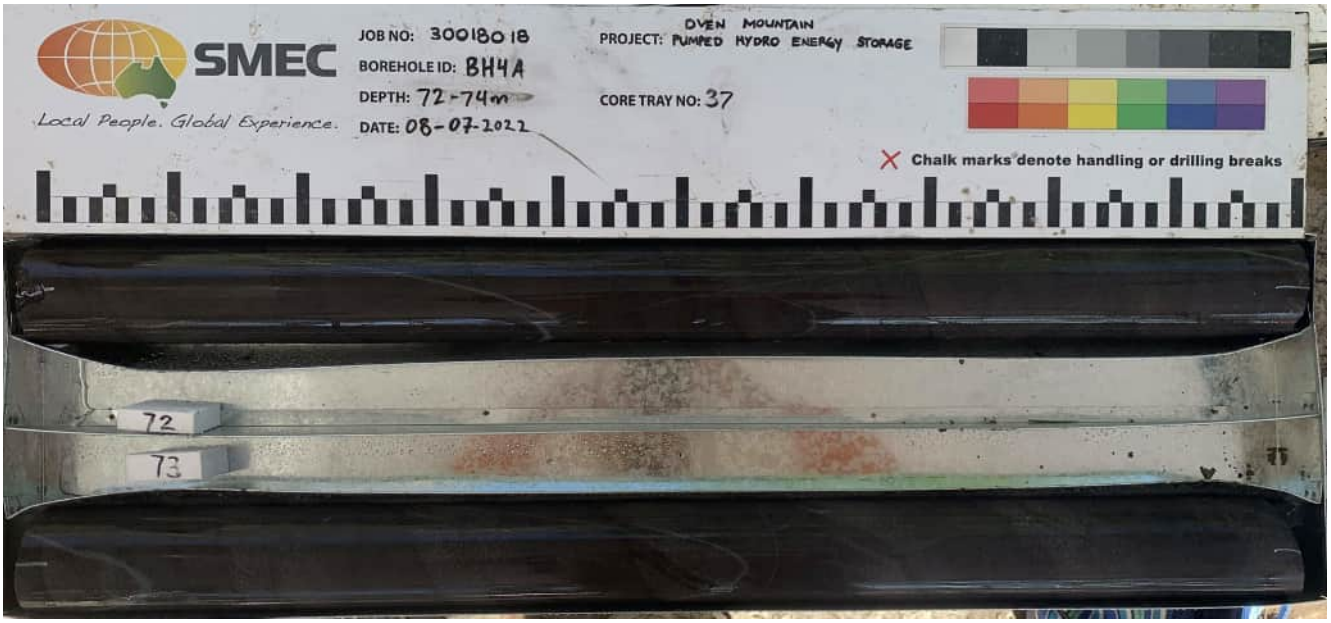
PointID : BH4A Depth Range: 68.00 - 70.00 m



PointID : BH4A Depth Range: 70.00 - 72.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 18/20

SMEC 2.10.15 LIB:GLB GrfxTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 72.00 - 74.00 m



PointID : BH4A Depth Range: 74.00 - 76.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 19/20

SMEC 2.10.15 LIB:GLB GrfcTbl DG:PHOTO CORE PHOTO 2 PER PAGE A4P SMEC.GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4A Depth Range: 76.00 - 77.76 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4A	DRAWN: GDM	DATE: 29/07/2022
		CHECKED: DC	DATE: 29/07/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 20/20

SMEC 2.10.15 UB GLB GrfxTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 29/07/2022 07:44 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3	Steel Casing - HW (114.3 mm)	0 % Loss	R1 0.53m (100%) 8%		PP=250kPa		0.0 883.8			883.80	CORE LOSS 0.20m (0.00-0.20)												0.2
										0.20													
							0.2 883.6			883.60	SILTY CLAY: orange brown, with fine to coarse grained, sub-rounded to angular weathered hornfels gravel.	W<PL	VSt		RS							RESIDUAL SOIL	
							0.4 883.4						H										0.4
					PP=550kPa		0.6 883.2																0.6
										0.67													
										883.13	HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. 0.70: Siltstone Protolith			SA	SW	L - M				0.68: JT, 20° Cl VN, PL, SM, Sandy clay.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							0.8 883.0									H				0.69: JT, 30° Cl VN, PL, SM 0.69: JT, 50° IT, PL, Discontinuous. 0.71: JT, 40° Cl VN, PL, SM 0.72: JT, 75° IT, PL, SM 0.78: JT, 45° Cl VN, UN, SM 0.86: JT, 45° Cl CT, UN, SM, 3 mm, Sandy clay. 0.87: JT, 70° IT, UN, Terminates on joint.			0.8
							1.0 882.8													0.92: JT, 60° Cl CT, UN, SM, 2 mm, Sandy clay. 0.99: JT, 30° Cl VN, PL, SM 1.05: JT, Cl VN, ST, SM, 60 - 70°, smooth to slickensided.			1.0
															HW	SS - VL				1.09-1.20: CS, Multiple angular rock fragments, with sandy clay, low to medium plasticity clay,fine sand, mulitple joints 60 to 70°, fragmented by drilling.		1.09-1.26: drilling induced core fragment due to multiple fractures	
							1.2 882.6								SW	H				1.23: JT, 60° Cl VN, PL, SM 1.26: JT, 70° IT, PL 1.30: JT, 25° IT, PL 1.31: JT, 70° IT, PL			1.2
			1.20																	1.40: JT, 70° IT, PL 1.41: JT, 25° FeO SN, PL, SM 1.43: JT, 70° IT, PL 1.44: JT, 50° FeO SN, UN, SM			
			R2 0.30m (100%) 87%				1.4 882.4																1.4
			1.50																				
							1.6 882.2													1.65: JT, 30° Cl VN, PL, SM 1.69: JT, 50° Cl VN, PL, SM			1.6
			R3 0.26m (100%) 58%																				
			1.76																	1.75: JT, 10° Cl VN, PL, SM 1.75-1.76: DB, Drilling blocked off, crushed rocked fragment, sandy clay, fine sand, low to medium plasticity clay.			
			R4 1.34m (100%) 100%		1.90 m Is(50) ds(50) a=0.55 MPa		1.8 882.0													1.83: JT, 10° CN, PL, SM 1.93: JT, 70° IT, PL, SM			1.8
							2.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

Logged By	EM/LJ	Date	11/10/2021
Approved By	NP	Date	05/08/2022
Status	3	Page	1 of 223

SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:56 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		3.00 m Is(50) d=2.52 3.05 m Is(50) a=3.22		2.0 881.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H *(cont)*				2.01: JT, 65° IT, PL		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							2.2 881.6													2.22: JT, 50° FeO SN, UN, Intact.			2.2
											2.27-3.19: Amorphous Silica, hydrothermal vein / intrusion, pale grey to blue, very fine grained. Irregular and sharp contacts and, with minor alteration halo dipping at 55° to 80°, orange brown iron staining			MA									
							2.4 881.4													2.49: JT, 40° FeO SN, UN, Intact.	2.13-2.72: Set A): Joint, 55°, Undulating, FeO, .1 mm tk, @ 10 - 30 mm sp.	2.50: Point Load >20KN – No Failure	2.4
							2.6 881.2													2.59: JT, FeO SN, CR, SM, 10 - 20°. 2.64: JT, 85° FeO SN, UN, Terminates on joint, intact. 2.61-2.69: k, 50° FeO SN, UN, Intact.	2.50-2.87: Set A): Joint, 50°, Irregular, @ 10 - 30 mm sp. Set B): Joint, 70°, Undulating, @ 5 - 50 mm sp. , discontinuous.		2.6
							2.8 881.0													2.64-2.95: VE, FeO ID, UN, 3 - 15 mm ,60 - 80°, healed. 2.82: JT, 25° FeO SN, PL, SM			2.8
							3.0 880.8													3.09: JT, 3° FeO SN, UN, SM 3.05-3.17: Vugh, iron oxide, clay 20 to 50 mm x 5 to 20 mm dimension. 3.15: JT, 5° FeO SN, PL, Intact. 3.21: JT, 2° FeO SN, UN, Intact.			3.0
			3.10				3.2 880.6													3.29: JT, FeO SN, IR, 40 - 80°, intact.			3.2
							3.4 880.4							SA						3.44: JT, 5° FeO SN, PL, SM			3.4
			0 % Loss				3.6 880.2													3.58: JT, 65° FeO SN, PL, Terminates on joint, intact. 3.62: JT, 5° FeO SN, UN, Terminates on joint, intact. 3.65: JT, 40° FeO SN, PL, Intact. 3.69: JT, Qz CT, UN, 1 mm, 70 - 85°, healed.			3.6
							3.8 880.0													3.78: JT, 65° FeO SN, UN, SM			3.8
							4.0													3.90: JT, FeO SN, UN, SM, 0 - 80°. 3.99: JT, 45° FeO SN, UN, SM			

R4 1.34m (100%) 100%

R5 3.07m (100%) 97%

Observations and Comments

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:56 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			0 % Loss	R5 3.07m (100%) 97%			4.40 m Is(50) d=6.05 5.50 m Is(50) d=2.86		4.0 / 879.8 4.2 / 879.6 4.4 / 879.4 4.6 / 879.2 4.8 / 879.0 5.0 / 878.8 5.2 / 878.6 5.4 / 878.4 5.6 / 878.2 5.8 / 878.0 6.0				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 4.05-4.24: Quartz Vein, irregular 2 - 20 mm thickness, with iron staining, trace chlorite 4.90: Diamictite Protolith, dark greybrown, in a silty to fine sand matrix supporting 5% fine to coarse angular gravel clasts up to 40 mm, minor lineation dipping at 60-70° and flattening of clasts, fine to coarse grained sub-rounded to sub-angular gravel up to			SA *(cont)*	SW *(cont)*	H - VH				4.12: JT, 50° IT, UN 4.05-4.24: VE, Qz ID, IR, 40 - 80°, 3 - 20 mm, healed. 4.24: JT, 70° Qz VN, UN, Originates on adjacent joint, healed. 4.29: JT, 70° Qz VN, UN, Originates on adjacent joint, healed. 4.29-4.34: Shear, 45° Qz VN, PL, 1 to 2 mm displacement, healed. 4.33-4.41: Shear, 50° Qz VN, PL, 1 mm displacement. 4.38: JT, 45° HE, UN 4.34-4.44: VE, Qz CT, UN, 70°, 1 to 2 mm. 4.37-4.42: VE, 50° Qz CT, UN, 2 mm, Healed. 4.42: JT, 50° Qz VN, UN, Terminates on joint. 4.43: JT, Qz VN, IR, 10 - 30°, healed. 4.43: JT, 15° Qz CT, UN, 2 mm, Healed. 4.46: JT, 60° HE, PL 4.46: JT, 45° Qz VN, UN, Healed. 4.71: JT, 50° FeO SN, PL, SM, Intact, opened on handling. 4.84: JT, PL 4.84: JT, 10° FeO SN, PL, SM, Intact, opened on handling. 4.85: JT, 70° FeO SN, PL, SM, Intact, opened on handling. 4.86: JT, 60° IT, PL, Originates and terminates on joint. 4.90: JT, 15° Qz CT, UN, 1 mm, Healed. 4.97: JT, 15° Qz CT, PL, 2 mm, Healed. 5.25-5.34: Shear, 55° FeO SN, PL, SM, 8 mm displacement, intact, opened on handling. 5.30: JT, 20° Qz VN, PL 5.37: JT, 45° IT, PL 5.39: JT, 40° IT, PL 5.48: JT, 20° Qz VN, PL, Healed. 5.57: JT, 5° Qz VN, PL, SM, Intact, opened on handling. 5.70: JT, 15° Qz VN, PL, SM, Intact, opened on handling. 5.78: JT, 5° Qz VN, PL, Healed. 5.79: JT, 3° Qz CT, UN, 1 mm, Healed. 5.83: JT, Qz VN, ST, 5 - 40°, healed. 5.88: JT, 60° Qz VN, UN, Originates on joint. 5.88: JT, 85° Qz CT, PL, 1 mm, Healed.	4.07-4.27: Set A): Shear, 50°, Undulating, FeO, @ 20 -50 mm sp. Set B): Joint, 10 - 70°, Irregular, FeO, @ 5 - 20 mm sp. 4.47-4.62: Set A): Joint, 35°, Undulating, Quartz, 1-3 mm tk, @ 10 - 40 mm sp.	NAMBUCCA BEDS - CONTACT METAMORPHISM	4.2 4.4 4.6 4.8 5.0 5.2 5.4 5.6 5.8

Observations and Comments

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:56 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	6.17		6.20 m Is(50) d=0.51		6.0 / 877.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H - VH *(cont)*				5.95: JT, 60° FeO SN, UN, Originates on joint. 5.97: JT, 75° FeO SN, UN, Originates on joint, discontinuous, intact. 6.08: JT, 45° Qz CT, ST, 1 mm, Healed. 6.13: JT, 70° Qz VN, UN, Originates and terminates on joint, healed. 6.14: JT, 15° FeO SN, UN, SM, Intact, opened on handling. 6.15: JT, 75° FeO SN, PL, Intact. 6.12-6.18: VE, Qz ID, IR, 1 mm, 20 - 60°, healed. 6.17-6.18: VE, Qz ID, IR, 1 mm, 10 - 30°, healed. 6.24: JT, 50 - 60° FeO SN, UN, Originates on contact, intact. 6.25: JT, 65° FeO SN, UN, Originates on adjacent joint, intact. 6.30: JT, 3° FeO SN, UN, SM, Intact, opened on handling. 6.30-6.40: VE, Qz ID, IR, 2 mm, 10 - 50°, healed. 6.52: JT, 5° FeO SN, UN, SM, Intact, opened on handling. 6.58: JT, 25° Qz CT, IR, 1 mm, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								6.2 / 877.6				6.18-6.30: Quartz Vein, white with pale grey, with orange and green staining on joint surfaces											6.2
								6.4 / 877.4				6.32-6.60: Alteration Veins, light grey, green and orange brown, quartz, chlorite, iron staining			MA - SA							6.30-6.60: cream grey and orange staining, irregular texture, moderately altered	6.4
			0 % Loss	R6 0.83m (100%) 100%				6.6 / 877.2							SA								6.6
								6.8 / 877.0												6.80: JT, 15° Py SN, UN, SM, Intact, opened on handling. 6.88: JT, 65° Qz VN, UN, Healed.			6.8
				7.00		7.00 m Is(50) d=6.01		7.0 / 876.8												7.01: JT, 15° FeO SN, PL, SM, Intact, opened on handling.		7.05: Point Load >20KN – No Failure	7.0
								7.2 / 876.6												7.22: JT, 10° IT, PL 7.32: JT, 25° IT, PL 7.37: JT, IT, UN			7.2
			0 % Loss	R7 2.56m (100%) 100%				7.4 / 876.4				7.50: indistinct sub-horizontal bedding											7.4
								7.6 / 876.2												7.64: JT, 65° Qz VN, UN, Healed. 7.69: JT, FeO SN, CR, SM, 10 - 45°, intact, opened on handling.			7.6
								7.8 / 876.0												7.82: JT, 5° Qz CT, PL, 3 mm, Healed. 7.83: JT, 2° Qz VN, PL, Healed.			7.8
								8.0															

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		9.40 m Is(50) d=4.42		8.0 875.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H - VH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		8.09: JT, 25° FeO SN, UN, SM, Trace pyrite, intact, opened on handling.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
																				8.16: JT, 5° Qz VN, UN, Healed.		8.00: Point Load >20KN – No Failure	
							8.2 875.6													8.23: JT, 40° Qz VN, UN, Healed.			8.2
							8.4 875.4													8.40: JT, 70° Py VN, PL, SM, Intact, opened on handling.			8.4
																				8.41: JT, 35° Py VN, PL, SM, Intact, opened on handling.			
																				8.52: JT, 25° IT, UN			
							8.6 875.2																8.6
							8.8 875.0													8.70: JT, 10° FeO SN, PL, SM, Intact, opened on handling.			8.8
																				8.73: JT, 75° Py VN, UN, SM, Intact, opened on handling.			
							9.0 874.8																9.0
							9.2 874.6													8.90-9.35: Shear, 80° Py VN, PL, SM, With yellow white clay veneer, 2 mm displacement, intact, opened on handling.			9.2
																				9.29: JT, 30° Qz VN, PL, Healed.			
																				9.33: JT, 70° Qz VN, PL, Healed.			
			9.56				9.4 874.4													9.40: JT, 5° Qz VN, PL, Healed.			9.4
			0 % Loss				9.6 874.2																9.6
							9.8 874.0													9.80: JT, 75° Qz VN, UN, Discontinuous, healed.			9.8
							10.0													9.97: JT, 70° FeO SN, UN, SM, Discontinuous.			

R7 2.56m (100%) 100%

R8 1.34m (100%) 100%

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:57 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R8 1.34m (100%) 100%		10.90 m Is(50) d=3.65 10.94 m Is(50) a=6.12 11.00 m Is(50) d=4.98		10.0 / 873.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			MA MA *(cont)* SA	SW *(cont)*	H - VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								10.2 / 873.6												10.22: JT, 75° FeO SN, PL, SM, Intact, opened on handling. 10.32: JT, 75° FeO SN, PL, SM, Intact, opened on handling.			10.2
								10.4 / 873.4												10.44-10.45: Shear, 10° IT, UN, 3 mm displacement. 10.50: JT, 5° IT, UN 10.55: JT, 15° FeO SN, PL, SM, Intact, opened on handling.			10.4
								10.6 / 873.2												10.67: JT, IT, UN, 10 - 20°. 10.72: JT, 20° Qz VN, PL, Healed.			10.6
								10.8 / 873.0												10.83-10.85: k, 25° IT, PL 10.87: JT, 0° IT, PL			10.8
								11.0 / 872.8												10.94-10.96: Shear, 15° IT, PL, 2 mm displacement. 11.01: JT, 10° FeO SN, PL, SM, Intact, opened on handling.		11.06: Point Load >20KN – No Failure	11.0
			0 % Loss	R9 1.82m (100%) 100%				11.2 / 872.6												11.26: JT, 10° Qz VN, PL, Healed.			11.2
								11.4 / 872.4												11.39: JT, 10° Qz VN, PL, SM, Intact, opened on handling. 11.30-11.52: HB, 75° Qz VN, PL, Healed. 11.43-11.49: Shear, 45° FeO VN, UN, SL 11.49: JT, 5° IT, UN 11.57: JT, 15° Py SN, UN, SM, Intact, opened on handling.		11.46-11.51: orange brown iron staining pervasive from defect surface	11.4
								11.6 / 872.2												11.66-11.67: VE, 5° Qz CT, 7 mm, Healed.			11.6
								11.8 / 872.0															11.8
								12.0							MA					11.91: JT, 60° Cl VN, UN, SM, Trace pyrite.			

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● - Axial ○ - Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		13.00 m Is(50) a=3.38		12.0 871.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 12.00: indistinct sub-horizontal bedding			MA *(cont)*	SW *(cont)*	H - VH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		12.09: JT, 20° Qz VN, UN, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM 12.00: Point Load >20KN – No Failure	
							12.2 871.6							SA						12.16: JT, 60° IT, UN, Terminates on joint. 12.18: JT, Py SN, UN, SM, 5 - 15°, intact, opened on handling.		12.04: Point Load >20KN – No Failure	12.2
											12.34-18.81: Sandstone Protolith brown grey, fine to coarse, indistinct sub-horizontal thin to medium bedding, slight lineation at 60 - 70° with trace fine to coarse sub-angular to sub-rounded gravel clasts up to 35 mm									12.34: JT, 15° Qz VN, PL, Healed.			
							12.4 871.4													12.41: JT, 70° Qz VN, PL, Healed.			12.4
																				12.51: JT, 75° Qz VN, PL, Healed.			
							12.6 871.2													12.59: JT, Py VN, UN, SM 12.60: JT, 75° Qz VN, UN, Healed.			12.6
																				12.69: JT, 70° Qz VN, PL, Originates on adjacent joint, healed.			
							12.8 871.0													12.80: JT, 40° Qz VN, UN, Healed. 12.81: JT, 40° Qz VN, UN, Healed. 12.83: JT, 30° Qz VN, PL, Healed.			12.8
																				12.99: JT, 75° Qz VN, PL, SM			
							13.0 870.8													13.03: JT, 75° IT, UN, Discontinuous. 13.07: JT, 75° IT, UN, Discontinuous. 13.10: JT, 75° IT, UN, Discontinuous. 13.18: JT, 70° IT, UN, Terminates on joint.		13.00: Point Load >20KN – No Failure	13.0
							13.2 870.6																13.2
																				13.32: JT, 40° IT, UN			
							13.4 870.4													13.37: JT, 25° FeO SN, UN, SM, Intact, opened on handling. 13.43: JT, 40° Py VN, UN, Healed.			13.4
							13.6 870.2													13.50-13.69: Shear, 70° Cl VN, UN, SL, Intact, opened on handling. 13.70: JT, 5° Qz CT, UN, 1 mm, Healed.			13.6
							13.8 870.0				13.81-13.88: dark grey brown												13.8
											13.88-14.15: Igneous intrusion, dark grey brown, black with green, aphanitic irregular quartz veins, with green and orange staining dipping at 60-80°, moderately chlorite altered									13.80-13.99: Shear, 75° Cl CT, UN, SL, 1 mm, Iron staining, intact, opened on handling. 13.98: JT, Cl CT, UN, 1 mm, 65 -			
							14.0																

R9 1.82m (100%) 100%
12.72
R10 2.96m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● - Axial ○ - Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R10 2.96m (100%) 100%			14.90 m Is(50) d=2.79		14.0 869.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H - VH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		80°, iron staining, intact, opened on handling. 14.05: JT, Cl CT, IR, 1 mm, 60 - 80°, intact.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
										14.2 869.6				14.15-16.98: Diamictite Protolith, dark grey brown, very fine matrix supporting 5% fine to coarse angular gravel clasts up to 30 mm, minor lineation at 60 - 70°								14.26: JT, FeO SN, IR, 60 - 75°, originates on joint. 14.30: JT, 10° CN, UN, SM, Intact, opened on handling.			14.2
										14.4 869.4															14.4
										14.6 869.2												14.59: JT, 0° FeO SN, PL, SM, Intact, opened on handling. 14.61: JT, 40° FeO SN, PL, SM, Intact, opened on handling. 14.64: JT, 80° IT, PL 14.65-14.68: Shear, IT, CR, 30 - 40°, 5 mm displacement. 14.70: JT, 65° FeO SN, UN, Healed, discontinuous. 14.78-14.79: Shear, 5° Qz VN, PL, 3 mm displacement, healed. 14.83: JT, 75° IT, PL, Originates on joint.			14.6
										14.8 869.0															14.8
										15.0 868.8												15.00: JT, 75° Qz VN, PL, Healed. 15.06: JT, 75° Qz VN, PL, Healed. 15.06: JT, 75° Qz VN, PL, Discontinuous, healed.			15.0
										15.2 868.6															15.2
										15.4 868.4												15.26: JT, 75° Qz VN, PL, Healed. 15.28-15.32: Shear, 50° CN, UN, SL			15.4
				15.68						15.6 868.2												15.56: JT, 70° Qz VN, PL, Healed. 15.62: JT, 25° Py VN, PL, SM, Intact, opened on handling. 15.68: JT, 70° Qz CT, UN, 1 mm, Healed.			15.6
				0 % Loss	R11 3.01m (100%) 100%			15.90 m Is(50) d=5.76		15.8 868.0												15.82: JT, 80° Qz VN, PL, Healed. 15.87-15.92: Shear, 35° Qz VN, PL, 3 mm displacement, healed. 15.91: JT, 20° Qz CT, PL, 2 mm, Intact, opened on handling.			15.8
										16.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
								16.05 m Is(50) d=5.61		16.0 / 867.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H - VH *(cont)*				15.92: JT, 80° Qz VN, PL, Healed. 15.97: JT, 80° Qz VN, PL, Healed. 16.09: JT, 80° Qz VN, PL, Healed. 16.14: JT, 20° CN, PL, SM, Intact, opened on handling.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
										16.2 / 867.6															16.2
																						16.23-16.37: Shear, 65° IT, PL, 2 mm displacemetn.			
								16.40 m Is(50) d=3.62		16.4 / 867.4												16.40: JT, 20° CN, PL, SM, Intact, opened on handling.			16.4
										16.6 / 867.2															16.6
																						16.70: JT, 40° Py VN, UN, SM, Intact, opened on handling.			
										16.8 / 867.0															16.8
	HQ3			0 % Loss	R11 3.01m (100%)	100%		17.00 m Is(50) d=3.64		17.0 / 866.8				16.98-17.27: Amorphous Silica, hydrothermal vein / intrusion, pale grey to blue, very fine grained. Irregular and sharp contacts and, with 5-10mm alteration halo dippingat 40 to 70°												17.0
																						16.98-17.17: CX, IT, IR, 60 - 80°, intrusion. 17.12: JT, CN, CR, SM, 40 - 50°, intact, opened on handling.			
										17.2 / 866.6															17.2
																						17.26: JT, 75° FeO SN, UN, SM, Trace pyrite, intact, opened on handling.			
										17.4 / 866.4				17.36-20.30: Diamictite Protolith, dark grey brown, very fine matrix supporting 5% fine to medium sub-rounded to angular gravel clasts												17.4
																						17.42-17.43: Shear, 10° IT, PL, 2 mm displacement.			
										17.6 / 866.2															17.6
																						17.78: JT, Py VN, UN, 40 - 60°.			
										17.8 / 866.0												17.82: JT, Py VN, UN, SM, 5 - 10°, intact, opened on handling. 17.85: JT, 45° Ch CD, UN, SM, 1 mm, Healed.			17.8
										18.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R11 3.01m (100%) 100%				18.0 865.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	SW *(cont)*	H - VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
								18.2 865.6															18.2
								18.4 865.4												18.50: JT, Py VN, IR, 40 - 55°, healed.			18.4
								18.6 865.2												18.59: JT, 5° FeO SN, PL, SM		18.60: Point Load >20KN – No Failure	18.6
			18.69																	18.70: JT, 55° IT, PL			
								18.8 865.0												18.79: JT, 30° FeO SN, UN, SM, Intact, opened on handling.			18.8
								19.0 864.8												18.96: JT, 70° FeO SN, UN, SM, Intact, opened on handling.			19.0
																				19.06: JT, 65° FeO SN, UN, SM, Trace pyrite, intact, opened on handling.			
								19.2 864.6												19.16: JT, 80° Qz CT, PL, 1 mm, Healed.			19.2
			0 % Loss	R12 2.94m (100%) 100%				19.4 864.4															19.4
						19.62 m Is(50) a=6.09		19.6 864.2												19.65: JT, 10° Cl CT, UN, RO, 1 mm, Iron staining,.		19.62: Point Load >20KN – No Failure	19.6
								19.8 864.0												19.68-19.96: FO, 70° Cl VN, UN, SM, Intact, trace pyrite.			19.8
								20.0															

Observations and Comments

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:57 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R12 2.94m (100%) 100%				20.0 863.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F	VH				20.00: JT, 5° Ch VN, PL, Healed. 20.03: JT, 50° Cl VN, PL, SM, Intact, opened on handling.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
									20.2 863.6												20.21: JT, 50° Cl VN, PL, SM, Intact, opened on handling.			20.2
									20.4 863.4				20.38-21.81: dark grey to brown grey, interbedded mudstone and siltstone photolith Interbedded Mudstone & Siltstone Protolith, dark grey to brown grey, indistinct sub-horizontal thin to medium bedding, minor lineation at 60 - 70°										20.39: JT, 20° Py VN, PL, SM, Intact, opened on handling.			20.4
									20.6 863.2												20.54: JT, 20° Py VN, PL, SM, Intact, opened on handling.			20.6
									20.8 863.0												20.68: JT, Qz CT, UN, 2 mm, 40 - 50°, healed.			20.8
									21.0 862.8												20.93: JT, 20° CN, PL, SM, Intact, opened on handling.		20.90: Point Load >20KN – No Failure 20.94: Point Load >20KN – No Failure 21.00: Point Load >20KN – No Failure	21.0
									21.2 862.6												21.13-21.18: Shear, 40° Cl VN, UN, SL, Trace pyrite, intact, opened on handling.			21.2
									21.4 862.4												21.20-21.45: Shear, 72° Py VN, UN, SL, Intact, opened on handling.			21.4
																MA					21.49: JT, IT, IR, 85 - 90°, originates and terminates on joint.			
									21.6 862.2				21.58-21.65: clay infilled, 12 to 22 mm aperture, cream grey with brown orange staining, slightly altered								21.58-21.65: FT, 70° Cl infilled, 12 - 22 mm, slightly altered 21.47-21.81: FT, 70° Cl ID, IR, 12 - 22 mm, healed. 21.69: JT, 80° Cl CT, UN, 1 mm, SA, Terminates on joint.			21.6
				21.63																				
				0 % Loss	R13 3.07m (100%) 100%				21.8 862.0				21.79-21.86: Quartz Veins Subvertical and sub-horizontal cross cutting each other, rock fabric lineation, and relic indistinct bedding 21.86-22.60: Amorphous Silica, hydrothermal vein / intrusion, pale grey to blue, very fine grained. Irregular and sharp contacts and, with minor alteration halo dippingat 55° to 90°								21.80: JT, 65° IT, UN, Terminates on joint. 21.80: JT, 5° IT, PL 21.84: JT, 40° Qz VN, UN, Healed. 21.85: JT, 30° Cl VN, UN, Healed. 21.85: JT, 20° Cl VN, UN,			21.8
									22.0															

Observations and Comments

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Geological & Engineering Log

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Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		22.00 m Is(50) d=3.39		22.0 861.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			MA *(cont)*	F *(cont)*	VH *(cont)*				Healed. 21.87: JT, 10° Cl VN, UN, Healed. 21.98: JT, 80° Cl VN, UN, Discontinuous. 22.00: JT, 40° Cl VN, UN, SM, Healed. 22.14: JT, 75° Cl VN, UN, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM 22.05: Point Load >20KN – No Failure	
							22.2 861.6													22.30: JT, 60° IT, PL, Discontinuous. 22.32: JT, 50° IT, PL 22.37: JT, 50° IT, UN			22.2
							22.4 861.4													22.42: JT, 50° IT, PL			22.4
							22.6 861.2				22.59-22.71: Quartz Vein, moderately altered, irregular, dipping at 40 - 60° cross-cutting and parallel to minor lineation in rock fabric									22.63: JT, Py VN, UN, SM, 80 - 85°,.. 22.59-22.71: VE, ID, IR, SA, 40 - 60°, 1 - 8 mm, trace pyrite, chlorite, healed.			22.6
							22.8 861.0							SA									22.8
							23.0 860.8													23.01: JT, 20° Py VN, PL, SM, Intact, opened on handling. 23.04-23.09: VE, 50° Qz ID, IR, 1 - 10 mm, trace pyrite, chlorite, healed. 23.09-23.11: Shear, 20° Ch HE, PL			23.0
							23.2 860.6				23.23-24.74: Mudstone Protolith, dark grey to brown grey, indistinct bedding sub-horizontal, thinly to thickly bedded												23.2
							23.4 860.4													23.43: JT, 75° IT, UN, Discontinuous. 23.47: JT, 30° Py VN, PL, SM, Intact, opened on handling.		23.45: Point Load >20KN – No Failure	23.4
							23.6 860.2													23.56: JT, 20° Py VN, PL, SM, Intact, opened on handling. 23.60: JT, 70° Qz VN, PL, Healed. 23.68: JT, 30° IT, PL			23.6
							23.8 860.0													23.77: JT, 30° Py VN, UN, Healed. 23.82: JT, 50° IT, PL			23.8
							24.0													23.98: JT, 35° Py VN, PL, SM,			

R13 3.07m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
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Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R13 3.07m (100%) 100%		24.10 m Is(50) d=2.6		24.0 859.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH *(cont)*				Intact, opened on handling.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								24.2 859.6												24.14: JT, 20° IT, PL 24.16: JT, 5° Cl VN, PL, SM, Intact, opened on handling.		24.14: Point Load >20KN – No Failure	24.2
								24.4 859.4												24.37: JT, 40° Py VN, PL, SM, Intact, opened on handling. 24.44: JT, 60° IT, PL			24.4
								24.6 859.2												24.62: JT, 60° IT, PL, Healed.			24.6
												24.74-26.73: foliated at 60 - 70°, multiple heat altered minerals, 1 to 10 mm, sub-rounded								24.73: JT, 70° Py VN, UN, Healed. 24.76: JT, 30° Py VN, PL, SM, Intact, opened on handling.			24.8
				24.70				24.8 859.0												24.92: JT, 25° Qz VN, PL, Healed. 24.97: JT, 60° Qz VN, UN, Healed. 25.03: Shear, 3° IT, UN, 2 mm displacement. 25.07: JT, 60° Qz VN, UN, Healed.			
								25.0 858.8														25.00: Point Load >20KN – No Failure	25.0
			0 % Loss	R14 3.04m (100%) 100%				25.2 858.6												25.17: JT, 20° Py VN, UN, SM, Intact, opened on handling. 25.20: JT, 65° Qz VN, UN, Healed.			25.2
								25.4 858.4												25.33-25.35: Shear, 40° Py VN, PL, 3 mm displacement, intact. 25.40: JT, 65° Ch VN, UN, Healed. 25.42: JT, 65° Py CT, UN, 2 mm, MA, Clay and chlorite, healed. 25.44: JT, 70° Py CT, UN, 2 mm, MA, Clay and chlorite, healed.			25.4
								25.6 858.2												25.63: JT, 60° Ch VN, UN, Healed. 25.68: JT, 80° IT, UN, Originates and terminates on joint.			25.6
								25.8 858.0												25.75-25.89: Shear, 65° IT, UN, 1 mm displacement. 25.79-25.86: Shear, IT, UN, 60 - 70°, 4 mm displacement. 25.84: JT, 70° IT, UN 25.93: JT, 25° Ch VN, PL, Healed.			25.8
								26.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:57 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R14 3.04m (100%) 100%		26.00 m Is(50) d=3.02 26.04 m Is(50) a=5.82		26.0 857.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH *(cont)*				25.96: JT, 60° IT, PL, Discontinuous. 26.12: JT, 60° Qz VN, UN, Terminates on joint. 26.18: JT, 35° Qz CT, UN, 1 - 3 mm, healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
									26.2 857.6				26.31: Quarts Veinlets, discontinuous, dipping parallel to sub-horizontal indistinct bedding											
									26.4 857.4												26.53: JT, 65° Qz VN, PL, Terminates on joint. 26.64: JT, 70° Qz VN, PL, Healed.			
									26.6 857.2				26.68: Quarts Veinlets, discontinuous, dipping parallel to sub-horizontal indistinct bedding 26.72: Sandstone Protolith beds increasing light brown grey, possibly tuffacious								26.69-26.75: Shear, 50° Cl VN, UN			
									26.8 857.0															
									27.0 856.8														27.00: Point Load >20KN – No Failure	
									27.2 856.6												27.24: JT, 5° pyrie VN, PL, SM, Intact, opened on handling.			
									27.4 856.4												27.35: JT, 40° IT, PL 26.70-28.00: FT, Qz ID, IR, 10 - 60°, 1 to 50 mm, with sub angular to angular quartz gravel greater than 50 mm, healed. 27.40: JT, 25° Qz VN, PL, SM, Healed. 27.40-27.50: Shear, Py VN, IR, 20 - 40°, healed. 27.52: JT, Qz CT, CR, 1 mm, 20 - 30°, healed.			
									27.6 856.2															
				0 % Loss	27.74 R15 3.01m (100%) 100%				27.8 856.0				27.68: Quarts Vein, discontinuous, 10mm appature dipping parallel to sub-horizontal indistinct bedding								27.74-27.93: Shear, 70° IT, UN, Terminates on joint. 27.90: JT, 40° Py VN, UN, SM, Intact, opened on handling.			
									28.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R15 3.01m (100%)	100%		28.00 m Is(50) d=1.9		28.0 / 855.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM 28.02-28.33: pale grey to dark grey with brown, white, green and blue	
														28.09-28.33: Fault Gouge, pale grey to dark grey with brown, white, green and blue, angular quartz fragments and quartz veins throughout up to 60 mm, silty and clay matrix, distinctly altered, low to medium strength, healed			DA		L - M				28.09-28.33: FT, HE, IR, 50 - 70°, angular quartz fragments up to 60 mm, silty and clay matrix, low to medium strength, fragmented by drilling.			
										28.2 / 855.6															28.2
														28.33-28.62: multiple quartz veins, with chlorite and trace pyrite, 2 to 50 mm thickness, sub-horizontal to sub-vertical dip, 40 to 240 mm spacing			SA		VH				28.35-28.42: Shear, 55° Qz CT, UN, 3 mm, Healed.		28.33-28.36: grey to dark grey brown with white and green	
										28.4 / 855.4												28.45: JT, 5° Qz VN, PL, Healed.			28.4
																						28.55: JT, 15° Qz CT, UN, 1 mm, Healed.			
										28.6 / 855.2												28.59-28.61: SI, Qz ID, UN, 0 - 5°, 5 - 10 mm.			28.6
																						28.66: JT, 40° IT, UN			
																						28.67-28.77: VE, Qz ID, IR, 0 - 20°, 1 to 20 mm, healed.			
																						28.76: JT, 60° Py VN, UN, Healed.			
										28.8 / 855.0												28.79-28.83: VE, 35° Qz ID, UN, 3 mm, Healed.			28.8
																						28.86-28.92: VE, 40° Qz ID, UN, 3 mm, Healed.			
																						28.93-28.95: VE, Qz VN, CR, 5 - 20°, healed.			
								29.00 m Is(50) d=5.26 29.05 m Is(50) a=3.93		29.0 / 854.8												28.96-29.08: VE, Qz ID, UN, 5 - 10 mm, 30 - 50°.			29.0
										29.2 / 854.6															29.2
														29.36-29.51: Quartz Vein, with chlorite and trace pyrite, irregular contact, sigma shearing dipping 5-30°								29.36-29.51: SI, Qz ID, IR, 150 mm, 5 - 30°, trace pyrite, chlorite, healed.			29.4
										29.4 / 854.4															
										29.6 / 854.2												29.61-29.62: VE, 3° Qz, IR, 5 mm, Healed.			29.6
																						29.74: JT, 5° Qz VN, PL, Healed. 29.76: JT, 5° Qz VN, PL, Healed.			
										29.8 / 854.0															29.8
										30.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength Point Load Is(50) ● - Axial ○ - Diametral	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R15 3.01m (100%) 100%				30.0 853.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		30.02: JT, 2° Py VN, PL, Intact, opened on handling.		NAMBUCCA BEDS - CONTACT METAMORPHISM 30.00: Point Load >20KN – No Failure	
							30.2 853.6													30.09: JT, 40° Ch VN, UN, Healed.			30.2
																				30.16: JT, Py VN, UN, 10 - 25°, healed.			
																				30.20: JT, 15° IT, UN			
							30.4 853.4													30.29: JT, 83° Ch VN, PL, Trace pyrite, healed.			30.4
																				30.39: JT, 30° Ch VN, UN, Healed.			
																				30.44: JT, Py VN, ST, SM, 20 - 60°.			
																				30.49: JT, 80° Py VN, UN, Healed.			
							30.6 853.2													30.56: JT, 20° Py VN, UN, SM, Intact, opened on handling.			30.6
		30.75																					
							30.8 853.0													30.76: JT, 70° Ch VN, PL, Discontinuous, healed.			30.8
																				30.86: JT, 35° Ch VN, PL, Healed.			
																				30.94: JT, 70° Ch VN, PL, Healed.			
							31.0 852.8													31.05: JT, 70° Ch VN, UN, Healed.			31.0
		0 % Loss	R16 2.96m (100%) 100%		31.56 m Is(50) a=2.42		31.2 852.6													31.21: JT, 40° IT, PL			31.2
																				31.25: JT, 30° IT, UN			
							31.4 852.4													31.42: JT, 80° Ch VN, PL			31.4
																						31.51: Point Load >20KN – No Failure	
							31.6 852.2																31.6
							31.8 852.0													31.73-32.08: Shear, 72° Py VN, PL, SL, Intact, opened on handling.			31.8
							32.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R16 2.96m (100%) 100%	32.90 m Is(50) d=5.73		32.0 851.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				32.10: JT, 5° CN, PL, SM 31.90-32.32: VE, Qz CT, IR, 1 - 2 mm, 60 - 90°, healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							32.2 851.6															32.2
							32.4 851.4												32.00-32.56: VE, Qz HE, IR, 1 mm, 60 - 90°. 32.39: JT, 45° Qz CT, UN, 1 mm, Healed. 32.40: JT, 25° CN, UN, SM					32.4
							32.6 851.2				32.63-33.38: Amorphous Silica, hydrothermal vein / intrusion, pale grey to blue, very fine grained. Irregular contact with alteration halo dipping at 40-60°			MA						32.62: JT, 70° Py VN, UN, Terminates on joint. 32.66: JT, 10° Qz VN, PL, Healed. 32.72: JT, 10° IT, UN 32.77: JT, 35° IT, PL			32.6
							32.8 851.0												32.83: JT, 70° Py HE, UN, Originates on joint. 32.84: JT, 65° Py HE, PL			32.8
							33.0 850.8												32.96: JT, 45° IT, PL 32.97: JT, 45° IT, PL 33.02: JT, IT, CR, 10 - 30°. 33.05: JT, 45° Qz CT, PL, 2 mm, Healed. 33.08: JT, 50° IT, PL 33.11: JT, 65° Py VN, UN, Originates on joint, healed. 33.15: JT, 75° Qz VN, UN, SM, Terminates on joint, healed. 33.19: JT, 70° Qz VN, UN, Originates and terminates on adjacent joint, healed. 33.23: JT, 50° Qz VN, UN, Healed. 33.28: JT, 30° Um VN, UN, Intac, opened on handling, yellowish white mineral soapy feel. 33.36: JT, intact, CR, 10 - 40°.			33.0
							33.2 850.6															33.2
							33.4 850.4							SA					33.50: JT, IT, UN, 70 - 80°, terminates on joint.			33.4
			0 % Loss	R17 3.03m (100%) 100%	33.90 m Is(50) d=0.57		33.6 850.2				33.59-34.55: Diamictite Protolith with very fine grained matrix, trace <5% matrix supported gravel sized clasts 5 to 45 mm sub-rounded								33.61: JT, 70° IT, PL, Discontinuous.			33.6
			33.71				33.8 850.0												33.70: JT, Py VN, CR, SM, 15 - 30°, intact, opened on drilling break. 33.72: JT, 15° IT, UN 33.78: JT, 50° Qz CT, UN, 1 mm, Healed.			33.8
							34.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R 17 3.03m (100%) 100%			34.90 m Is(50) d=4.91		34.0 / 849.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				34.02: JT, 75° Py VN, UN, Healed. 34.02: JT, 15° Qz CT, UN, 1 - 4 mm. 34.07: JT, 15° Qz VN, PL, Healed. 34.08: JT, 75° Py VN, UN, Healed. 34.15: JT, 85° UN, Incipient.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
										34.2 / 849.6															34.2
										34.4 / 849.4				34.45-36.80: with 5 - 10% 0.5 to 10 mm sub-rounded to sub-angular gravel sized clasts 34.47: indistinct sub-horizontal bedding								34.37: JT, 70° Qz VN, PL, Discontinuous, healed. 34.39: JT, 10° IT, PL 34.41: JT, IT, ST, 50 - 60°. 34.47: JT, 70° Qz VN, PL, Originates on joint, healed. 34.54: JT, 65° CN, UN, SM			34.4
										34.6 / 849.2															34.6
																						34.68: JT, 40° Qz VN, UN, Healed.			
										34.8 / 849.0												34.78: JT, 70° Qz VN, ST, Healed. 34.74-34.83: Shear, Qz VN, ST, 40 - 60°, 6 mm displacement, healed.			34.8
																						34.90: JT, 85° Py VN, UN, SM, Originates on joint, with yellowish white soapy mineral. 34.91: JT, 20° CN, UN, SM, Intact, opened on handling.			
										35.0 / 848.8												35.08: JT, 45° IT, PL			35.0
										35.2 / 848.6												35.22: JT, 20° CN, UN, SM		35.17: Point Load >20KN – No Failure	35.2
																						35.30: JT, 30° Qz CT, PL, 1 mm, Healed. 35.34: JT, 70° Qz VN, PL, Healed.			
										35.4 / 848.4												35.41: JT, 10° IT, PL 35.43: JT, 70° intact, PL, Originates on joint. 35.44: JT, 40° Qz VN, ST, Originates on joint, healed. 35.53: JT, Qz VN, ST, 70 - 80, healed.			35.4
										35.6 / 848.2												35.58-35.65: Shear, 40° IT, UN, 8 mm displacement. 35.67: JT, 3° Qz VN, PL, Healed.			35.6
										35.8 / 848.0												35.74: JT, 80° Py VN, UN, Terminates on joint, intact. 35.80: JT, 70° Qz VN, PL, Healed.			35.8
																						35.88: JT, 45° Py VN, UN, SM, Intact, opened on handling. 35.91 35.95: JT, 80° Py VN, UN, SM, Intact.			
										36.0															

Observations and Comments

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:57 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength Point Load Is(50) ● - Axial ○ - Diametral	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				36.0 / 847.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		35.99: JT, 30° Qz VN, PL, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							36.2 / 847.6													36.10: JT, 40° Qz VN, PL, Healed. 36.11: JT, 25° Qz VN, PL, Healed. 36.15: JT, 50° Qz VN, PL, Healed. 36.18: JT, 70° CN, UN, SM 36.19: JT, 70° Qz HE, PL, SM, Originates on joint. 36.20: JT, 75° HE, UN 36.24: JT, Py VN, UN, SM, 75 - 80°, healed. 36.24: JT, 65° Qz CT, UN, 1 mm, Discontinuous. 36.34: JT, Qz VN, IR, SM, 70 - 80°, healed. 36.52: JT, 5° Qz VN, PL, Healed.			36.2
							36.4 / 847.4																36.4
							36.6 / 847.2				36.50: increasing Sandstone Protolith, with fine to medium grain size tuffacious and lithic clasts										36.39-36.90: Set A): Joint, 70°, Undulating, Quartz, @ 10 - 50 mm sp. discontinuous.		36.6
							36.8 / 847.0													36.71: JT, Py HE, UN 36.79: JT, Qz VN, UN, 60 - 70°, healed.			36.8
							37.0 / 846.8													36.89: JT, 5° Qz VN, PL, Healed. 36.91: JT, 5° Qz VN, PL, Healed. 36.92: JT, 75° Qz VN, PL, Healed. 36.97: JT, 35° Qz VN, UN, Healed. 37.00: JT, 70° Qz HE, PL, Originates and terminates on adjacent joint. 37.02: JT, 65° Qz VN, PL, Healed. 37.02: JT, 78° Qz VN, PL, Healed.		36.90: Point Load >20KN – No Failure	37.0
							37.2 / 846.6													37.20: JT, 45° Py VN, UN, Healed. 37.27: JT, 75° Qz VN, UN, Healed.			37.2
							37.4 / 846.4													37.37: JT, 55° Qz HE, UN 37.43: JT, 50° Qz HE, PL 37.47: JT, 35° Qz HE, PL, Originates on joint. 37.50: JT, 75° Qz CT, UN, 1 - 3 mm, originates on joint.			37.4
							37.6 / 846.2													37.60: JT, 35° Py VN, UN, SM, Intact, opened on handling. 37.62: JT, 30° Py VN, UN, Originates on joint, healed. 37.65: JT, 60° HE, UN, Originates on joint.			37.6
							37.8 / 846.0				37.70: increasing Diamictite Protolith 37.73-38.86: increasing 5% gravel sized clasts, matrix supported, up to 20 mm, sub-rounded to sub-angular									37.77: JT, 45° Qz HE, UN 37.78: JT, 15° Qz VN, PL, Healed. 37.83: JT, 75° Qz VN, UN, Originates on joint, healed. 37.91: JT, 70° Py VN, UN, Originates on joint.		37.90: Point Load >20KN – No Failure	37.8
							38.0																

R17 3.03m (100%) 100%
36.74
R18 3.00m (100%) 100%

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				38.0 845.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		37.99-38.02: Shear, 25° Py VN, PL, SL		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							38.2 845.6													38.24: JT, 50° Qz CT, ST, 1 mm, Healed.			38.2
																				38.32: JT, 35° Qz CT, PL, 1 mm, Healed.			
							38.4 845.4													38.38: JT, 35° Qz VN, PL, Healed. 38.39: JT, 40° Qz VN, PL, Healed.			38.4
																				38.47: JT, Py VN, UN, 40 - 85°, discontinuous, healed. 38.48: JT, Qz CT, IR, 1 mm, 40 - 90°, originates on adjacent joint, healed.			
							38.6 845.2													38.63: JT, 55° Py VN, UN, Healed.			38.6
																				38.77: JT, 50° Py VN, PL, Healed.			
							38.8 845.0													38.85: JT, 5° Py VN, PL, Healed.			38.8
																				38.90: JT, 10° Py VN, PL, Healed.	38.01-39.80: Set A): Joint, 75°, Planar, @ 20 - 200 mm sp. discontinuous.	38.85: Point Load >20KN – No Failure	
																				38.95-38.98: Shear, 30° Py VN, PL, SL			
							39.0 844.8													39.09: JT, 15° VN, PL, SL, Intact, opened on handling, infill unknown, silvery mineral possibly mica with trace pyrite. 39.10: JT, Qz CT, IR, SM, 1 - 2 mm, 0 - 50°, healed.			39.0
											39.15-42.71: increasing 10 - 15% lithic grains, up to 5 mm, rounded to sub-angular									39.12: JT, 70° Um VN, PL, SM, Yellowish white mineral, soapy feel possibly high magnesium content, dolomite.			
							39.2 844.6													39.15: JT, 5° Qz VN, UN, Healed. 39.25: JT, Qz VN, UN, 70 - 90°, originates on joint, healed.			39.2
																				39.28: JT, 70° HE, UN, Terminates on joint. 39.29: JT, 20° Qz VN, PL, SM, Healed.			
							39.4 844.4													39.46: JT, 20° HE, PL, SM			39.4
																				39.56: JT, 85° Py HE, UN, SM, Terminates on joint. 39.57: JT, 20° HE, PL, SM			
							39.6 844.2																39.6
			39.74																	39.73: JT, Qz VN, IR, 30 - 90°, healed.		39.68: Point Load >20KN – No Failure	
			0 % Loss				39.8 844.0													39.83: JT, HE, UN, 10 - 20°.			39.8
																				39.94: JT, Py VN, IR, SM, 50 - 65°, healed.			
							40.0																

R18 3.00m (100%) 100%

R19 3.01m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			0 % Loss	R19 3.01m (100%) 100%					40.0 843.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				39.98: JT, 60° Py VN, UN, SM, Intact, opened on handling.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
																						40.10: JT, 45° Qz HE, UN			
																						40.14: JT, 10° HE, UN			
										40.2 843.6												40.19: JT, HE, CR, 30 - 60°.			40.2
																						40.26: JT, 60° Qz HE, UN, 1 mm			
																						40.29: JT, 65° Qz HE, UN			
																						40.30: JT, 20° Qz HE, PL, SM			
																						40.31: JT, 25° HE, PL			
																						40.32: JT, Qz HE, ST, 70 - 90°.			
										40.4 843.4												40.37: JT, 25° HE, PL, SM			40.4
																						40.54: JT, 15° Qz CT, UN, SM, 1 - 2 mm, healed.			
										40.6 843.2															40.6
																									40.8
																						40.90-40.92: VE, Qz HE, IR, 4 mm, 20 - 40°, trace pyrite.		40.90: Point Load >20KN – No Failure	
										41.0 842.8															41.0
																						41.05: JT, 35° Qz VN, UN, Healed.			
																						41.09: JT, Qz VN, IR, 25 - 50°, healed.			
																						41.16: JT, 40° (α 0°), Py VN, UN, SM, Intact, opened on handling.			
										41.2 842.6												41.17: JT, 45° Py VN, UN, Healed.			41.2
																						41.28: JT, 35° Qz VN, PL, Healed.			
																						41.28: JT, 20° Qz VN, PL, Healed.			
										41.4 842.4															41.4
																									41.6
										41.6 842.2												41.62: JT, 60° HE, UN, Discontinuous.			
																						41.63: JT, 35° Py VN, PL, SM, Healed.			
																						41.65: JT, Qz VN, IR, 60 - 85°, discontinuous, healed.			
																						41.70: JT, 20° Py VN, PL, SM, Intact, opened on handling.			
										41.8 842.0												41.72: JT, 15° Py VN, UN, Healed.			41.8
																						41.76: JT, 70° Py VN, PL, 5 mm displacement, healed.		41.83: Point Load >20KN – No Failure	
																						41.82: JT, 55° HE, PL			
																						41.94: JT, 10° Py VN, PL, SM, Intact, opened on handling.			
										42.0															

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● - Axial ○ - Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R19 3.01m (100%) 100%				42.0 841.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 42.00: Diamictite Protolith			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		42.01: JT, 25° Qz VN, PL, Healed. 42.06: JT, 45° Qz VN, PL, Healed. 42.09: JT, Qz CT, IR, 1 mm, 10 - 50°, healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								42.2 841.6												42.23: JT, 45° Py VN, UN, SM, Intact, opened on handling.			42.2
								42.4 841.4												42.47: JT, healed, ST, 40 - 50°, healed.			42.4
								42.6 841.2												42.65: JT, CR, SM, 20 - 40°, intact, opened on handling. 42.73: JT, 45° Qz CT, UN, 1 mm, Healed.			42.6
			42.75					42.8 841.0														42.90: Point Load >20KN – No Failure	42.8
			0 % Loss	R20 3.00m (100%) 100%				43.0 840.8												42.95: JT, 80° Qz CT, ST, 1 mm, Discontinuous, healed. 43.03: JT, 50° Qz CT, UN, 1 mm, Trace pyrite, healed. 43.11: JT, 35° HE, PL 43.13: JT, 10° HE, PL, 3 - 5 mm displacement.			43.0
								43.2 840.6												43.22-43.24: Shear, 20° Qz VN, UN, SL, Trace pyrite, intact, opened on handling. 43.33: JT, 25° Qz VN, PL, SM, Healed.			43.2
								43.4 840.4															43.4
								43.6 840.2												43.66: JT, 20° Py VN, PL, SM, Intact, opened on handling. 43.66-43.70: VE, 40° Qz ID, IR, 1 mm 43.71-43.75: VE, 30° Qz ID, IR, 2 - 12 mm. 43.78: JT, 30° Qz CT, UN, 1 mm, Healed.	43.40-44.00: Set A): Joint, 75 - 85°, Undulating, Unidentifed mineral, @ 20 - 40 mm sp.		43.6
								43.8 840.0														43.83: Point Load >20KN – No Failure	43.8
								44.0												43.92: JT, 20° Qz VN, UN, Healed.			

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			0 % Loss	R20 3.00m (100%) 100%					44.0 839.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*						NAMBUCCA BEDS - CONTACT METAMORPHISM	
										44.2 839.6				44.13-44.35: trace 5 - 10% lithic clasts up to 15 mm, sub-rounded to sub-angular									44.16: JT, 50° Py CT, UN, 1 mm, Healed. 44.17: JT, 30° Py VN, UN, SM, Intact, opened on handling.			44.2
										44.4 839.4													44.31: JT, 45° HE, PL 44.35: JT, 10° Py VN, PL, SM, Intact, opened on handling. 44.40: JT, Qz CT, IR, 2 mm, 30 - 60° healed. 44.43: JT, 60° Qz VN, UN, Healed. 44.47: JT, 45° Qz VN, UN, Healed. 44.48: JT, 60° Qz VN, UN, Healed. 44.56: JT, 10° Qz VN, CR, Healed. 44.64: JT, 50° Qz VN, UN, Healed. 44.66: JT, 60° Qz VN, PL, Healed.			44.4
										44.6 839.2															44.6
										44.8 839.0													44.81: JT, 25° Py VN, PL, SM, Intact, opened on handling.			44.8
										45.0 838.8													44.89: Point Load >20KN – No Failure 44.95: JT, 65° Qz VN, ST, Healed. 45.08: JT, 80° Py VN, UN, Healed.			45.0
										45.2 838.6													45.20: JT, 55° Qz VN, PL, Healed.			45.2
										45.4 838.4													45.33: JT, 75° Qz HE, UN, Discontinuous. 45.33: JT, 45° Qz VN, PL 45.45: JT, 35° Qz VN, PL, Healed.			45.4
										45.6 838.2													45.54: JT, Qz VN, CR, SM, 10 - 20°, intact, opened on handling. 45.55: JT, 20° Qz VN, PL, SM, Intact, opened on handling. 45.62: JT, 50° Qz VN, PL, Healed.			45.6
										45.8 838.0													45.72: JT, 70° Py VN, PL, SM, Healed.			45.8
				0 % Loss	R21 3.00m (100%) 100%					45.75 46.0															45.90: Point Load >20KN – No Failure

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:57 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		R21 3.00m (100%) 100%		46.90 m Is(50) d=5.58		46.0 837.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				46.11: JT, 60° healed, UN 46.14: JT, 70° Py VN, UN, Terminates on joint, healed. 46.15: JT, 60° Py VN, UN, Healed. 46.15: JT, 55° Py VN, UN, Healed. 46.21: JT, 20° Qz VN, UN, Healed. 46.24: JT, 35° Qz VN, UN, Healed. 46.30: JT, 45° Qz VN, PL, Healed. 46.31: JT, 55° UN, SM, Intact, opened on handling. 46.44: JT, 75° HE, UN, Terminates on joint. 46.47: JT, 10° Py VN, UN, SM, Intact, opened on handling. 46.51: JT, 5° HE, UN 46.58: JT, 15° HE, UN 46.63: JT, 45° CN, UN, SM, Intact, opened on handling. 46.67: JT, 15° Qz VN, PL, Healed. 46.75: JT, 40° Py VN, PL, SM, Intact, opened on handling. 46.75: JT, 60° Py VN, UN, SM, Healed. 46.86: JT, 83° Qz VN, PL, Healed. 46.90: JT, Py VN, CR, SM, 20 - 30°, intact, opened on handling. 46.90: JT, 0° Qz VN, PL, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	46.2 46.4 46.6 46.8
									46.2 837.6															
									46.4 837.4				46.37-46.52: Amorphous Silica, hydrothermal vein / intrusion pale grey to blue, very fine grained, sharp contact with alteration halo dipping at 40 to 65°											
									46.6 837.2															
									46.8 837.0															
									47.0 836.8												47.04: JT, 10° HE, PL			47.0
									47.2 836.6												47.17: JT, 80° Qz VN, UN, Healed. 47.19-47.42: Shear, Qz VN, IR, 70 - 80°, 4 mm displacement, healed. 47.41: JT, 15° Py VN, PL, SM, Intact, opened on handling. 47.43: JT, 15° Qz VN, PL, Healed. 47.46: JT, HE, CR, 5 - 10°.			47.2 47.4
									47.4 836.4															
									47.6 836.2				47.53-48.26: Amorphous Silica, hydrothermal vein / intrusion, pale grey to blue, very fine grained. Irregular upper contact (possible relic rip up clasts) and sharp lower contact with alteration halo dipping at 40° 47.70: indistinct sub-horizontal bedding			DA					47.59: JT, 40° Qz CT, ST, 1 mm, Healed. 47.60: JT, IR, 75 - 85°, incipient. 47.66: JT, IR, 60 - °85°, incipient. 47.67: JT, 40° Py VN, UN, Healed. 47.69: JT, 10° HE, PL			47.6
									47.8 836.0															47.8
									48.0												47.88: JT, 70° HE, UN 47.93: JT, 40° HE, PL		47.90: Point Load >20KN – No Failure	

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R21 3.00m (100%) 100%		48.75 m Is(50) a=5.95		48.0 / 835.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			DA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000		48.02: JT, 40° HE, IR, SM		NAMBUCCA BEDS - CONTACT METAMORPHISM	
																				48.07: JT, 20° HE, PL, SM		48.00: Point Load >20KN – No Failure	
																				48.08: JT, 20° HE, PL, SM			
																				48.09: JT, 20° HE, PL, SM			
								48.2 / 835.6												48.20: JT, 30° HE, PL, SM			48.2
															SA					48.25: JT, 30° HE, PL, SM			
								48.4 / 835.4															48.4
																				48.49: JT, 85° Qz VN, PL, SM			
																				48.51: JT, 45° Qz VN, PL, SM, Healed.			
								48.6 / 835.2															48.6
																				48.68: JT, 87° Py VN, PL, SM, Healed.			
			0 % Loss					48.8 / 835.0															48.8
																						49.00: Point Load >20KN – No Failure	49.0
								49.0 / 834.8												49.18: JT, 35° Qz VN, PL, SM, Healed.			
																				49.21: JT, 2° Qz VN, PL, SM, Healed.			
								49.2 / 834.6															49.2
				R22 2.95m (100%) 100%								49.40-50.19: Sandstone Protolith increasing matrix grain size, fine to medium, increasing lithic clasts												49.4
								49.4 / 834.4												49.45: JT, 45° Qz VN, PL, SM, Healed.			
																				49.53: JT, 75° Qz CT, PL, SM, 1mm, healed.			
																				49.57: JT, 35° Qz VN, PL, SM			
								49.6 / 834.2												49.69: JT, 35° Qz VN, PL, SM			49.6
								49.8 / 834.0												49.80: JT, 30° Qz VN, PL, SM, Healed.			49.8
																				49.80: JT, 45° Qz VN, PL, SM, Healed.			
								50.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Testing: Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		50.62 m Is(50) d=4.98		R22 2.95m (100%) 100%	50.0 / 833.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				50.07: JT, 87° Qz VN, PL, SM		NAMBUCCA BEDS - CONTACT METAMORPHISM	
																				50.11: JT, 30° Qz VN, PL, SM, Healed.			
								50.2 / 833.6															50.2
								50.4 / 833.4				50.46-50.48: Quartz Vein, 5 - 20 mm aperture, dipping at 10-25°, 5%								50.42: JT, 70° Qz CD, PL, SM, Trace pyrite, terminates on vein.			50.4
																				50.51: JT, Qz VN, PL, SM, Terminates on vein.			
								50.6 / 833.2												50.55-50.60: VO, 30° Qz CT, UN, SM, Chlorite, <10 mm.			50.6
												50.75-50.96: Quartz Veinletts, irregular sub-horizontal								50.69-50.71: Vugh, Qz ID, IR, SM, 10 - 20°, trace pyrite, chlorite.			
								50.8 / 833.0												50.73-50.84: VO, Qz CT, IR, SM, 5 mm, 10 - 50°, chlorite.			50.8
												50.86-50.88: Quartz Vein, 10 mm aperture, dipping at 15°											
												50.90-50.91: Quartz Vein, 10 mm aperture, dipping at 15°											
								51.0 / 832.8												51.01: JT, 45° Qz CT, PL, SM, 5 mm			51.0
																				51.06: JT, 35° Qz VN, PL, SM, Trace pyrite.			
								51.2 / 832.6												51.27: JT, Py VN, IR, SM, 45 - 75°, healed.			51.2
												51.31-51.32: Quartz Vein, 30°								51.32: JT, 75° Py VN, UN, RO			
								51.4 / 832.4															51.4
												51.51-51.67: Quartz Vein, irregular contact, dipping at 15 - 80°								51.51: JT, 30° Qz VN, PL, SM, Healed.			
					51.60 m Is(50) d=5.49, a=5.65			51.6 / 832.2															51.6
			51.70																	51.71-51.73: VE, Qz CT, IR, SM, 5 mm, 10 - 30°.			
			0 % Loss				R23 3.00m (100%) 100%	51.8 / 832.0												51.78-51.80: VE, 20° Qz CT, PL, SM, 5 mm			51.8
																				51.87: JT, 80° Qz VN, PL, SM, Healed.			
								52.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water (Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R23 3.00m (100%) 100%					52.0 831.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				52.01: JT, 45° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
																					52.13: JT, 85° Qz VN, PL, SM, Healed.			
																					52.18: JT, 70° Qz VN, PL, SM, Healed.			
									52.2 831.6												52.24: JT, 70° Qz VN, PL, SM, Healed.			52.2
																					52.26: JT, 30° Qz VN, PL, SM, Healed.			
									52.4 831.4															52.4
													52.52-52.69: Sandstone Protolith, fine to medium grained 20% lithic clasts								52.51: JT, 85° Qz VN, PL, SM, Trace pyrite, healed.			
									52.6 831.2												52.63: JT, 30° Qz VN, PL, SM, Healed.			52.6
																					52.73: JT, 45° Qz VN, PL, SM, Trace pyrite, healed.			
									52.8 831.0															52.8
																					52.94: JT, Qz VN, IR, SM, 10 - 80°, healed.			
																					52.94: JT, 45° Qz VN, PL, SM, Trace pyrite, healed.			
									53.0 830.8												52.97: JT, Qz VN, IR, SM, 10 - 80°, healed.			53.0
																					53.01: JT, 30° Qz CT, PL, SM, 1 mm, Healed.			
													53.11-53.43: Ripup Clasts, tabular, 5-10 mm rtrfrdx											
									53.2 830.6															53.2
																					53.23-53.30: Shear, 45° X VN, PL, SM, Trace pyrite, healed.			
																							53.32: Point Load >20KN – No Failure	
									53.4 830.4															53.4
													53.45: becoming Siltstone Protolith								53.49: JT, 10° Qz VN, PL, SM, Healed.			
																					53.56: JT, 40° Qz CT, PL, SM, Healed.			
									53.6 830.2															53.6
													53.59-56.25: Sandstone Protolith, fine to medium grained 20% lithic clasts								53.70: JT, 40° Qz VN, PL, SM, Healed.			
																					53.72: JT, 35° Qz VN, UN, SM, Healed.			
									53.8 830.0												53.75: JT, 3° Qz VN, PL, SM, Healed.			53.8
																					53.85: JT, 35° Qz VN, UN, SM, Healed.			
									54.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				54.0 829.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		54.08: JT, 35° Qz VN, PL, SM, Healed. 54.08: JT, 5° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							54.2 829.6													54.19-54.26: Shear, 55° CN, UN, RO, Healed. 54.23-54.30: Shear, 55° CN, UN, RO, Healed. 54.29: JT, Check details. 54.36: JT, 80° Qz VN, PL, SM, Healed.		54.19-56.85: soft sediment deformation	54.2
							54.4 829.4													54.33-54.40: Shear, 55° CN, UN, RO, Healed. 54.40-54.43: Shear, 30° CN, UN, RO, Healed. 54.42-54.45: Shear, 30° CN, UN, RO, Healed. 54.43-54.45: Shear, 30° CN, UN, RO, Healed. 54.45: JT, 30° Qz VN, PL, SM, Trace pyrite, healed.			54.4
							54.6 829.2													54.43-54.49: Shear, 55° CN, UN, RO, Healed. 54.45-54.51: Shear, 55° CN, UN, RO, Healed. 54.52-54.57: Shear, 55° CN, UN, RO, Healed. 54.56-54.60: Shear, 50° CN, UN, RO, Healed. 54.61-54.66: Shear, 50° CN, UN, RO, Healed.			54.6
							54.8 829.0													54.68: JT, 70° Qz VN, PL, SM, Healed. 54.76: JT, 70° Qz VN, PL, SM, Healed, discontinuous. 54.90-54.92: Shear, 15° Py VN, PL, SM, Healed, 1mm displacement.			54.8
							55.0 828.8													54.93: JT, 25° Qz VN, PL, SM, Healed. 54.97: JT, 25° Qz VN, PL, SM, Healed. 55.05-55.13: Shear, 60° CN, UN, RO, Healed, 2 mm displacement. 55.14-55.23: Shear, 60° CN, UN, RO, Healed, 2 mm displacement. 55.31: JT, Qz VN, CR, SM, 80 - 90°, healed. 55.37: JT, 60° Qz VN, PL, SM, Healed. 55.40: JT, 60° Qz VN, PL, SM, Healed.		55.00: Point Load >20KN – No Failure	55.0
							55.2 828.6																55.2
							55.4 828.4																55.4
							55.6 828.2													55.60: JT, 40° Qz VN, PL, SM, Healed.			55.6
							55.8 828.0																55.8
							56.0													55.80-55.88: Shear, 60° CN, UN, RO, Healed, 2 mm displacement. 55.85-55.89: Shear, 45° CN, UN, RO, Healed.			

0 % Loss — R23 3.00m (100%) 100% — 54.70 — 0 % Loss — R24 3.05m (100%) 100%

Observations and Comments

Notes

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Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Loss / Gain	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R24 3.05m (100%) 100%					56.0 827.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				56.02: JT, 40° Py VN, PL, SM, Healed. 56.06: JT, 50° Qz VN, PL, SM, Healed. 56.03-56.08: Shear, 40° CN, UN, RO, Healed, 3 to 10 mm displacement. 56.06-56.17: Shear, 60° CN, UN, RO, Healed, 3 - 10 mm displacement. 56.16: JT, 10° Qz VN, PL, SM, Healed. 56.24: JT, 10° Qz VN, PL, SM 56.34: JT, 65° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
										56.2 827.6															56.2
										56.4 827.4															56.4
										56.6 827.2				56.56-56.69: Amorphous Silica, hydrothermal vein / intrusion pale grey to blue, very fine grained, sharp contact with alteration halo dipping at 40 to 60°			DA						56.50-56.61: BD, 70° Qz VN, PL, SM, Healed. 56.56: JT, 10° Qz VN, PL, SM			56.6
																	SA					56.64-56.75: BD, 70° Qz VN, PL, SM, Healed.				
										56.8 827.0												56.83: JT, 65° Qz VN, PL, SM, Healed.		56.80: Point Load >20KN – No Failure	56.8
														56.86-57.06: Amorphous Silica, hydrothermal vein / intrusion pale grey to blue, very fine grained, sharp contact upper contact, irregular lower contact with alteration halo dipping at 40 to 60°			DA									
										57.0 826.8												56.90-57.13: BD, 80° Qz VN, PL, SM, Healed.			57.0
																	SA								
										57.2 826.6															57.2
																						57.30: JT, 45° Qz VN, PL, SM, Healed. 57.31: JT, 45° Qz VN, PL, SM, Healed. 57.37: JT, 30° Qz VN, PL, SM, Healed.			
										57.4 826.4															57.4
																						57.49: JT, 40° Qz VN, PL, SM, Healed. 57.50: JT, 50° Qz VN, PL, SM, Healed. 57.55: JT, 45° Qz VN, PL, SM, Healed. 57.55: JT, 40° Qz VN, PL, SM, Healed. 57.64: JT, 55° Py VN, PL, SM, Healed.			
										57.6 826.2															57.6
				57.75																		57.76: JT, 25° CN, PL, SM, Healed.			
				0 % Loss	R25 3.02m (100%) 100%					57.8 826.0															57.8
										58.0												57.95: JT, 30° Qz VN, PL, SM, Healed.			

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R25 3.02m (100%)	100%				58.0 825.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				58.09: JT, 25° Qz CT, PL, SM, 1 mm, Healed. 58.12: JT, 70° Py VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
										58.2 825.6															58.2
																						58.29: JT, 35° Qz VN, PL, SM, Healed. 58.36: JT, 50° Py VN, PL, SM, Healed.			
										58.4 825.4				58.42-58.75: Amorphous Silica, hydrothermal vein / intrusion pale grey to blue, very fine grained, sharp contact with alteration halo 2mm upper contact, 25mm lower contact, dipping at 15 to 60°			DA							58.39: JT, 20° Py VN, PL, SM, Healed. 58.42: JT, 20° Py VN, PL, SM, Healed. 58.43: JT, 50° Py VN, PL, SM, Healed, discontinuous. 58.44: JT, 20° Py VN, PL, SM, Healed. 58.48: JT, 40° Qz VN, PL, SM, Healed. 58.49: JT, 40° Qz VN, PL, SM, Healed. 58.54: JT, 50° Qz CT, PL, SM, 2 mm, Healed. 58.58: JT, 40° Qz VN, PL, SM, Healed. 58.67: JT, 75° Qz VN, PL, SM, Healed. 58.75: JT, 70° Py VN, PL, SM, Healed. 58.85: JT, 50° Qz VN, PL, SM, Healed.			58.4
										58.6 825.2															58.6
										58.8 825.0							SA								58.8
										59.0 824.8												59.00: JT, 70° Py VN, PL, SM, Healed.			59.0
										59.2 824.6															59.2
																						59.24: JT, 25° Qz CT, PL, SM, 2 mm, Healed. 59.28: JT, 60° Qz VN, PL, SM, Healed.			
										59.4 824.4												59.40: JT, 70° Qz VN, PL, SM, Healed. 59.47: JT, 60° Qz VN, PL, SM, Healed.			59.4
										59.6 824.2				59.56-59.58: Quartz Vein, 5 to 10mm aperture, dipping at 10° ,1mm hydrothermal alteration halo											59.6
																						59.73: JT, 30° Py VN, PL, SM, Healed.		59.72: Point Load >20KN – No Failure	
										59.8 824.0				59.76: Diamictite Protolith, with veryfine grained matrix, trace <5% matrix supported gravel sized 5 to 25 mm angular clasts, Minor lineation and flattening of clasts											59.8
																						59.82: JT, 30° Qz VN, PL, SM, Healed. 59.83: JT, 80° Qz VN, PL, SM, Healed. 59.85: JT, 30° Qz VN, PL, SM, Healed. 59.92: JT, 30° Qz VN, PL, SM,			
										60.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R25 3.02m (100%) 100%				60.0 823.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 60.07-60.13: Quartz Vein, 50mm apature, dipping 10-20°, trace chlorite inclusions, 3mm alteration halo lower contact			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		Healed. 59.94: JT, 30° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								60.2 823.6				60.23: Sandstone Protolith, fine to medium grained, lithic clasts, quartz porphroblasts up to 2mm, some flattening of grains								60.14: JT, 70° Qz VN, IR, SM, Healed. 60.16: JT, 30° Qz VN, PL, SM, Healed. 60.22: JT, 30° Qz VN, PL, SM, Healed.			60.2
								60.4 823.4				60.38-60.77: 3 x Quartz Veins, 5-15mm aperture, 50mm to 300mm spaced 10-15° dip sub-parallel to bedding								60.38-60.40: VE, 15° Qz CT, PL, SM, Healed. 60.40: JT, 80° Qz VN, PL, SM, Healed. 60.44: JT, 60° Qz VN, PL, SM, Healed. 60.47: JT, 20° Qz CT, PL, SM, 1 mm, Healed. 60.56: JT, 5° Qz VN, PL, SM, Healed. 60.61: JT, 70° Qz VN, PL, SM, Healed, discontinuous.			60.4
								60.6 823.2															60.6
				60.77				60.8 823.0												60.70-60.72: VE, 15° Qz CT, PL, SM, 10 mm, Healed. 60.76-60.77: VE, 15° Qz CT, PL, SM, 10 mm, Healed.		60.77: Point Load >20KN – No Failure	60.8
								61.0 822.8				61.03-61.08: Quartz Vein, 15-40mm aperture, dipping 10-45°, chlorite inclusions, alteration halo lower contact											61.0
			0 % Loss	R26 2.95m (100%) 100%				61.2 822.6												61.10-61.12: VE, 15° Qz CT, PL, SM, 3 mm, Healed.			61.2
								61.4 822.4				61.49-61.99: increasing lithic clasts, lineation fabric								61.26: VE, 0° Qz CT, PL, SM, 1 mm, Healed. 61.27: JT, 15° Qz VN, PL, SM, Healed. 61.28: VE, 0° Qz CT, PL, SM, 1 mm, Healed. 61.35: JT, 30° Qz VN, PL, SM, Healed. 61.40: JT, 15° Qz VN, PL, SM, Healed. 61.41: JT, 60° Qz VN, PL, SM, Healed.			61.4
								61.6 822.2												61.61: JT, 65° Qz VN, PL, SM, Healed. 61.65: JT, 30° Qz VN, PL, SM, Healed.			61.6
								61.8 822.0												61.86: JT, 30° Qz VN, PL, SM, Healed.			61.8
								62.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R26 2.95m (100%) 100%				62.0 821.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				62.00: JT, 70° Qz CT, PL, SM, 1 mm, Healed, slightly altered.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							62.2 821.6													62.01: JT, 20° Qz VN, PL, SM, Healed.			62.2
																				62.08: JT, 20° Qz VN, PL, SM, Healed.			
																				62.17: JT, 65° Qz CT, PL, SM, 1 mm, Healed.			
							62.4 821.4																62.4
																				62.43: JT, 30° Qz VN, PL, SM, Healed.			
							62.6 821.2													62.56: JT, 30° Qz VN, PL, SM, Healed.			62.6
																				62.65: JT, 20° Qz VN, PL, SM, Healed.			
																				62.70: JT, 30° Qz VN, PL, SM, Healed.			
							62.8 821.0													62.78: JT, 30° Qz VN, PL, SM, Healed.			62.8
							63.0 820.8				63.01-64.36: increasing lithic clasts up to 20%									63.01: JT, 30° Qz VN, PL, SM, Healed.			63.0
							63.2 820.6													63.29: JT, 30° Qz VN, PL, SM, Healed.			63.2
																				63.37: JT, 45° Qz VN, ST, SM, Healed.			
							63.4 820.4													63.52: JT, 30° Qz VN, PL, SM, Healed.			63.4
																				63.56: JT, 30° Qz VN, PL, SM, Healed.			
																				63.59: JT, 30° Qz VN, PL, SM, Healed.			
		63.72					63.6 820.2													63.66: JT, 15° Qz CT, PL, SM, 1 mm, Healed.			63.6
		0 % Loss	R27 3.06m (100%) 100%				63.8 820.0													63.81: JT, 30° Qz VN, PL, SM, Healed.		63.80: Point Load >20KN – No Failure	63.8
							64.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				64.0 819.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				64.02: JT, 15° Qz VN, PL, SM, Healed. 64.06: JT, 25° Qz VN, PL, SM, Healed. 64.08: JT, 20° Py VN, PL, SM, Healed. 64.15: JT, 20° Py VN, PL, SM, Healed. 64.18: JT, 20° Py VN, PL, SM, Healed. 64.21: JT, 30° Qz VN, PL, SM, Healed. 64.22: JT, 30° Qz VN, PL, SM, Healed. 64.24: JT, 30° Qz VN, PL, SM, Healed. 64.32: JT, 75° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM 64.00: Point Load >20KN – No Failure	
							64.2 819.6															64.2
							64.4 819.4															64.4
							64.6 819.2														64.57: soft sediment deformation	64.6
							64.8 819.0													64.80: JT, 85° Qz CT, PL, SM, 1 mm, Healed. 64.82: JT, 15° Qz VN, PL, SM, Healed. 64.94: JT, 20° Py VN, PL, SM, Healed.			64.8
							65.0 818.8													65.05: JT, 25° Py VN, PL, SM, Healed.			65.0
							65.2 818.6													65.15: JT, 65° Qz VN, PL, SM, Healed. 65.17: JT, 65° Qz VN, PL, SM, Healed. 65.22: JT, 40° Qz VN, PL, SM, Healed. 65.22: JT, 40° Qz VN, PL, SM, Healed. 65.28: JT, 80° Qz VN, PL, SM, Terminates on adjacent joint, healed.			65.2
							65.4 818.4				65.41-65.92: Diamictite Protolith pale grey and grey sub-angular clasts, 2 -20 mm, matrix supported, minor lineation and flattening of grains									65.40: JT, 80° Qz CT, PL, SM, 1 mm, Terminates on adjacent joint, healed. 65.41: JT, 35° Qz VN, PL, SM, Healed. 65.51: JT, 80° Qz VN, PL, SM, Terminates on adjacent joint, healed.			65.4
							65.6 818.2															65.6
							65.8 818.0													65.77: JT, 80° Qz VN, PL, SM, Terminates on adjacent joint, healed. 65.93: JT, 45° Qz VN, PL, SM, Healed.			65.8
							66.0															

R27 3.06m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
			0 % Loss	R27 3.08m (100%) 100%				66.0 / 817.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				66.04: JT, 80° Qz VN, PL, SM, Terminates on adjacent joint, healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								66.2 / 817.6															66.2
																				66.28: JT, 80° Qz VN, PL, SM, Terminates on adjacent joint, healed. 66.31: JT, 80° Qz VN, PL, SM, Healed. 66.34: JT, 25° Qz VN, PL, SM, Healed.		66.36: Point Load >20KN – No Failure	
								66.4 / 817.4															66.4
																				66.59: JT, 30° Qz VN, PL, SM, Healed. 66.62: JT, 15° Qz CT, PL, SM, 1 mm, Healed. 66.65: JT, 80° Py VN, PL, SM, Healed. 66.69: JT, 30° Qz VN, PL, SM, Healed. 66.77: JT, 70° Qz VN, PL, SM, Healed.			
								66.6 / 817.2															66.6
								66.8 / 817.0															66.8
																				66.89: JT, 25° Qz VN, PL, SM, Healed. 66.90: JT, 30° Qz VN, PL, SM, Healed. 66.98: JT, 25° Qz VN, PL, SM, Healed. 67.03: JT, 25° Qz VN, PL, SM, Healed. 67.04: JT, 20° Qz VN, PL, SM, Healed. 67.08: JT, 50° Qz VN, PL, SM, Healed.			
								67.0 / 816.8															67.0
																				67.18: JT, 15° Qz VN, PL, SM, Healed. 67.22: JT, 80° Qz CT, PL, SM, 1 mm, Terminates on adjacent joint, healed. 67.23: JT, 80° Qz CT, PL, SM, 1 mm, Terminates on adjacent joint, healed. 67.25: JT, 15° Qz VN, PL, SM, Healed. 67.31: JT, 80° Qz CT, PL, SM, 1 mm, Terminates on adjacent joint, healed. 67.35: JT, 25° Qz CT, PL, SM, 1 - 3 mm, healed.			
								67.2 / 816.6															67.2
																				67.60: JT, 25° Qz CT, PL, SM, 1 mm, Healed. 67.63-67.67: Shear, 30° CN, PL, SM, 3 mm displacement. 67.69: JT, 10° Py VN, PL, SM, Healed.			
								67.4 / 816.4				67.48: Siltstone Protolithpale grey, elongated lenses parallel to lineation fabric at 45° 67.54-67.56: Alteration Lens grey to pale blue											67.4
								67.6 / 816.2				67.65-67.74: 3 x Quartz Veins / lenses irregular contacts, with chlorite, and trace pyrite veins, 1-30mm apature dipping 0 to 45° spaced 1 - 40mm apart											67.6
																				67.78: JT, 40° Py VN, PL, SM, Healed. 67.79: JT, 40° Py VN, PL, SM, Healed. 67.80: JT, 40° Qz CT, PL, SM, 3 mm, Healed. 67.80: JT, 15° Qz VN, PL, SM, Healed. 67.81: JT, 25° Qz VN, PL, SM,			
								67.8 / 816.0				67.84-68.07: Quartz Veins with chlorite, trace pyrite, irregular contacts, dipping 0 - 45°											67.8
HQ3			5 % Loss	R28 2.95m (100%) 100%		67.85 m Is(50) d=4.49 Is(50) a=3.22 MPa		68.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:57 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				5 % Loss	R28 2.95m (100%) 100%				68.0 815.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		Healed. 67.82: JT, 25° Qz VN, PL, SM, Healed. 67.84: JT, 25° Py VN, PL, SM, Healed. 68.02-68.04: BD, 20° CN, PL, SM, Healed. 68.11: JT, 40° Qz VN, PL, SM, Healed. 68.20: JT, 10° Qz CT, PL, SM, Healed. 68.20: JT, 40° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
									68.2 815.6				68.25-69.29: increasing lithic clasts 20% with quartz porphyorblasts up to 2mm												68.2
									68.4 815.4												68.50: JT, 25° Qz VN, PL, SM, Healed. 68.57: JT, 40° Qz VN, PL, SM, Healed.				68.4
									68.6 815.2																68.6
									68.8 815.0												68.85: JT, 35° Qz VN, IR, SM, Healed. 68.87: JT, 40° Qz VN, PL, SM, Healed.		68.90: Point Load >20KN – No Failure		68.8
									69.0 814.8				69.06-69.14: Sandstone Protolith Bed								69.04: JT, 40° Qz VN, PL, SM, Healed. 69.05: JT, 70° Py VN, PL, SM, Healed. 69.10: JT, 70° Py VN, PL, SM, Healed.				69.0
									69.2 814.6																69.2
									69.4 814.4												69.40: JT, 5° Qz CT, PL, SM, 1 mm, Healed. 69.47: JT, 40° Qz VN, PL, SM, Healed.				69.4
									69.6 814.2																69.6
				5 % Loss	R29 3.02m (100%) 100%				69.8 814.0												69.61: JT, 5° Qz VN, PL, SM, Healed. 69.62: JT, 5° Qz VN, PL, SM, Healed. 69.64: JT, 5° Qz VN, PL, SM, Healed. 69.69: JT, 5° Qz VN, PL, SM, Healed. 69.69-69.74: SS, 50° CN, PL, RO, Healed.		69.90: Point Load >20KN – No Failure		69.8
					69.73				70.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									70.0 813.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 70.06-70.88: Diamictite Protolith, grey clasts up to < 30mm, matrix supported, flattened grains, minor lineation			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				70.07: JT, 87° Qz CT, PL, SM, 2 mm, Healed. 70.07: JT, 85° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
									70.2 813.6			70.2									70.30: JT, Py VN, PL, SM, 30 - 40°, healed. 70.34: JT, 20° Qz VN, PL, SM, Healed. 70.36: JT, 20° Qz VN, PL, SM, Healed.			70.2
									70.4 813.4			70.4									70.44: JT, 30° Qz CT, PL, SM, 2 mm, Healed. 70.45: JT, 60° Py VN, PL, SM, Healed. 70.50: JT, 30° Qz VN, PL, SM, Healed.			70.4
									70.6 813.2			70.6									70.62: JT, 30° Qz VN, PL, SM, Healed. 70.69: JT, 30° Qz VN, PL, SM, Healed. 70.75: JT, 30° Qz VN, PL, SM, Healed.			70.6
									70.8 813.0			70.8												70.8
									71.0 812.8			71.0	70.90: Siltstone Protolith												71.0
	HQ3			5 % Loss	R29 3.02m (100%) 100%								71.09-71.15: Fault Gouge, yellow green and light grey, clay infill, high hydrothermal alteration, soil strength infill			HA		VL				71.03-71.19: SS, 70° Qz CT, PL, RO, 3 mm, Trace pyrite, healed. 71.12: JT, 20° Qz VN, PL, SM, Healed.			
							71.20 m Is(50) d=2.12 71.25 m Is(50) a=2.97		71.2 812.6			71.2				SA		VH - EH				71.16-71.22: SS, 70° Qz CT, PL, RO, 5 mm, Trace pyrite, healed. 71.21: JT, 20° Qz VN, PL, SM, Healed. 71.26: JT, 10° Qz VN, PL, SM, Healed.			71.2
									71.4 812.4			71.4									71.38: JT, 60° Qz VN, PL, SM, Healed. 71.44: JT, 60° Qz VN, PL, SM, Healed.			71.4
									71.6 812.2			71.6	71.64: Sandstone thinly interbedded with Diamictite Protolith								71.54: JT, 30° Qz VN, PL, SM, Healed.			71.6
									71.8 812.0			71.8									71.73: JT, 70° Qz VN, PL, SM 71.90: JT, 70° Qz VN, PL, SM			71.8
									72.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● - Axial ○ - Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss	R29 3.02m (100%) 100%			72.0 811.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		72.07: JT, 35° Py VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							72.2 811.6				72.19-72.68: Increasing sand and sub-angular gravel sized lithic clasts, minor lineation, flattening of grains									72.27: JT, 40° Qz VN, PL, SM, Healed.			72.2
							72.4 811.4													72.36: JT, 35° Py VN, PL, SM, Healed.			72.4
			72.75				72.6 811.2													72.59: JT, 35° Qz VN, PL, SM, Healed.			72.6
																				72.62: JT, 75° Qz VN, PL, SM, Healed.			
																				72.63: JT, 35° Qz VN, PL, SM, Healed.			
																				72.67: JT, 35° Qz VN, PL, SM, Discontinuous, healed.		72.74: Point Load >20KN – No Failure	
							72.8 811.0													72.75: JT, 10° Qz VN, PL, SM, Healed.			72.8
																				72.85: JT, 20° Qz VN, PL, SM, Healed.			
																				72.87: JT, 25° Qz VN, PL, SM, Healed.			
																				72.88: JT, 20° Qz CT, PL, SM, 1 mm, Healed.			
							73.0 810.8													72.93: JT, 60° Py VN, PL, SM, Healed.			73.0
																				72.99: JT, 90° Py VN, PL, SM, Discontinuous, healed.			
																				73.04: JT, 80° Qz VN, PL, SM, 1 mm, Discontinuous, healed.			
																				73.05: JT, 40° Qz VN, PL, SM, Healed.			
							73.2 810.6				73.18-73.42: increasing lithic sand sized clasts up to 20%									73.07: JT, 65° Py VN, PL, SM, Discontinuous, healed.			73.2
																				73.09: JT, 40° Qz VN, PL, SM, Healed.			
																				73.18: JT, 50° Qz VN, PL, SM, Healed.			
																				73.23: JT, 60° Qz VN, PL, SM, Healed.			
			5 % Loss	R30 3.02m (100%) 100%			73.4 810.4													73.28: JT, 88° Qz VN, PL, SM, Healed.			73.4
																				73.45: JT, 75° Qz VN, PL, SM, Healed.			
																				73.53: JT, 60° Qz VN, PL, SM, Healed.			
																				73.58: JT, 50° Qz VN, PL, SM, Healed.			
							73.6 810.2													73.65: JT, 55° Qz VN, PL, SM, Healed.			73.6
																				73.71: JT, 20° Qz CT, PL, SM, 1 mm, Healed.			
					73.78 m Is(50) d=6.47												○			73.77: JT, 10° Qz VN, PL, SM, Healed.			
					73.83 m Is(50) a=7.13		73.8 810.0										●			73.78-73.80: VE, 15° Qz CT, PL, SM, 2 mm, Healed.			73.8
																				73.83: JT, 10° Qz VN, PL, SM, Healed.			
																				73.89: JT, 15° Qz VN, PL, SM, Healed.			
							74.0													73.93: JT, 15° Qz VN, PL, SM,			

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				5 % Loss	R30 3.02m (100%) 100%				74.0 / 809.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				Healed. 74.04: JT, 15° Qz VN, PL, SM, Healed. 74.11: JT, 70° Py VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
									74.2 / 809.6												74.21: JT, 80° Qz CT, PL, SM, 1 mm, Discontinuous, healed. 74.23: JT, 65° Qz VN, PL, SM, Healed.			74.2
													74.30-74.67: increasing lithic sand sized clasts up to 20% with quartz porphyroblasts up to 2mm in size 30%											
									74.4 / 809.4												74.37: JT, 20° Py VN, PL, SM, Discontinuous, healed. 74.41: JT, 89° Qz CT, PL, SM, 1 mm, Discontinuous, healed. 74.48: JT, 20° Py VN, PL, SM, Discontinuous, healed.			74.4
									74.6 / 809.2												74.56: JT, 75° Qz VN, PL, SM, Discontinuous, healed.			74.6
																					74.72: JT, 40° Qz CT, PL, SM, 1 mm, Discontinuous, healed. 74.77: JT, 89° Py VN, PL, SM, Healed. 74.78: JT, 90° Py VN, PL, SM, Dscontinuous, healed. 74.83: JT, 70° Py VN, PL, SM, Healed.			74.8
									74.8 / 809.0														74.90: Point Load >20KN – No Failure	
									75.0 / 808.8															75.0
													75.06-75.65: Diamictite Protolith, clasts up to 30mm, matrix supported, flattened grains, minor lineation								75.03-75.12: FO, 60° CN, PL, SM			
									75.2 / 808.6												75.18: JT, 40° Py VN, PL, SM, Healed.			75.2
									75.4 / 808.4															75.4
																					75.46: JT, 70° Py VN, PL, SM, Healed. 75.48: JT, 30° Qz VN, PL, SM, Healed. 75.50: JT, 30° Qz VN, PL, SM, Healed.			
									75.6 / 808.2												75.63: JT, 20° Qz VN, PL, SM, Healed. 75.65: JT, 15° Qz CT, PL, SM, 1 mm, Healed.			75.6
				0 % Loss	75.77 R31 3.01m (100%) 100%		75.86 m Is(50) d=3.76		75.8 / 808.0				75.65: Siltstone Protolith 75.80-75.94: Amorphous Silica, hydrothermal vein / intrusion pale grey to blue, very fine grained, irregular contact with alteration halo 2mm, dipping at 45 to 60°								75.78: JT, 65° Qz VN, PL, SM, Healed.			75.8
																					75.86: JT, 20° Py VN, PL, SM, Healed. 75.92: JT, 50° Py VN, PL, SM, Discontinuous, healed. 75.96: JT, 30° Py VN, PL, SM,			
									76.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● - Axial ○ - Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									76.0 807.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		Healed. 75.99: JT, 50° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
									76.2 807.6				76.20: Sandstone interbedded with Diamictite Protolith 76.21-76.64: increased lithic clasts and quartz porphyroblasts up to 2mm									76.19: JT, 15° Qz CT, PL, SM, 1 mm, Healed. 76.30: JT, 50° Qz CT, PL, SM, 1 mm, Healed.			76.2
									76.4 807.4													76.45: JT, 65° Py VN, PL, SM, Healed. 76.48: JT, 45° Py VN, PL, SM, Discontinuous. 76.51: JT, 45° Qz VN, PL, SM, Healed. 76.57: JT, 10° Qz VN, PL, SM, Healed. 76.63: JT, 70° Qz VN, PL, SM, Discontinuous, healed. 76.65: JT, 75° Qz VN, PL, SM, Healed. 76.67: JT, 70° Qz CT, PL, SM, 1 mm, Healed.			76.4
									76.6 807.2																76.6
									76.8 807.0				76.76-77.41: increased lithic clasts and quartz porphyroblasts up to 2mm												76.8
HQ3				0 % Loss	R31 3.01m (100%) 100%				77.0 806.8													76.98: JT, 5° Qz VN, PL, SM, Healed. 77.04: JT, 10° Qz VN, PL, SM, Healed. 77.05: JT, 25° Qz VN, PL, SM, Healed. 77.06: JT, 30° Qz VN, PL, SM, Healed. 77.06: JT, 80° Qz VN, PL, SM, Discontinuous, healed. 77.08: JT, 80° Qz VN, PL, SM, Discontinuous, healed. 77.09: JT, 85° Qz CT, PL, SM, 1 mm, Healed. 77.09: JT, 80° Qz VN, PL, SM, Discontinuous, healed. 77.14: JT, 15° Qz VN, PL, SM, Discontinuous, healed. 77.19: JT, 60° Py VN, PL, SM, Healed. 77.34: JT, 40° Qz VN, PL, SM, Healed. 77.46: JT, 40° Qz CT, PL, SM, 1 mm, Healed. 77.53: JT, 10° Qz CT, PL, SM, 1 mm, Healed.		76.90: Point Load >20KN – No Failure	77.0
									77.2 806.6																77.2
									77.4 806.4																77.4
									77.6 806.2																77.6
									77.8 806.0													77.90: JT, 85° Qz VN, PL, SM, Healed. 77.95: JT, 45° Qz VN, PL, SM, Healed.		77.90: Point Load >20KN – No Failure	77.8
									78.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R31 3.01m (100%) 100%		78.00 m Is(50) a=5.48		78.0 805.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				77.98: JT, 30° Qz VN, PL, SM, Healed. 78.04: JT, 10° Py VN, PL, SM, Healed. 78.05: JT, 15° Qz VN, PL, SM, Healed. 78.06: JT, 85° Qz VN, PL, SM, Healed. 78.08: JT, 15° Qz VN, PL, SM, Healed. 78.09: JT, 50° Qz VN, PL, SM, Healed. 78.10: JT, 45° Qz VN, PL, SM, Healed. 78.12: JT, 15° Qz VN, PL, SM, Healed. 78.14: JT, 60° Qz VN, PL, SM, Discontinuous, healed. 78.16: JT, 45° Py VN, PL, SM, Healed. 78.29: JT, 30° Qz VN, PL, SM, Healed. 78.35: JT, 45° Qz VN, PL, SM, Healed. 78.56: JT, 75° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
									78.2 805.6															78.2
									78.4 805.4															78.4
									78.6 805.2															78.6
				0 % Loss	78.78				78.8 805.0				78.87: Increasing Sandstone Protolith bedding, brown grey, medium to coarse grained								78.75: JT, 30° Qz VN, PL, SM, Healed. 78.76: JT, 40° Qz VN, PL, SM, Healed. 78.81: JT, 60° Qz VN, PL, SM, Healed. 78.89: JT, 25° Py VN, PL, SM 78.92: JT, 30° Qz VN, PL, SM, Healed.			78.8
									79.0 804.8												79.03: JT, 10° Qz CT, PL, SM, 1 mm, Discontinuous, healed.			79.0
									79.2 804.6				79.23: indistinct sub-horizontal bedding								79.10: JT, 45° Qz VN, PL, SM, Healed. 79.15: JT, 60° Qz VN, PL, SM, Discontinuous, healed. 79.17: JT, 30° Qz VN, PL, SM, Healed. 79.21: JT, 5° Qz VN, PL, SM, Healed.			79.2
									79.4 804.4				79.36: lithic clasts concentrated in alternating beds, dark grey colour, indistinct sub-horizontal bedding								79.31: JT, 65° Qz VN, PL, SM, Healed. 79.32: JT, 15° Qz VN, PL, SM, Healed. 79.33: JT, 70° Py VN, PL, SM, Healed. 79.38: JT, 70° Py VN, PL, SM, Healed. 79.47: JT, 55° Pl VN, PL, SM, Healed,. 79.47: JT, 55° Qz VN, PL, SM, Trace pyrite, healed. 79.58: JT, 15° Qz VN, PL, SM, Healed.			79.4
				0 % Loss	R32 2.94m (100%) 100%				79.6 804.2															79.6
									79.8 804.0												79.73: JT, 45° Qz VN, PL, SM, Healed. 79.70-79.78: FO, 55° PL, SM 79.79: JT, 80° Qz VN, PL, SM, Healed.			79.8
									80.0														79.90: Point Load >20KN – No Failure	

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R32 2.94m (100%) 100%				80.0 / 803.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)* 80.08: fine grained matrix			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				80.01: JT, 40° Qz VN, PL, SM, Healed. 80.00-80.10: Shear, 55° CN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								80.2 / 803.6												80.14: JT, 45° Qz VN, PL, SM, Healed. 80.16: JT, Qz VN, PL, SM, Healed. 80.17: JT, 5° Qz VN, PL, SM, Healed. 80.23: JT, 30° Qz VN, PL, SM, Healed. 80.27: JT, 40° Qz VN, PL, SM, Healed. 80.31: JT, 50° Qz VN, PL, SM, Healed. 80.43: JT, 85° Qz VN, PL, SM, Discontinuous, moderately altered, healed.			80.2
								80.4 / 803.4															80.4
								80.6 / 803.2				80.62-81.07: Diamictite Protolith, increasing sub-angular clasts up to 30mm								80.68: JT, 30° Qz VN, PL, SM, Moderately altered, healed. 80.69: JT, 85° Qz VN, PL, SM, Moderately altered, healed. 80.70: JT, 30° Qz VN, PL, SM, Moderately altered, healed.			80.6
								80.8 / 803.0														80.85: Point Load >20KN – No Failure	80.8
								81.0 / 802.8							DA					81.04: JT, 45° Py VN, PL, SM, Healed.			81.0
								81.2 / 802.6				81.07-81.34: Amorphous Silica, hydrothermal vein / intrusion pale grey to blue, very fine grained, irregular contact with alteration halo 8mm on lower contact, dipping at 45 to 60°								81.11: JT, 30° Qz VN, PL, SM, Healed. 81.13: JT, 35° Qz VN, PL, SM, Healed. 81.17: JT, 40° Qz VN, PL, SM, Healed. 81.19: JT, 25° Qz VN, PL, SM, Healed. 81.24: JT, 45° Qz VN, PL, SM, Healed. 81.27: JT, 40° Qz CT, PL, SM, 4 mm, Healed.		81.14: Point Load >20KN – No Failure	81.2
								81.4 / 802.4							SA					81.31: JT, 35° Qz VN, PL, SM, Healed. 81.35: JT, 40° Qz VN, PL, SM, Discontinuous, healed. 81.35: JT, 45° Qz VN, PL, SM, Healed. 81.38: JT, 25° Qz VN, PL, SM, Healed. 81.55: JT, 45° Qz VN, PL, SM, Healed. 81.60: JT, 15° Qz VN, PL, SM, Healed. 81.66: JT, 40° Qz CT, PL, SM, 1 mm, Healed.			81.4
			81.72					81.6 / 802.2												81.72: JT, 10° Py VN, PL, SM, Healed.			81.6
			0 % Loss	R33 3.06m (100%) 100%				81.8 / 802.0												81.81: JT, 45° Py VN, PL, SM, Healed. 81.84: JT, 45° Qz VN, PL, SM, Healed. 81.89: JT, 30° Qz VN, PL, SM, Healed.		81.90: Point Load >20KN – No Failure	81.8
								82.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				82.0 / 801.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				81.95: JT, 30° Qz VN, PL, SM, Healed. 81.97: JT, 50° Qz VN, PL, SM, Discontinuous, healed. 81.98: JT, 85° Qz VN, PL, SM, Discontinuous, healed. 82.03: JT, 25° Qz VN, PL, SM, Healed. 82.06: JT, 10° Qz VN, PL, SM, Healed. 82.08: JT, 10° Qz VN, PL, SM, Healed. 82.09: JT, 20° Qz VN, PL, SM, Healed. 82.12: JT, 10° Qz VN, PL, SM, Healed. 82.15: JT, 30° Qz VN, PL, SM, Terminates on joint, healed. 82.17: JT, 35° Qz VN, PL, SM, Terminates on joint, healed. 82.18: JT, 20° Qz VN, PL, SM, Terminates on joint, healed. 82.19: JT, 20° Qz VN, PL, SM, Terminates on joint, healed. 82.35: JT, 40° Qz CT, PL, SM, 2 mm, Healed. 82.39: JT, 30° Qz VN, PL, SM, Terminates on joint, healed. 82.40: JT, 30° Qz VN, PL, SM, Terminates on joint, healed. 82.47: JT, 50° Qz VN, PL, SM, Terminates on joint, healed. 82.52: JT, 30° Qz VN, PL, SM, Terminates on joint, healed. 82.54: JT, 25° Qz VN, PL, SM, Healed. 82.68: JT, 50° Qz VN, PL, SM, Healed. 82.95: JT, 80° Qz VN, PL, SM, Healed. 83.04: JT, 25° Py VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM 82.90: Point Load >20KN – No Failure	82.2 82.4 82.6 82.8 83.0
							82.2 / 801.6															
							82.4 / 801.4															
							82.6 / 801.2															
							82.8 / 801.0															
							83.0 / 800.8															
							83.2 / 800.6				83.34-83.60: increase in quartz porphyroblasts up to 2mm									83.34: JT, 85° Qz VN, PL, SM, Terminates on joint, healed. 83.45: JT, 50° Qz VN, PL, SM, Healed. 83.54: JT, 80° Qz VN, PL, SM, Healed. 83.54: JT, 40° Qz VN, PL, SM, Healed. 83.58: JT, 20° Qz VN, PL, SM, Healed. 83.62: JT, 80° Qz VN, PL, SM, Terminates on joint, healed. 83.68: JT, Qz VN, PL, SM, Healed. 83.80: JT, 5° Qz VN, PL, SM, Healed. 83.82: JT, 5° Qz VN, PL, SM, Healed. 83.83: JT, 5° Qz VN, PL, SM, Healed. 83.84: JT, 45° Qz VN, PL, SM, Healed.		83.90: Point Load >20KN – No Failure	83.2 83.4 83.6 83.8
							83.4 / 800.4															
							83.6 / 800.2															
							83.8 / 800.0															
							84.0															

R33 3.06m (100%) 100%

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R33 3.08m (100%) 100%				84.0 799.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				83.88: JT, 45° Qz VN, PL, SM, Healed. 83.93: JT, 45° Qz VN, PL, SM, Healed. 83.94: JT, 45° Qz VN, PL, SM, Healed. 83.95: JT, 45° Qz VN, PL, SM, Healed. 83.99: JT, 20° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								84.2 799.6															84.2
								84.4 799.4															84.4
								84.6 799.2															84.6
				84.78		84.78 m Is(50) d=0.8		84.8 799.0															84.8
								85.0 798.8				85.00-85.51: sub-vertical alteration veins								84.91: JT, 85° Qz VN, PL, SM, Terminates on joint, healed.		85.00-91.00: Flasar bedding structures in protolith rocks producing textured surface on HQ core	85.0
								85.2 798.6				85.18-90.86: thinly to thickly bedded Siltstone and Sandstone Protolith beds, spaced 10-600mm appart displaying flasar bedding structure								85.18: JT, 87° Qz VN, PL, SM, Terminates on joint, healed.			85.2
			0 % Loss	R34 2.98m (100%) 100%				85.4 798.4									H			85.30: JT, 85° Qz VN, PL, SM, Terminates on joint, healed. 85.32: JT, 85° Qz VN, PL, SM, Terminates on joint, healed. 85.36: JT, 85° Qz VN, PL, SM, Terminates on joint, healed.			85.4
								85.6 798.2															85.6
								85.8 798.0												85.74: JT, 50° Qz VN, PL, SM, Healed.			85.8
								86.0									VH - EH					85.84: Point Load >20KN – No Failure	

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R34 2.98m (100%) 100%				86.0 797.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		86.01: JT, 40° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
							86.2 797.6													86.14: JT, 30° Qz VN, PL, SM, Healed. 86.15: JT, 45° Qz VN, PL, SM, Healed.			86.2
																H				86.34: JT, Qz VN, PL, SM, Healed.			
							86.4 797.4													86.43: JT, 80° Qz VN, PL, SM, Healed. 86.45: JT, 80° Qz VN, PL, SM, Healed.			86.4
							86.6 797.2																86.6
							86.8 797.0															86.80: Point Load >20KN – No Failure	86.8
							87.0 796.8																87.0
							87.2 796.6															87.15: Point Load >20KN – No Failure	87.2
																				87.26: JT, 20° Py VN, PL, SM, Healed.			
							87.4 796.4													87.42: JT, 15° Qz VN, PL, SM, Healed. 87.50: JT, 80° Qz VN, PL, SM, Healed.			87.4
							87.6 796.2																87.6
		87.76																		87.70: JT, 45° Qz VN, PL, SM, Healed.			
		0 % Loss	R35 3.02m (100%) 100%				87.8 796.0									VH - EH							87.8
							88.0													87.98: JT, 85° Qz VN, PL, SM,			

Observations and Comments

Notes

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			0 % Loss	R35 3.02m (100%) 100%					88.0 795.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	VH - EH *(cont)*				Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
																						88.12: JT, 55° Qz VN, PL, SM, Healed. 88.15: JT, 55° Qz VN, PL, SM, Healed.			
										88.2 795.6															88.2
										88.4 795.4															88.4
														88.52-88.81: Amorphous Silica, hydrothermal vein / intrusion pale grey to blue, very fine grained, irregular contact with alteration halo 4mm, dipping at 45 to 60°								88.39-88.59: BD, 65° Qz VN, PL, RO, Healed. 88.54: JT, 30° Qz VN, PL, SM, Healed.			
										88.6 795.2															88.6
																						88.60-88.84: BD, 75° Qz VN, PL, SM, Healed. 88.62-88.86: BD, 75° Qz VN, PL, SM, Healed. 88.78: JT, 30° Qz VN, PL, SM, Healed.		88.80: Point Load >20KN – No Failure	
										88.8 795.0															88.8
														88.88-89.96: irregular Alteration Veins, 2mm appature, sub-horizontal to sub-vertical											
										89.0 794.8												88.99: JT, 85° Qz CT, CR, SM, 1 mm, Healed.			89.0
																						89.12: JT, 50° Qz VN, PL, SM, Healed. 89.03-89.24: Shear, 75° HE, PL, RO, 2 mm displacement.			
										89.2 794.6															89.2
										89.4 794.4															89.4
																						89.49: JT, 15° Qz VN, PL, SM, Healed. 89.51: JT, 40° Qz VN, PL, SM, Healed. 89.55: JT, 80° Qz CT, IR, SM, 1 mm, Healed.		89.58: Point Load >20KN – No Failure	
										89.6 794.2															89.6
										89.8 794.0												89.79: JT, 87° Qz VN, PL, SM, Healed. 89.82: JT, 45° Qz VN, PL, SM, Healed. 89.81-89.85: Shear, 40° HE, PL, RO, 5 mm displacement. 89.84: JT, 45° Qz VN, PL, SM, Healed.			89.8
										90.0															

Observations and Comments

Notes
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● - Axial ○ - Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R35 3.02m (100%) 100%		90.58 m Is(50) d=3.79		90.0 793.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	H	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		89.92: JT, 60° Qz VN, PL, SM, Healed. 89.78-90.20: Shear, 80° Qz VN, PL, RO, 2 mm displacement, healed. 90.05: JT, 87° Qz VN, PL, SM, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
								90.2 793.6									VH - EH			90.24: JT, 70° Py VN, PL, SM, Healed. 90.32: JT, 45° Qz VN, PL, SM, Healed.			
								90.4 793.4															
								90.6 793.2												90.56: JT, 20° Qz VN, PL, SM, Healed. 90.65: JT, 70° Qz VN, PL, SM, Healed.			
								90.8 793.0				90.86: Mudstone & Siltstone with Sandstone beds Protolith								90.90: JT, 30° Py VN, PL, SM, Healed. 90.92: JT, 85° Qz VN, PL, SM, Healed. 90.96: JT, 35° Py VN, PL, SM, Healed. 91.06: JT, 40° Qz VN, PL, SM, Healed.			
								91.0 792.8															
								91.2 792.6															
			0 % Loss	R36 2.99m (100%) 100%				91.4 792.4				91.38-92.98: increased lithic clasts up to 20%								91.39: JT, 45° Qz VN, PL, SM, Healed. 91.50: JT, 10° Qz VN, PL, SM, Healed.		91.69: Point Load >20KN – No Failure	
								91.6 792.2															
								91.8 792.0												91.76: JT, 15° Qz VN, PL, SM, Healed.			
								92.0												91.95: JT, 85° Qz VN, PL, SM, Healed.			

Observations and Comments

Notes

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Core Loss (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R36 2.99m (100%) 100%				92.0 791.8				HORNFELS: dark grey and brown, indistinct sub-horizontal bedding, very fine grained, weakly foliated at 60 - 70°. *(continued)*			SA *(cont)*	F *(cont)*	H				92.00: JT, 40° Qz CT, PL, SM, 1 mm, Healed.		NAMBUCCA BEDS - CONTACT METAMORPHISM	
																					92.09: JT, 20° Py VN, PL, SM, Healed.			
																					92.12: JT, 30° Qz CT, PL, SM, 1 mm, Healed.			
									92.2 791.6															92.2
													92.34: increasing thin Sandstone Protolith beds								92.36: JT, 30° Qz CT, PL, SM, 1 mm, Healed.			
									92.4 791.4												92.42: JT, 40° Qz CT, PL, SM, 1 mm, Terminates on joint, healed.			92.4
									92.6 791.2									VH - EH			92.56: JT, 30° Qz VN, PL, SM, Healed.			92.6
									92.8 791.0												92.81: JT, 30° Qz VN, PL, SM, Healed.			92.8
																					92.91: JT, 10° Py VN, PL, SM, Healed.		92.90: Point Load >20KN – No Failure	
									93.0 790.8															93.0
													93.07-93.19: with Ripup Clasts up to 5 mm											
									93.2 790.6												93.18: JT, 35° Qz VN, PL, SM, Healed.			93.2
																					93.19: JT, 35° Qz VN, PL, SM, Healed.			
																					93.20-93.21: VE, 5° Qz CT, PL, SM, 6 mm, Healed.			
																					93.32: JT, 35° Qz VN, PL, SM, Healed.			
									93.4 790.4												93.33: JT, 65° Py VN, PL, SM, Healed.			93.4
																					93.39: JT, 80° Qz VN, PL, SM, Discontinuous, healed.			
																					93.41: JT, 5° Qz VN, PL, SM, Healed.			
												93.54									93.53: JT, 25° Qz VN, PL, SM, Healed.			
									93.6 790.2			790.26	93.54-100.43: equiangular, with some feldspar crystals up to 8mm GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. 93.64-93.95: mafic layering										CARRAI GRANODIORITE 93.54: Igneous Contact, distinct, planar, dipping 60°	93.6
				100 % Loss																				
					R37 2.85m (100%) 95%				93.8 790.0														93.78: Point Load >20KN – No Failure		93.8
									94.0														93.90: Point Load >20KN – No Failure		
					93.77																			

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss		R37 2.85m (100%) 96%				94.0 789.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*				94.05: JT, 50° Py VN, PL, RO		CARRAI GRANODIORITE	
																	SW				94.15: JT, 55° Py VN, PL, RO			
									94.2 789.6															94.2
									94.4 789.4															94.4
																					94.52: JT, 85° Py VN, PL, RO			
									94.6 789.2															94.6
									94.8 789.0															94.8
																							94.90: Point Load >20KN – No Failure	
									95.0 788.8															95.0
									95.2 788.6															95.2
									95.4 788.4															95.4
									95.6 788.2															95.6
																					95.72: JT, 80° CN, PL, RO			
									95.8 788.0												95.82: JT, 80° CN, PL, RO			95.8
									96.0								F							

Observations and Comments

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss	R37 2.85m (100%) 96%				96.0 787.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	96.2
								96.2 787.6																
								96.4 787.4															96.40: Point Load >20KN – No Failure	96.4
								96.6 787.2																96.6
				96.62				96.8 787.0																96.8
								97.0 786.8																97.0
			100 % Loss	R38 3.07m (100%) 99%				97.2 786.6																97.2
								97.4 786.4																97.4
								97.6 786.2																97.6
								97.8 786.0													97.85: JT, 20° CN, PL, RO 97.87: JT, 20° CN, PL, RO			97.8
								98.0																

Observations and Comments

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss				98.0 785.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		98.11: JT, 88° CN, PL, RO		CARRAI GRANODIORITE	
							98.2 785.6																98.2
							98.4 785.4																98.4
							98.6 785.2																98.6
							98.8 785.0																98.8
							99.0 784.8				99.14-99.27: grey to green, minor chlorite									99.19: JT, 10° Qz VN, PL, RO, Trace pyrite.				99.0
							99.2 784.6																99.2
							99.4 784.4																99.4
							99.6 784.2																99.6
			0 % Loss				99.8 784.0				99.88-100.20: grey to green, minor chlorite									99.89: JT, 25° Qz VN, PL, RO, Healed. 99.89: JT, 20° Qz VN, PL, RO, Healed. 99.91: JT, Qz VN, CR, RO, 10 -		99.69: Borehole grouted to stop water loss 99.69: Point Load >20KN – No Failure	99.8
							100.0																

99.69

R38 3.07m (100%) 99%

R39 2.89m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
		HQ3	0 % Loss				100.0 783.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000		30°, healed, discontinuous.		CARRAI GRANODIORITE	
							100.2 783.6																100.2
							100.4 783.4																100.4
							100.6 783.2																100.6
							100.8 783.0																100.8
							101.0 782.8																101.0
							101.2 782.6																101.2
							101.4 782.4																101.4
							101.6 782.2																101.6
							101.8 782.0																101.8
							102.0																

R39 2.89m (100%) 100%

Observations and Comments

Notes
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SMEC 2.10.15 LIB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				102.0 781.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*				102.74: JT, 25° Qz VN, PL, RO, Healed. 102.74: JT, 20° Qz VN, PL, RO, Healed.		CARRAI GRANODIORITE	
							102.2 781.6															102.2
							102.4 781.4															102.4
							102.6 781.2														102.58: Point Load >20KN – No Failure	102.6
							102.8 781.0															102.8
							103.0 780.8															103.0
							103.2 780.6															103.2
			0 % Loss		R40 3.07m (100%) 100%		103.4 780.4															103.4
							103.6 780.2															103.6
							103.8 780.0				103.92: slightly porphyritic feldspar crystals up to 30mm											103.8
							104.0															

102.58 — R39 2.89m (100%) 100%

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				104.0 779.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	
							104.2 779.6																104.2
							104.4 779.4																104.4
							104.6 779.2																104.6
							104.8 779.0																104.8
							105.0 778.8																105.0
							105.2 778.6																105.2
							105.4 778.4																105.4
							105.6 778.2															105.65: Point Load >20KN – No Failure	105.6
			0 % Loss				105.8 778.0																105.8
							106.0																

R40 3.07m (100%) 100%

105.65

R41 3.04m (100%) 100%

SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									106.0 / 777.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*						CARRAI GRANODIORITE	
													106.12: increasing porphyritic texture, feldspar crystals up to 30mm											
HQ3				0 % Loss	R41 3.04m (100%) 100%				106.2 / 777.6															106.2
									106.4 / 777.4															106.4
									106.6 / 777.2													106.65: JT, 0° HE, PL, RO 106.72: JT, 0° HE, PL, RO			106.6
									106.8 / 777.0													106.88: JT, 10° VN, PL, RO, Mineral unknown, silver colour, soft <3 mohs.			106.8
									107.0 / 776.8															107.0
									107.2 / 776.6															107.2
									107.4 / 776.4															107.4
									107.6 / 776.2													107.61: JT, 35° Qz CT, PL, RO, 1 mm 107.62: JT, 25° Py VN, PL, RO, Healed.		107.63: Point Load >20KN – No Failure	107.6
									107.8 / 776.0															107.8
									108.0													107.88: JT, 45° HE, PL, RO			

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		108.30 m Is(50) d=4.81		108.0 / 775.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*				108.12: JT, 25° Qz VN, PL, RO, Healed. 108.13: JT, 25° Qz VN, PL, RO, Healed.		CARRAI GRANODIORITE	
							108.2 / 775.6																108.2
																				108.30: JT, 25° HE, PL, RO		108.30: Point Load >20KN – No Failure	
							108.4 / 775.4																108.4
																						108.43-111.77: horizontal fractures, discing of core, drill breaks due to increase in drill pressure from worn drill bit	
							108.6 / 775.2																108.6
			108.69																				
							108.8 / 775.0																108.8
							109.0 / 774.8															109.00: Point Load >20KN – No Failure	109.0
							109.2 / 774.6																109.2
			0 % Loss				109.4 / 774.4																109.4
							109.6 / 774.2																109.6
							109.8 / 774.0				109.84-111.23: thin mafic igneous layering, fine to medium grained, spaced 100-600mm, slight chlorite alteration												109.8
							110.0																

R41 3.04m (100%) 100%

R42 2.26m (100%) 100%

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		110.03 m Is(50) d=4.19		110.0 / 773.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	○			110.12: JT, 0° Qz VN, PL, RO, Healed. 110.13: JT, 0° Qz VN, PL, RO, Healed.		CARRAI GRANODIORITE 110.03: Point Load >20KN – No Failure	
							110.2 / 773.6															110.2
							110.4 / 773.4													110.33: JT, 0° Qz VN, PL, RO, Healed. 110.38: JT, 0° Qz VN, PL, RO, Healed. 110.40: JT, 0° Qz VN, PL, RO, Healed. 110.43: JT, 0° Qz VN, PL, RO, Healed. 110.46: JT, 0° Qz VN, PL, RO, Healed. 110.55: JT, 0° Qz VN, PL, RO, Healed. 110.57: JT, 0° Qz VN, PL, RO, Healed.			110.4
							110.6 / 773.2				110.56: becoming dark grey with green											110.6
							110.8 / 773.0													110.77: JT, 0° Qz VN, PL, RO, Healed. 110.80: JT, 0° Qz VN, PL, RO, Healed.			110.8
							111.0 / 772.8															111.0
							111.2 / 772.6				111.24: increasing porphyritic texture, feldspar crystals up to 20mm											111.2
							111.4 / 772.4															111.4
							111.6 / 772.2															111.6
							111.8 / 772.0															111.8
							112.0															

110.95
111.77

R42 2.26m (100%) 100%
R43 0.82m (100%) 100%
R44 2.93m (100%) 100%

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				112.0 771.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*						CARRAI GRANODIORITE	
							112.2 771.6																112.2
							112.4 771.4																112.4
							112.6 771.2																112.6
							112.8 771.0																112.8
							113.0 770.8													113.09: JT, 89° HE, PL, RO			113.0
							113.2 770.6				113.25: Plagioclase feldspar crystal 40mm												113.2
							113.4 770.4																113.4
							113.6 770.2																113.6
							113.8 770.0																113.8
							114.0																

R44 2.93m (100%) 100%

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				114.0 769.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							114.2 769.6																114.2
							114.4 769.4																114.4
							114.6 769.2																114.6
							114.8 769.0															114.82: Point Load >20KN – No Failure	114.8
							115.0 768.8				115.00-127.78: porphyritic with feldspar crystals up to 35mm												115.0
							115.2 768.6																115.2
			5 % Loss				115.4 768.4													115.35: JT, 65° CN, PL, RO			115.4
							115.6 768.2																115.6
							115.8 768.0																115.8
							116.0																

114.70

R44 2.93m (100%) 100%

R45 3.01m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		5 % Loss	R45 3.01m (100%) 100%				116.0 / 767.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*						CARRAI GRANODIORITE	
							116.2 / 767.6																116.2
							116.4 / 767.4																116.4
							116.6 / 767.2																116.6
							116.8 / 767.0																116.8
							117.0 / 766.8															116.90: Point Load >20KN – No Failure	117.0
							117.2 / 766.6																117.2
							117.4 / 766.4																117.4
							117.6 / 766.2																117.6
		0 % Loss	R46 3.00m (100%) 100%				117.71													117.92: JT, 89° HE, PL, RO			
							117.8 / 766.0															117.90: Point Load >20KN – No Failure	117.8
							118.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		R46 3.00m (100%) 100%				118.0 765.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*				119.07: JT, 65° HE, PL, RO		CARRAI GRANODIORITE	
									118.2 765.6															
									118.4 765.4															
									118.6 765.2															
									118.8 765.0															
									119.0 764.8															
									119.2 764.6															
									119.4 764.4															
									119.6 764.2															
									119.8 764.0															
									120.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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SMEC 2.10.15 LIB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				R46 3.00m (100%) 100%	120.0 / 763.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*				120.34: JT, 45° HE, PL, RO		CARRAI GRANODIORITE	120.2
								120.2 / 763.6															120.4
								120.4 / 763.4															120.6
							120.71	120.6 / 763.2														120.71: Point Load >20KN – No Failure	
								120.8 / 763.0															120.8
								121.0 / 762.8															121.0
								121.2 / 762.6				121.20: increasing in percentage of coarse grained feldspar phenocrysts, phenocrysts up to 40mm across											121.2
								121.4 / 762.4															121.4
			0 % Loss				R47 3.00m (100%) 100%	121.6 / 762.2													121.57: JT, 30° HE, PL, RO			121.6
								121.8 / 762.0															121.8
								122.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°		
Azimuth			
North			
Survey			

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				122.0 761.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000		122.55: JT, 85° HE, PL, RO, Discontinuous.		CARRAI GRANODIORITE	
							122.2 761.6																122.2
							122.4 761.4																122.4
							122.6 761.2																122.6
							122.8 761.0																122.8
							123.0 760.8																123.0
							123.2 760.6																123.2
							123.4 760.4																123.4
							123.6 760.2																123.6
			123.71				123.8 760.0														123.70: Point Load >20KN – No Failure		123.8
			0 % Loss				124.0																

R47 3.00m (100%) 100%

R48 3.00m (100%) 100%

Observations and Comments

Notes

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:58 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		R48 3.00m (100%) 100%				124.0 759.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*						CARRAI GRANODIORITE	
									124.2 759.6															124.2
									124.4 759.4															124.4
									124.6 759.2															124.6
									124.8 759.0															124.8
									125.0 758.8														124.90: Point Load >20KN – No Failure	125.0
									125.2 758.6															125.2
									125.4 758.4															125.4
									125.6 758.2												125.55: JT, 20° HE, PL, RO 125.56: JT, 20° HE, PL, RO			125.6
									125.8 758.0														125.90: Point Load >20KN – No Failure	125.8
									126.0															

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				R48 3.00m (100%) 100%	126.0 / 757.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 126.00: increasing abundance of larger feldspar crystals up to 40mm				F *(cont)*	VH - EH *(cont)*						CARRAI GRANODIORITE	
								126.2 / 757.6															126.2
								126.4 / 757.4															126.4
								126.6 / 757.2												126.68: JT, 25° HE, PL, RO			126.6
								126.8 / 757.0														126.90: Point Load >20KN – No Failure	126.8
								127.0 / 756.8															127.0
								127.2 / 756.6															127.2
			0 % Loss				R49 2.98m (100%) 100%	127.4 / 756.4												127.53: JT, 35° HE, PL, RO			127.4
								127.6 / 756.2															127.6
								127.8 / 756.0				127.79-130.26: igneous layering, grey to dark grey, mafic composition								127.79: CX, HE, UN, RO, 0 - 10°, granodiorite and siltstone xenolith. 127.81: JT, 15° HE, PL, SM 127.83: CX, HE, UN, RO, 0 - 5°, granodiorite and siltstone xenolith. 127.84: JT, 15° Qz VN, PL, SM,		127.90: Point Load >20KN – No Failure	127.8
								128.0															

126.71

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R49 2.98m (100%) 100%			128.0 / 755.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000		Healed.		CARRAI GRANODIORITE	
							128.2 / 755.6				128.00-128.48: becoming porporitic, feldspar crystals up to 15mm in a mafic groundmass									127.87: JT, 15° Qz VN, PL, SM, Healed. 127.88: JT, 15° Qz VN, PL, SM, Healed. 127.93: JT, 15° Qz VN, PL, SM, Healed. 127.95: JT, 15° Qz VN, UN, SM, Healed. 128.01: JT, 15° HE, PL, RO 128.02: JT, 30° HE, PL, RO 128.07: JT, 15° HE, PL, RO 128.08: JT, 15° HE, PL, RO 128.11: JT, 30° HE, PL, RO 128.16: JT, 50° HE, PL, RO 128.17: JT, 30° HE, PL, RO, Terminates on joint. 128.19: JT, 50° HE, PL, RO 128.22: JT, 50° HE, PL, RO 128.22: JT, 15° HE, PL, RO 128.25: JT, 30° HE, PL, RO 128.30: JT, 45° HE, PL, RO, MA. 128.34: JT, 15° HE, PL, RO			128.2
							128.4 / 755.4				128.49-128.77: chill margin, fine grained mafic groundmass with some feldspar crystals up to 10mm												128.4
							128.6 / 755.2																128.6
							128.8 / 755.0													128.75: JT, 30° HE, PL, RO			128.8
							129.0 / 754.8															128.88: Point Load >20KN – No Failure	129.0
							129.2 / 754.6				129.16: becoming darker grey, porphoritic with feldspar crystals up to 10mm and mafic crystals up to 20mm												129.2
							129.4 / 754.4																129.4
							129.6 / 754.2																129.6
			129.69 0 % Loss	R50 2.98m (100%) 100%			129.8 / 754.0															129.90: Point Load >20KN – No Failure	129.8
							130.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R50 2.98m (100%) 100%				130.0 753.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 130.00-130.26: chill margin of mafic layering mafic groundmass with coarse grained, 2 to 25 mm, feldspar, quartz, hornblende, biotite up to 20mm				F *(cont)*	VH - EH *(cont)*				130.53: JT, 45° HE, PL, RO 130.69-130.83: VE, 40° CT, PL, SM, Unknown black mineral, healed. 130.83: JT, 35° Qz VN, PL, RO, Healed. 130.84: JT, 75° Qz VN, PL, RO, Discontinuous, healed. 130.88: JT, 25° HE, PL, RO 130.89: JT, 25° HE, PL, RO 130.89: JT, 30° CT, PL, RO, 1 mm, Unknown black mineral, healed. 130.94: JT, 40° HE, PL, RO 130.94: JT, 15° CT, PL, RO, 2 mm, Unknown black mineral, healed. 130.95: JT, 15° CT, PL, RO, 2 mm, Unknown black mineral, healed.		CARRAI GRANODIORITE 130.90: Point Load >20KN – No Failure 131.90: Point Load >20KN – No Failure	
									130.2 753.6				130.26: basal contact of mafic layering 130.27: porphyritic texture, feldspar crystals up to 30mm											130.2
									130.4 753.4															130.4
									130.6 753.2				130.70-130.79: mafic igneous layering, dipping at 60°											130.6
									130.8 753.0															130.8
									131.0 752.8															131.0
									131.2 752.6															131.2
									131.4 752.4															131.4
									131.6 752.2															131.6
									131.8 752.0															131.8
									132.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R50 2.98m (100%) 100%				132.0 751.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH - EH *(cont)*				132.03: JT, 10° HE, PL, RO		CARRAI GRANODIORITE	
																				132.11: JT, 20° HE, PL, RO			
								132.2 751.6				132.20: mafic veins, irregular, subhorizontal								132.19-132.24: VE, 40° CT, PL, SM, Unknown black mineral, healed.			132.2
																				132.25: JT, 20° HE, PL, RO			
																				132.27-132.29: VE, 20° CT, PL, SM, Unknown black mineral, healed.			
								132.4 751.4															132.4
								132.6 751.2															132.6
			132.67																	132.66: JT, 25° Qz CT, PL, SM, 2 mm, Healed.			
																				132.74: JT, 20° Qz VN, PL, RO, Healed.			
								132.8 751.0															132.8
																				132.91: JT, 20° Qz VN, PL, RO, Healed.			
																				132.95: JT, 88° Qz VN, PL, RO, Discontinuous, healed.			
								133.0 750.8									VH						133.0
																				133.15-133.19: VE, 30° HE, UN, SM			
								133.2 750.6				133.22: mafic veins, irregular, subhorizontal to subvertical								133.18-133.24: VE, 40° HE, UN, SM			133.2
																				133.24-133.29: VE, 40° HE, UN, SM			
			0 % Loss	R51 3.01m (100%) 100%				133.4 750.4															133.4
								133.6 750.2															133.6
																				133.73: JT, 30° HE, PL, RO			
								133.8 750.0															133.8
								134.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				134.0 / 749.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							134.2 / 749.6													134.19: JT, 50° HE, PL, RO			134.2
																				134.24: JT, 50° HE, PL, RO 134.25: JT, 50° HE, PL, RO 134.28: JT, 0° HE, PL, RO 134.30-134.31: VE, 5° HE, UN, SM 134.34: JT, 50° HE, PL, RO, 50 134.39: JT, 35° Py HE, PL, RO			
							134.4 / 749.4																134.4
																						134.53: Point Load >20KN – No Failure	
							134.6 / 749.2													134.61: JT, 35° Py HE, PL, RO			134.6
																				134.68: JT, 15° HE, PL, RO 134.70: JT, 5° HE, PL, RO 134.74: JT, 25° HE, PL, RO 134.76: JT, 30° HE, PL, RO			
							134.8 / 749.0																134.8
																				134.86: JT, 50° HE, PL, RO 134.88: JT, 50° HE, PL, RO 134.91: JT, 40° HE, PL, RO			
							135.0 / 748.8																135.0
																				135.03: JT, 30° HE, PL, RO 135.04: JT, 30° HE, PL, RO			
							135.2 / 748.6																135.2
																				135.16-135.21: VE, 40° Grey mineral CT, PL, RO 135.20-135.21: VE, 40° Grey mineral CT, PL, RO 135.22-135.23: VE, 10° Grey mineral CT, PL, RO 135.23: VE, 5° Grey mineral CT, PL, RO 135.23-135.27: VE, 40° Grey mineral CT, PL, RO 135.27-135.28: VE, 10° Grey mineral CT, PL, RO 135.27-135.30: VE, 25° Grey mineral CT, PL, RO 135.32-135.35: VE, 25° Grey mineral CT, PL, RO 135.36-135.39: VE, 25° Grey mineral CT, PL, RO 135.39-135.41: VE, 20° Qz HE, PL, RO 135.45-135.47: VE, 20° Qz HE, PL, RO 135.48-135.50: VE, 20° Qz HE, PL, RO 135.62-135.64: VE, 20° Qz HE, PL, RO 135.63-135.65: VE, 20° Qz HE, PL, RO 135.65-135.67: VE, 20° Qz HE, PL, RO 135.66-135.68: VE, 20° Qz HE, PL, RO		135.30: Point Load >20KN – No Failure	
							135.4 / 748.4																135.4
							135.6 / 748.2				135.71-135.74: mafic lenses, irregular, subhorizontal 135.75: becoming lighter grey and less mafic												135.6
			100 % Loss				135.8 / 748.0																135.8
							136.0																

135.68

R51 3.01m (100%) 100%

R52 1.02m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss				136.0 / 747.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000		135.68-135.70: VE, 20° Qz HE, PL, RO 135.69-135.71: VE, 20° Qz HE, PL, RO 135.70-135.75: VE, 40° Um HE, PL, RO, 5 - 20 mm, x5. 135.79-135.81: VE, 15° Ca HE, PL, RO 135.89-135.92: VE, 40° Qz HE, PL, RO, 2 mm, Discontinuous. 135.93-135.94: VE, 10° Ca HE, PL, RO 135.94-135.95: VE, 10° Ca HE, PL, RO 136.05-136.07: VE, 20° Qz HE, PL, RO, 2 mm 136.07-136.09: VE, 15° Silt VN, PL, SL		CARRAI GRANODIORITE 136.00: Point Load >20KN – No Failure 136.07-136.66: 100% water loss on joint. Borehole grouted	
							136.2 / 747.6																136.2
							136.4 / 747.4																136.4
							136.6 / 747.2													136.58: JT, 65° HE, PL, RO 136.59: JT, 65° Ca, PL, RO, Quartz.				136.6
							136.8 / 747.0																136.8
			5 % Loss				137.0 / 746.8															137.00: Point Load >20KN – No Failure	137.0
							137.2 / 746.6																137.2
			10 % Loss				137.4 / 746.4				137.36-137.59: increasing mafic groundmass igneous layering												137.4
							137.6 / 746.2				137.59-137.70: fine grained chill margin												137.6
							137.8 / 746.0																137.8
							138.0																

R52 1.02m (100%) 100%
136.70
R53 0.23m (100%) 100%
136.93
R54 1.47m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R54 1.47m (100%) 100%				138.0 / 745.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 138.00: becoming less porphyritic with finer felsic phenocrysts				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							138.2 / 745.6																138.2
		138.40					138.4 / 745.4																138.4
							138.6 / 745.2																138.6
							138.8 / 745.0																138.8
		10 % Loss	R55 2.76m (100%) 100%				139.0 / 744.8																139.0
							139.2 / 744.6																139.2
							139.4 / 744.4																139.4
							139.6 / 744.2																139.6
							139.8 / 744.0																139.8
							140.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				140.0 / 743.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 – L 0.3 – M 1 – H 3 – VH 10 – EH	20 – 60 – 200 – 600 – 2000				CARRAI GRANODIORITE	
							140.2 / 743.6				140.18: becoming equigranular, 5mm crystal size												140.2
							140.4 / 743.4																140.4
							140.6 / 743.2																140.6
							140.8 / 743.0																140.8
							141.0 / 742.8															141.00: Point Load >20KN – No Failure	141.0
							141.16																
							141.2 / 742.6																141.2
							141.4 / 742.4																141.4
			10 % Loss				141.6 / 742.2																141.6
							141.8 / 742.0																141.8
							142.0																

R55 2.76m (100%) 100%
R56 3.09m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (Axial / Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				142.0 / 741.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1, L 0.3, M 1, H 3, VH 10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	
							142.2 / 741.6																142.2
							142.4 / 741.4																142.4
							142.6 / 741.2																142.6
							142.8 / 741.0																142.8
							143.0 / 740.8															142.89: Point Load >20KN – No Failure	143.0
							143.2 / 740.6																143.2
							143.4 / 740.4				143.36-143.62: mafic igneous layering, subhorizontal												143.4
							143.6 / 740.2																143.6
							143.8 / 740.0																143.8
							144.0																

R56 3.09m (100%) 100%

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R56 3.09m (100%) 100%				144.0 739.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							144.2 739.6				144.19: mafic phenocryst											144.2
		144.25					144.4 739.4				144.33: mafic phenocryst											144.4
		10 % Loss	R57 1.88m (100%) 100%				144.6 739.2															144.6
							144.8 739.0															144.8
							145.0 738.8															145.0
							145.2 738.6															145.2
							145.4 738.4															145.4
							145.6 738.2															145.6
							145.8 738.0															145.8
							146.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3		10 % Loss	146.13				146.0 737.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 146.00: Point Load >20KN – No Failure	
								146.2 737.6															146.2
												146.35-146.47: 3 x thin mafic veins dipping at 30-40°											
								146.4 737.4															146.4
								146.6 737.2															146.6
				R58 1.17m (100%) 100%																			
			10 % Loss					146.8 737.0															146.8
								147.0 736.8															147.0
								147.2 736.6															147.2
				147.30																			
												147.30-147.86: Chlorite alteration			SA		H						
								147.4 736.4															147.4
								147.6 736.2															147.6
			10 % Loss	R59 3.00m (100%) 100%																			
								147.8 736.0															147.8
								148.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									148.0 735.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*			SA *(cont)*	F *(cont)*	H *(cont)*						CARRAI GRANODIORITE	
HQ3			10 % Loss		R59 3.00m (100%) 100%		148.17 m Is(50) d=0.98, a=0.96						148.15-148.40: hydrothermal alteration			DA		M				148.17: JT, 2° HE, PL, RO 148.31: JT, 50° CN, UN, RO			
									148.2 735.6															148.2
									148.4 735.4							SA		H						148.4
									148.6 735.2				148.60: becoming less mafic					VH						148.6
									148.8 735.0															148.8
									149.0 734.8															149.0
									149.2 734.6															149.2
									149.4 734.4															149.4
									149.6 734.2															149.6
									149.8 734.0															149.8
									150.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss	R59 3.00m (100%) 100%				150.0 733.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
								150.2 733.6				150.23: mafic phenocryst											
			150.30					150.4 733.4															
								150.6 733.2															
								150.8 733.0															
			10 % Loss	R60 2.87m (100%) 100%				151.0 732.8															
								151.2 732.6															
								151.4 732.4															
								151.6 732.2															
								151.8 732.0															
								152.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R60 2.87m (100%) 100%				152.0 / 731.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	
							152.2 / 731.6																152.2
							152.4 / 731.4																152.4
							152.6 / 731.2																152.6
							152.8 / 731.0																152.8
							153.0 / 730.8															153.00: Point Load >20KN – No Failure	153.0
							153.2 / 730.6																153.2
							153.4 / 730.4																153.4
							153.6 / 730.2																153.6
							153.8 / 730.0																153.8
		10 % Loss	R61 0.78m (100%) 100%				154.0															153.95: Point Load >20KN – No Failure	

153.17

153.95

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss	R62 2.43m (100%) 100%			154.0 729.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							154.2 729.6				154.26-154.67: quartz vein, 1-2 mm thick dipping 80-90°												154.2
							154.4 729.4				154.44-154.70: increasing mafic crystals												154.4
							154.6 729.2																154.6
							154.8 729.0																154.8
							155.0 728.8				154.95-155.38: becoming finer grained and less mafic												155.0
							155.2 728.6																155.2
							155.4 728.4				155.38: increasing mafic crystals												155.4
							155.6 728.2																155.6
							155.8 728.0																155.8
							156.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R62 2.43m (100%) 100%				156.0 / 727.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	156.2
							156.2 / 727.6																
		156.38					156.4 / 727.4																156.4
		10 % Loss	R63 2.11m (100%) 100%				156.6 / 727.2																156.6
							156.8 / 727.0															156.83: Point Load >20KN – No Failure	156.8
							157.0 / 726.8																157.0
							157.2 / 726.6																157.2
							157.4 / 726.4				157.53: becoming finer grained and less mafic												157.4
							157.6 / 726.2																157.6
							157.8 / 726.0																157.8
							158.0																

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R63 2.11m (100%) 100%				158.0 725.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							158.2 725.6															158.2
							158.4 725.4															158.4
		158.49					158.6 725.2															158.6
							158.8 725.0															158.8
		10 % Loss	R64 3.01m (100%) 100%				159.0 724.8															159.0
							159.2 724.6															159.2
							159.4 724.4															159.4
							159.6 724.2															159.6
							159.8 724.0															159.8
							160.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R64 3.01m (100%) 100%				160.0 723.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							160.2 723.6																160.2
											160.31: felsic phenocrysts up to 10 mm												
							160.4 723.4																160.4
							160.6 723.2																160.6
							160.8 723.0																160.8
							161.0 722.8																161.0
							161.2 722.6																161.2
							161.4 722.4				161.52: Xenolith												161.4
		161.50					161.6 722.2																161.6
		10 % Loss	R65 3.03m (100%) 100%				161.8 722.0																161.8
							162.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R65 3.03m (100%) 100%				162.0 721.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 162.00: increasing abundance of felsic phenocrysts up to 10-20 mm				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									162.2 721.6															162.2
									162.4 721.4															162.4
									162.6 721.2															162.6
									162.8 721.0															162.8
									163.0 720.8															163.0
									163.2 720.6															163.2
									163.4 720.4															163.4
									163.6 720.2															163.6
									163.8 720.0															163.8
									164.0														163.89: Point Load >20KN – No Failure	

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R65 3.03m (100%) 100%				164.0 719.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							164.2 719.6																164.2
							164.4 719.4																164.4
		164.53					164.6 719.2																164.6
							164.8 719.0																164.8
							165.0 718.8															165.00: Point Load >20KN – No Failure	165.0
		10 % Loss	R66 3.01m (100%) 100%				165.2 718.6																165.2
							165.4 718.4																165.4
							165.6 718.2																165.6
							165.8 718.0																165.8
							166.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:59 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°		
Azimuth	North		
Survey			

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				166.0 / 717.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	166.2
							166.2 / 717.6																166.4
							166.4 / 717.4																166.6
							166.6 / 717.2																166.8
							166.8 / 717.0																167.0
							167.0 / 716.8																167.2
							167.2 / 716.6																167.4
							167.4 / 716.4																167.6
							167.6 / 716.2																167.8
							167.8 / 716.0																
							168.0																

R66 3.01m (100%) 100%
167.54
R67 3.00m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R67 3.00m (100%) 100%				168.0 715.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									168.2 715.6															168.2
									168.4 715.4															168.4
									168.6 715.2															168.6
									168.8 715.0															168.8
									169.0 714.8															169.0
									169.2 714.6															169.2
									169.4 714.4															169.4
									169.6 714.2															169.6
									169.8 714.0															169.8
									170.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				170.0 713.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	170.2
							170.2 713.6																170.4
							170.4 713.4																
			10 % Loss		R67 3.00m (100%) 100%		170.54															170.54: Point Load >20KN – No Failure	170.6
							170.6 713.2																
							170.8 713.0																170.8
							171.0 712.8																171.0
			10 % Loss		R68 3.08m (100%) 100%		171.2 712.6																171.2
							171.4 712.4																171.4
							171.6 712.2																171.6
							171.8 712.0																171.8
							172.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project: Oven Mountain Pumped Hydro Energy Storage
Client: OMPS Pty Ltd
Site: Site 8
Job No: 30018018

East: 421495.500 m
North: 6591273.500 m
Elevation: 883.800 m
Datum: MGA94 Zone 56/AHD

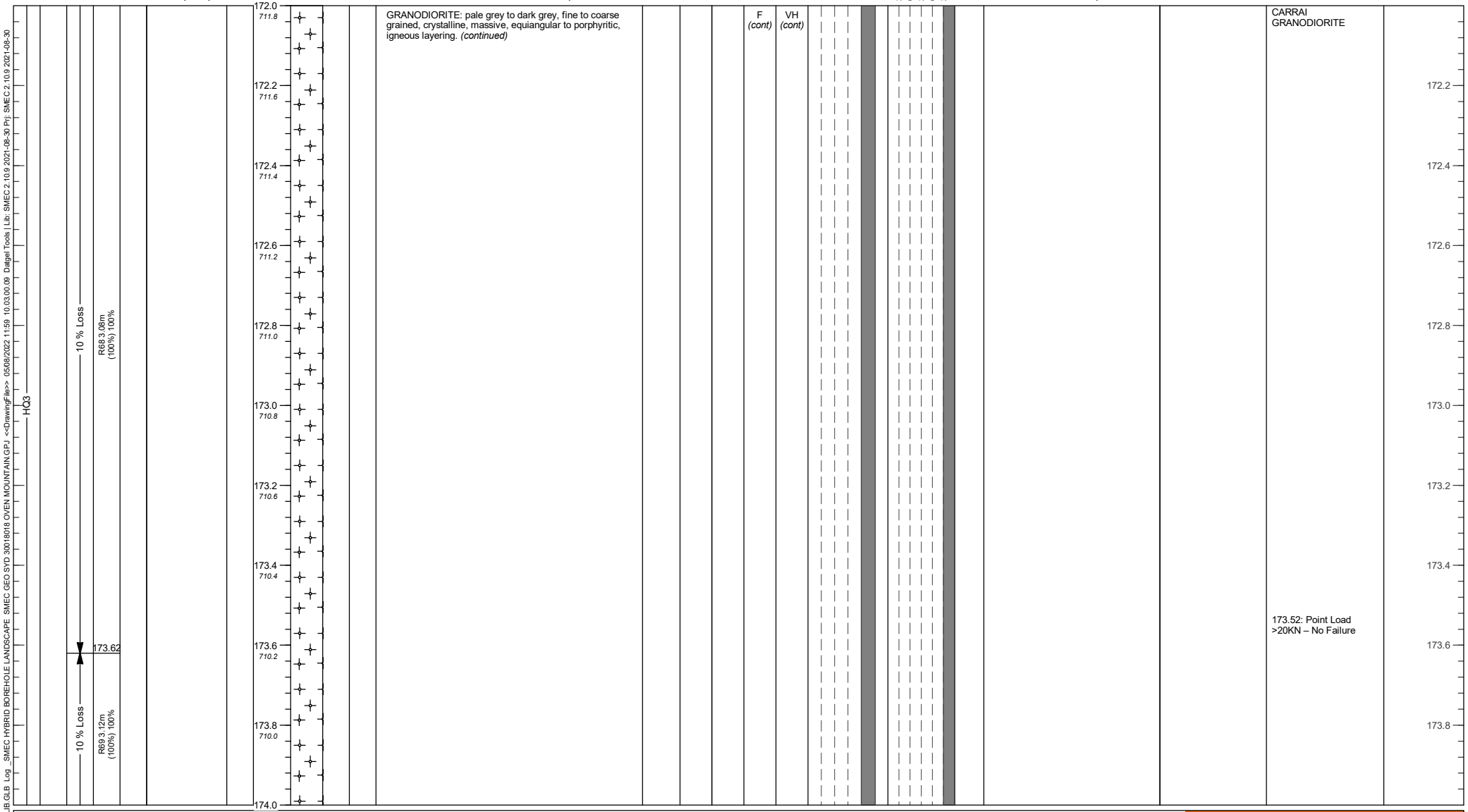
Start Date: 11/10/2021
End Date: 11/10/2021

Contractor: Mulligan Geotechnical
Rig Type: Boart Longyear DB520
Mounting: track

Inclination: 90°
Azimuth: North
Survey:

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**



Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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SMEC 2.10.15 UB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 11:59 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R69 3.12m (100%) 100%				174.0 709.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 174.00: Point Load >20KN – No Failure	
									174.2 709.6															174.2
									174.4 709.4															174.4
									174.6 709.2															174.6
									174.8 709.0															174.8
									175.0 708.8															175.0
									175.2 708.6															175.2
									175.4 708.4															175.4
									175.6 708.2				175.70: felsic phenocrysts 10-30 mm											175.6
									175.8 708.0															175.8
									176.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				176.0 / 707.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	176.2
							176.2 / 707.6																176.4
							176.4 / 707.4																176.6
							176.6 / 707.2																
			10 % Loss		R69 3.12m (100%) 100%		176.74															176.74: Point Load >20KN – No Failure	176.8
							176.8 / 707.0																177.0
							177.0 / 706.8																177.2
					R70 2.91m (100%) 100%		177.2 / 706.6																177.4
							177.4 / 706.4																177.6
							177.6 / 706.2																177.8
							177.8 / 706.0																
							178.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss	R70 2.91m (100%) 100%			178.0 705.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							178.2 705.6																178.2
							178.4 705.4																178.4
							178.6 705.2																178.6
							178.8 705.0																178.8
							179.0 704.8																179.0
							179.2 704.6																179.2
							179.4 704.4																179.4
							179.6 704.2																179.6
			10 % Loss	R71 3.12m (100%) 100%			179.65 179.8 704.0																179.8
							180.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R71 3.12m (100%) 100%				180.0 703.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									180.2 703.6															180.2
									180.4 703.4															180.4
									180.6 703.2															180.6
									180.8 703.0															180.8
									181.0 702.8															181.0
									181.2 702.6															181.2
									181.4 702.4															181.4
									181.6 702.2															181.6
									181.8 702.0															181.8
									182.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss	R71 3.12m (100%) 100%				182.0 701.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
								182.2 701.6															182.2
								182.4 701.4															182.4
								182.6 701.2														182.67: Point Load >20KN – No Failure	182.6
				182.77				182.8 701.0															182.8
			5 % Loss	R72 3.12m (100%) 100%				183.0 700.8															183.0
								183.2 700.6															183.2
								183.4 700.4															183.4
								183.6 700.2															183.6
								183.8 700.0															183.8
								184.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss	R72 3.12m (100%) 100%			184.0 699.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							184.2 699.6																184.2
							184.4 699.4																184.4
							184.6 699.2																184.6
							184.8 699.0																184.8
							185.0 698.8																185.0
							185.2 698.6																185.2
							185.4 698.4																185.4
							185.6 698.2																185.6
							185.8 698.0																185.8
			5 % Loss				186.0																

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss		R73 2.87m (100%) 100%				186.0 697.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									186.2 697.6															186.2
									186.4 697.4															186.4
									186.6 697.2															186.6
									186.8 697.0															186.8
									187.0 696.8															187.0
									187.2 696.6															187.2
									187.4 696.4															187.4
									187.6 696.2															187.6
									187.8 696.0															187.8
									188.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss				R73 2.87m (100%) 100%	188.0 695.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
								188.2 695.6															188.2
								188.4 695.4															188.4
								188.6 695.2															188.6
							188.76	188.8 695.0															188.8
			5 % Loss				R74 2.99m (100%) 100%	189.0 694.8														189.00: Point Load >20KN – No Failure	189.0
								189.2 694.6															189.2
								189.4 694.4															189.4
								189.6 694.2															189.6
								189.8 694.0															189.8
								190.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss	R74 2.99m (100%) 100%			190.0 693.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 190.07-190.17: fine grained felsic xenolith				F *(cont)*	VH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							190.2 693.6																190.2
							190.4 693.4																190.4
							190.6 693.2																190.6
							190.8 693.0																190.8
							191.0 692.8																191.0
							191.2 692.6																191.2
							191.4 692.4																191.4
							191.6 692.2																191.6
			5 % Loss	R75 3.04m (100%) 100%			191.75 191.8 692.0				191.84: gradational igneous contact, igneous layering 191.85-192.18: very fine to fine grained chill margin										191.84: Igneous Contact 191.95: Point Load >20KN – No Failure		191.8
							192.0																

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				5 % Loss	R75 3.04m (100%) 100%				192.0 691.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									192.2 691.6				192.20: fine grained equigranular											
									192.4 691.4															
									192.6 691.2															
									192.8 691.0															
									193.0 690.8															
									193.2 690.6															
									193.4 690.4															
									193.6 690.2															
									193.8 690.0															
									194.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss	R75 3.04m (100%) 100%			194.0 689.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 194.00: Point Load >20KN – No Failure	
							194.2 689.6				194.00: becoming porphyritic, phenocrysts up to 5 mm											194.2
							194.4 689.4															194.4
							194.6 689.2															194.6
							194.8 689.0															194.8
							195.0 688.8															195.0
							195.2 688.6															195.2
			5 % Loss	R76 3.04m (100%) 100%			195.4 688.4															195.4
							195.6 688.2															195.6
							195.8 688.0															195.8
							196.0															

194.79

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°		
Azimuth	North		
Survey			

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss	R76 3.04m (100%) 100%			196.0 687.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	196.2
							196.2 687.6																196.4
							196.4 687.4																196.6
							196.6 687.2																196.8
							196.8 687.0																197.0
							197.0 686.8																197.2
							197.2 686.6																197.4
							197.4 686.4																197.6
							197.6 686.2																197.8
			5 % Loss				197.8 686.0															197.83: Point Load >20KN – No Failure	
							198.0																

Observations and Comments

Notes

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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss	R77 3.02m (100%) 100%			198.0 685.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							198.2 685.6																198.2
							198.4 685.4																198.4
							198.6 685.2																198.6
							198.8 685.0																198.8
							199.0 684.8				199.13: gradational igneous contact fine grained chill margin											199.13: Igneous Contact	199.0
							199.2 684.6																199.2
							199.4 684.4																199.4
							199.6 684.2																199.6
							199.8 684.0																199.8
							200.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss	R77 3.02m (100%) 100% RQD			200.0 683.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	200.2
							200.2 683.6																200.4
							200.4 683.4																200.6
							200.6 683.2																200.8
			5 % Loss				200.8 683.0															201.00: Point Load >20KN – No Failure	201.0
				R78 3.02m (100%) 100%			201.0 682.8																201.2
							201.2 682.6																201.4
							201.4 682.4																201.6
							201.6 682.2																201.8
							201.8 682.0																
							202.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss 100 % Loss	R78 3.02m (100%) 100%			202.0 681.8 202.2 681.6 202.4 681.4 202.6 681.2 202.8 681.0 203.0 680.8 203.2 680.6 203.4 680.4 203.6 680.2 203.8 680.0 204.0				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 202.36: becoming coarser grained increasing mafic phenocrysts 202.63-202.95: minor chlorite alteration of mafic minerals and 6 x quartz veins spaced 2-30 mm, dipping 60-80° 203.60: becoming fine grained			SA	F *(cont)*	VH *(cont)*				202.48: JT, 85° HE, PL, RO		CARRAI GRANODIORITE 202.14-204.00: water loss on joints	202.2 202.4 202.6 202.8 203.0 203.2 203.4 203.6 203.8

203.87

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Run (TCR) RQD	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3		100 % Loss				R79 3.07m (100%) 100%	204.0 679.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 204.00: fine grained equigranular				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
								204.2 679.6															204.2
								204.4 679.4															204.4
								204.6 679.2															204.6
								204.8 679.0															204.8
								205.0 678.8														204.87: Point Load >20KN – No Failure	205.0
								205.2 678.6				205.27: mafic vein < 1 mm thick											205.2
								205.4 678.4				205.45: mafic vein < 1 mm thick 205.50: becoming coarser grained								205.46: JT, 45° CN, PL, RO			205.4
								205.6 678.2															205.6
								205.8 678.0															205.8
								206.0												205.99: JT, 40° CN, PL, RO			

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		100 % Loss	R79 3.07m (100%) 100%				206.0 / 677.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000		206.45: JT, 60° CN, PL, RO		CARRAI GRANODIORITE	
							206.2 / 677.6																206.2
																						206.28-206.62: 100% water loss on joint	
							206.4 / 677.4																206.4
							206.6 / 677.2																206.6
							206.8 / 677.0																206.8
		0 % Loss	206.94 R80 0.10m (100%) 100%				207.0 / 676.8															206.95: Point Load >20KN – No Failure	207.0
			207.04				207.2 / 676.6																207.2
		10 % Loss	R81 1.13m (100%) 100%				207.4 / 676.4																207.4
							207.6 / 676.2				207.67-207.78: mafic lenses												207.6
							207.8 / 676.0																207.8
							208.0																

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	208.17				208.0 / 675.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
		10 % Loss	R82 2.87m (100%) 100%				208.2 / 675.6															208.2
							208.4 / 675.4															208.4
							208.6 / 675.2															208.6
							208.8 / 675.0															208.8
							209.0 / 674.8															209.0
							209.2 / 674.6															209.2
							209.4 / 674.4															209.4
							209.6 / 674.2															209.6
							209.8 / 674.0													209.80: JT, 80° HE, PL, RO 209.45-210.45: JT, 85° CN, PL, RO			209.8
							210.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				210.0 673.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000		209.55-210.45: JT, 85° CN, PL, RO		CARRAI GRANODIORITE	
							210.2 673.6																210.2
							210.4 673.4																210.4
							210.6 673.2																210.6
							210.8 673.0																210.8
							211.0 672.8															211.00: Point Load >20KN – No Failure 211.04: Point Load >20KN – No Failure	211.0
							211.2 672.6																211.2
							211.4 672.4																211.4
							211.6 672.2																211.6
							211.8 672.0																211.8
							212.0																

211.04

R82 2.87m (100%) 100%

10 % Loss

R83 2.96m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

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Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			10 % Loss	R83 2.96m (100%) 100%				212.0 671.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*				212.47: JT, 20° CN, PL, RO 212.53: JT, 70° CN, PL, RO 212.61: JT, 20° CN, PL, RO		CARRAI GRANODIORITE	212.2 212.4 212.6 212.8 213.0 213.2 213.4 213.6 213.8
									212.2 671.6															
									212.4 671.4															
									212.6 671.2															
									212.8 671.0															
									213.0 670.8															
									213.2 670.6															
									213.4 670.4															
									213.6 670.2															
									213.8 670.0															
									214.0															
					214.00																			

Observations and Comments

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Geological & Engineering Log

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Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss				214.0 669.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 214.00: Point Load >20KN – No Failure	
							214.2 669.6													214.30: JT, 3° HE, PL, RO			214.2
							214.4 669.4																214.4
							214.6 669.2																214.6
							214.8 669.0				214.82: increasing larger mafic grains												214.8
							215.0 668.8																215.0
							215.2 668.6																215.2
							215.4 668.4																215.4
							215.6 668.2																215.6
							215.8 668.0																215.8
							216.0																

R84 2.19m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss				216.0 667.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 216.00: decreasing grainsize				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							216.2 667.6																216.2
							216.4 667.4																216.4
							216.6 667.2				216.63: decreasing abundance of larger mafic crystals												216.6
							216.8 667.0													216.87: JT, 80° HE, PL, RO			216.8
							217.0 666.8																217.0
							217.2 666.6													217.22: JT, 65° HE, PL, RO			217.2
							217.4 666.4																217.4
							217.6 666.2													217.63: JT, 0° HE, PL, RO			217.6
							217.8 666.0																217.8
							218.0																

100 % Loss 216.19 — 5 % Loss — 217.24 — 5 % Loss

R85 1.05m (100%) 100%

R86 1.87m (100%) 100%

Observations and Comments

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss				218.0 / 665.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000		218.64: JT, 5° CN, PL, RO		CARRAI GRANODIORITE	
							218.2 / 665.6																218.2
							218.4 / 665.4																218.4
							218.6 / 665.2																218.6
							218.8 / 665.0																218.8
							219.0 / 664.8															219.00: Point Load >20KN – No Failure	219.0
							219.2 / 664.6																219.2
							219.4 / 664.4																219.4
							219.6 / 664.2																219.6
							219.8 / 664.0																219.8
							220.0																

R86 1.87m (100%) 100%
219.11
R87 3.04m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (Axial / Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				5 % Loss	R87 3.04m (100%) 100%				220.0 663.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 220.00: becoming equigranular				F *(cont)*	VH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	220.2
									220.2 663.6																220.4
									220.4 663.4																220.6
									220.6 663.2																220.8
									220.8 663.0																221.0
									221.0 662.8													221.08: JT, 0° CN, PL, RO		221.07: Point Load >20KN – No Failure	
									221.2 662.6													221.27: JT, 40° CN, PL, RO			221.2
									221.4 662.4													221.38: JT, 10° CN, PL, RO			221.4
									221.6 662.2													221.61: JT, 45° CN, PL, RO			221.6
																						221.71: JT, 20° CN, PL, RO			
									221.8 662.0				221.75-221.80: minor hydrothermal alteration			SA									221.8
									222.0																

Observations and Comments

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss				222.0 / 661.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 222.05-222.35: minor hydrothermal alteration			SA	F *(cont)*	VH *(cont)*				222.27: JT, 80° CN, PL, RO		CARRAI GRANODIORITE 222.00: Point Load >20KN – No Failure	
			50 % Loss				222.2 / 661.6															222.2
							222.4 / 661.4															222.4
							222.6 / 661.2															222.6
							222.8 / 661.0															222.8
							223.0 / 660.8															223.0
							223.2 / 660.6															223.2
							223.4 / 660.4															223.4
							223.6 / 660.2															223.6
							223.8 / 660.0															223.8
							224.0															

222.15

R88 3.07m (100%) 100%

Observations and Comments

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			50 % Loss				224.0 659.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*				224.10: JT, 80° CN, PL, RO		CARRAI GRANODIORITE	
							224.2 659.6																224.2
							224.4 659.4																224.4
							224.6 659.2																224.6
							224.8 659.0																224.8
							225.0 658.8				225.05-225.45: minor hydrothermal alteration			SA									225.0
							225.2 658.6																225.2
							225.4 658.4													225.39: JT, 10° HE, PL, RO 225.43: JT, 10° HE, PL, RO			225.4
			50 % Loss		225.62 m Is(50) d=1.99		225.6 658.2																225.6
							225.8 658.0				225.75: increasing grain size, becoming porphyritic with felsic phenocrysts up to 20 mm									225.72: JT, 10° CN, PL, RO			225.8
					Is(50) a=6.36 MPa		226.0													225.94: JT, 0° CN, PL, RO			

225.22

R88 3.07m (100%) 100%

R89 2.92m (100%) 100%

Observations and Comments

Notes

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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			50 % Loss				226.0 / 657.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							226.2 / 657.6																226.2
							226.4 / 657.4																226.4
							226.6 / 657.2																226.6
							226.8 / 657.0																226.8
							227.0 / 656.8																227.0
							227.2 / 656.6																227.2
							227.4 / 656.4																227.4
							227.6 / 656.2																227.6
							227.8 / 656.0																227.8
							228.0																

R89 2.92m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		50 % Loss 100 % Loss	228.14 R90 2.94m (100%) 100%				228.0 655.8 228.2 655.6 228.4 655.4 228.6 655.2 228.8 655.0 229.0 654.8 229.2 654.6 229.4 654.4 229.6 654.2 229.8 654.0 230.0				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH 20 60 200 600 2000				CARRAI GRANODIORITE 228.00: Point Load >20KN – No Failure	228.2 228.4 228.6 228.8 229.0 229.2 229.4 229.6 229.8

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				100 % Loss	R90 2.94m (100%) 100%				230.0 653.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									230.2 653.6															230.2
									230.4 653.4															230.4
									230.6 653.2															230.6
									230.8 653.0															230.8
					R91 (100%) 100%		231.08 m Is(50) a=7.16		231.0 652.8															231.0
									231.2 652.6				231.29: felsic phenocrysts up to 30 mm											231.2
				0 % Loss	R92 3.09m (100%) 100%				231.4 652.4															231.4
									231.6 652.2															231.6
									231.8 652.0															231.8
									232.0															

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			0 % Loss	R92 3.09m (100%) 100%				232.0 651.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
									232.2 651.6																232.2
									232.4 651.4																232.4
									232.6 651.2																232.6
									232.8 651.0																232.8
									233.0 650.8																233.0
									233.2 650.6																233.2
									233.4 650.4																233.4
									233.6 650.2													233.59: JT, 40° CN, PL, RO			233.6
									233.8 650.0													233.91: JT, 30° HE, PL, RO			233.8
									234.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss (Gain/Loss)				234.0 / 649.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							234.2 / 649.6															234.2
							234.4 / 649.4															234.4
							234.6 / 649.2															234.6
							234.8 / 649.0															234.8
							235.0 / 648.8															235.0
							235.2 / 648.6															235.2
							235.4 / 648.4															235.4
							235.6 / 648.2															235.6
							235.8 / 648.0															235.8
			5 % Loss				236.0															

234.20

R93 2.94m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project: Oven Mountain Pumped Hydro Energy Storage
Client: OMPS Pty Ltd
Site: Site 8
Job No: 30018018

East: 421495.500 m
North: 6591273.500 m
Elevation: 883.800 m
Datum: MGA94 Zone 56/AHD

Start Date: 11/10/2021
End Date: 11/10/2021

Contractor: Mulligan Geotechnical
Rig Type: Boart Longyear DB520
Mounting: track

Inclination: 90°
Azimuth: North
Survey:

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		5 % Loss	R93 2.94m (100%) 100%				236.0 647.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							236.2 647.6																236.2
							236.4 647.4																236.4
							236.6 647.2																236.6
							236.8 647.0																236.8
							237.0 646.8															237.00: Point Load >20KN – No Failure	237.0
							237.2 646.6																237.2
							237.4 646.4																237.4
		5 % Loss	R94 3.05m (100%) 100%				237.6 646.2																237.6
							237.8 646.0																237.8
							238.0																

237.14

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			5 % Loss	R94 3.05m (100%) 100%				238.0 645.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*				238.88: JT, 20° HE, PL, RO		CARRAI GRANODIORITE	238.2
									238.2 645.6															238.4
									238.4 645.4															238.6
									238.6 645.2															238.8
									238.8 645.0															239.0
									239.0 644.8															239.2
									239.2 644.6													239.29: JT, 80° HE, PL, RO 239.38: JT, 40° HE, PL, RO			239.4
									239.4 644.4													239.52: JT, 85° HE, PL, RO 239.58: JT, 60° CN, PL, RO 239.59: JT, 60° HE, PL, RO 239.61: JT, 60° HE, PL, RO			239.6
									239.6 644.2													239.75: JT, 30° HE, PL, RO 239.77: JT, 25° Ca VN, PL, RO			239.8
									239.8 644.0													239.86: JT, 45° HE, PL, RO			
									240.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss (Gain/Loss)				240.0 / 643.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000		240.14: JT, 40° HE, PL, RO		CARRAI GRANODIORITE 240.00: Point Load >20KN – No Failure	
							240.2 / 643.6																240.2
							240.4 / 643.4													240.39: JT, 50° HE, PL, RO 240.45: JT, 55° Ca HE, PL, RO 240.46: JT, 60° HE, PL, RO			240.4
			5 % Loss				240.6 / 643.2																240.6
			240.19				240.8 / 643.0																240.8
																				240.88: JT, 10° HE, PL, RO 240.94: JT, 10° HE, PL, RO			
							241.0 / 642.8																241.0
			5 % Loss				241.2 / 642.6																241.2
			R95 3.02m (100%) 94%				241.4 / 642.4													241.43: JT, 75° Ca HE, PL, RO, I. 241.47: JT, 75° Ca HE, PL, RO			241.4
							241.6 / 642.2													241.59: JT, 50° Ca HE, PL, RO 241.67: JT, 40° Ca HE, PL, RO 241.74: JT, 40° Ca HE, PL, RO			241.6
							241.8 / 642.0													241.83: JT, 40° Ca HE, PL, RO 241.85: JT, 35° Ca HE, PL, RO 241.90: JT, 30° Ca HE, PL, RO 241.92: JT, 35° Ca HE, PL, RO			241.8
							242.0																

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (Axial / Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss				242.0 / 641.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*			SA	F *(cont)*	VH *(cont)*	VL -0.1, L -0.3, M -1, H -3, VH -10, EH	20, 60, 200, 600, 2000		242.03: JT, 85° HE, PL, RO, Discontinuous. 242.03-242.07: Shear, 30° Ca CT, PL, RO, 20 mm, With fine to medium sand and gravel. 242.17: JT, 10° Ca HE, PL, RO 242.19: JT, 10° Ca HE, PL, RO 242.22: JT, 25° Ca HE, PL, RO 242.26: JT, 25° Ca HE, PL, RO 242.27: JT, 20° Ca HE, PL, RO, 3 mm, Trace sand. 242.29: VE, 5° Ca HE, UN, RO 242.35: JT, 15° HE, PL, RO 242.36: JT, 15° HE, PL, RO 242.45-242.48: Shear, 30° Ca CT, PL, RO, 10 mm, With fine to medium sand and gravel. 242.52: JT, 30° HE, PL, RO 242.56-242.59: Shear, 30° Ca CT, PL, RO, 25 mm, With fine to medium sand and gravel. 242.61: JT, 25° HE, PL, RO 242.63: JT, 40° HE, PL, RO 242.63: JT, 30° HE, PL, RO, Terminates on joint. 242.80: JT, 25° Ca HE, PL, RO, 1 mm 243.26: JT, 65° HE, PL, RO 243.98: JT, 55° HE, PL, RO	242.62-243.04: HE, Set A): Joint, 25°, Undulating, Rough, @ 30-100 mm sp.	CARRAI GRANODIORITE	242.2 242.4 242.6 242.8 243.0 243.2 243.4 243.6 243.8
							242.2 / 641.6																
							242.4 / 641.4																
							242.6 / 641.2																
							242.8 / 641.0																
							243.0 / 640.8																
							243.2 / 640.6																
							243.4 / 640.4																
							243.6 / 640.2																
							243.8 / 640.0																
							244.0																

243.21

5 % Loss — R95 3.02m (100%) 94%

5 % Loss — R96 3.01m (100%) 100%

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			5 % Loss	R96 3.01m (100%) 100%				244.0 639.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*				243.99: JT, 45° HE, PL, RO		CARRAI GRANODIORITE	
									244.2 639.6															244.2
									244.4 639.4															244.4
									244.6 639.2												244.58: JT, 65° HE, PL, RO			244.6
									244.8 639.0															244.8
									245.0 638.8															245.0
									245.2 638.6															245.2
									245.4 638.4															245.4
									245.6 638.2															245.6
									245.8 638.0															245.8
									246.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss				246.0 / 637.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE 246.00: Point Load >20KN – No Failure	
							246.2 / 637.6																246.2
			5 % Loss				246.22																
							246.4 / 637.4																246.4
							246.6 / 637.2																246.6
							246.8 / 637.0																246.8
							247.0 / 636.8				247.15-247.22: pale grey to grey, fine grained xenolith												247.0
							247.2 / 636.6																247.2
							247.4 / 636.4																247.4
							247.6 / 636.2																247.6
							247.8 / 636.0																247.8
							248.0																

R97 2.94m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss				248.0 / 635.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							248.2 / 635.6																248.2
							248.4 / 635.4																248.4
							248.6 / 635.2																248.6
							248.8 / 635.0																248.8
							249.0 / 634.8															249.00: Point Load >20KN – No Failure	249.0
							249.2 / 634.6				249.28-253.33: occasional dark grey xenolith up to 20 mm												249.2
							249.4 / 634.4																249.4
							249.6 / 634.2																249.6
							249.8 / 634.0																249.8
							250.0																

249.16

5 % Loss

R97 2.94m (100%) 100%

R98 2.97m (100%) 100%

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss				250.0 / 633.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							250.2 / 633.6																250.2
							250.4 / 633.4																250.4
							250.6 / 633.2																250.6
							250.8 / 633.0																250.8
							251.0 / 632.8																251.0
							251.2 / 632.6																251.2
							251.4 / 632.4																251.4
							251.6 / 632.2																251.6
							251.8 / 632.0																251.8
							252.0																

R98 2.97m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			5 % Loss 0 % Loss				252.0 631.8 252.2 631.6 252.4 631.4 252.6 631.2 252.8 631.0 253.0 630.8 253.2 630.6 253.4 630.4 253.6 630.2 253.8 630.0 254.0				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 253.00: mafic xenolith up to 100 mm				F *(cont)*	VH *(cont)*	VL -0.1 L -0.3 M -1 H -3 VH -10 EH	20 60 200 600 2000		252.26: JT, 85° Ca HE, PL, RO, Discontinuous. 253.01: JT, 85° HE, PL, RO, Discontinuous.		CARRAI GRANODIORITE 252.00: Point Load >20KN – No Failure	252.2 252.4 252.6 252.8 253.0 253.2 253.4 253.6 253.8

252.13

R99 3.07m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R99 3.07m (100%) 100%				254.0 629.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
								254.2 629.6															254.2
								254.4 629.4															254.4
								254.6 629.2															254.6
								254.8 629.0															254.8
								255.0 628.8														255.00: Point Load >20KN – No Failure	255.0
								255.2 628.6															255.2
			255.20					255.4 628.4															255.4
			0 % Loss	R100 2.95m (100%) 100%				255.6 628.2															255.6
								255.8 628.0															255.8
								256.0													255.91-256.00: 85° Ca HE, PL, RO		

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		R100 2.95m (100%) 100%					256.0 627.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
										256.2 627.6															256.2
										256.4 627.4															256.4
										256.6 627.2															256.6
										256.8 627.0															256.8
										257.0 626.8															257.0
										257.2 626.6															257.2
										257.4 626.4															257.4
										257.6 626.2															257.6
										257.8 626.0															257.8
										258.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	258.15				258.0 / 625.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 258.00: Point Load >20KN – No Failure	
			0 % Loss	R101 3.03m (100%) 100%				258.2 / 625.6															258.2
								258.4 / 625.4															258.4
								258.6 / 625.2				258.67-258.81: dark grey xenolith 30 to 50 mm											258.6
								258.8 / 625.0															258.8
								259.0 / 624.8															259.0
								259.2 / 624.6															259.2
								259.4 / 624.4															259.4
								259.6 / 624.2															259.6
								259.8 / 624.0															259.8
								260.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				260.0 623.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							260.2 623.6																260.2
							260.4 623.4																260.4
							260.6 623.2				260.55: felsic phenocrysts up to 40 mm												260.6
							260.8 623.0																260.8
							261.0 622.8															261.00: Point Load >20KN – No Failure	261.0
			261.18				261.2 622.6																261.2
							261.4 622.4																261.4
			0 % Loss				261.6 622.2																261.6
							261.8 622.0																261.8
							262.0																

R101 3.03m (100%) 100%

R102 3.02m (100%) 100%

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project: Oven Mountain Pumped Hydro Energy Storage
Client: OMPS Pty Ltd
Site: Site 8
Job No: 30018018

East: 421495.500 m
North: 6591273.500 m
Elevation: 883.800 m
Datum: MGA94 Zone 56/AHD

Start Date: 11/10/2021
End Date: 11/10/2021

Contractor: Mulligan Geotechnical
Rig Type: Boart Longyear DB520
Mounting: track

Inclination: 90°
Azimuth: North
Survey:

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		R102 3.02m (100%) 100%				262.0 621.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									262.2 621.6															262.2
									262.4 621.4															262.4
									262.6 621.2															262.6
									262.8 621.0															262.8
									263.0 620.8															263.0
									263.2 620.6															263.2
									263.4 620.4															263.4
									263.6 620.2															263.6
									263.8 620.0															263.8
									264.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss (Gain/Loss)				264.0 / 619.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 264.00: felsic phenocrysts up to 20 mm				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	264.2
			0 % Loss				264.2 / 619.6															264.27: Point Load >20KN – No Failure	264.4
							264.4 / 619.4															264.42: Point Load >20KN – No Failure	264.6
							264.6 / 619.2																264.8
							264.8 / 619.0																265.0
							265.0 / 618.8																265.2
							265.2 / 618.6																265.4
							265.4 / 618.4																265.6
							265.6 / 618.2																265.8
							265.8 / 618.0																
							266.0																

264.20

R103 2.97m (100%) 100%

Observations and Comments

Notes
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R103 2.97m (100%) 100%			266.0 617.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							266.2 617.6															266.2
							266.4 617.4															266.4
							266.6 617.2															266.6
							266.8 617.0															266.8
							267.0 616.8															267.0
			267.17				267.2 616.6				267.15-271.34: occasional mafic xenolith 20 to 40 mm											267.2
			0 % Loss	R104 2.95m (100%) 100%			267.4 616.4															267.4
							267.6 616.2															267.6
							267.8 616.0															267.8
							268.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			0 % Loss	R104 2.95m (100%) 100%				268.0 615.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000		269.23-269.25: VE, 5° Qz HE, PL, 20 mm		CARRAI GRANODIORITE	
									268.2 615.6																268.2
									268.4 615.4																268.4
									268.6 615.2																268.6
									268.8 615.0																268.8
									269.0 614.8																269.0
									269.2 614.6																269.2
									269.4 614.4																269.4
									269.6 614.2																269.6
									269.8 614.0																269.8
									270.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	270.12				270.0 613.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE 270.00: Point Load >20KN – No Failure	270.2
							270.2 613.6															270.4
							270.4 613.4															270.6
							270.6 613.2															270.8
		0 % Loss	R105 3.00m (100%) 100%				270.8 613.0															271.0
							271.0 612.8															271.2
							271.2 612.6															271.4
							271.4 612.4															271.6
							271.6 612.2															271.8
							271.8 612.0															
							272.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R105 3.00m (100%) 100%		273.00 m Is(50) d=3.76		272.0 611.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							272.2 611.6																272.2
							272.4 611.4																272.4
							272.6 611.2																272.6
							272.8 611.0																272.8
							273.0 610.8															273.00: Point Load >20KN – No Failure	273.0
		273.12					273.2 610.6																273.2
							273.4 610.4																273.4
		0 % Loss	R106 3.00m (100%) 100%				273.6 610.2				273.62-273.76: mafic xenolith up to 140 mm									273.65: JT, 88° HE, PL, RO			273.6
							273.8 610.0																273.8
							274.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									274.0 609.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									274.2 609.6															274.2
									274.4 609.4				274.44-281.01: occasional mafic xenolith 40 mm												274.4
									274.6 609.2															274.6
									274.8 609.0															274.8
HQ3				0 % Loss	R106 3.00m (100%) 100%				275.0 608.8															275.0
									275.2 608.6															275.2
									275.4 608.4															275.4
																						275.52: JT, 85° HE, PL, RO		
									275.6 608.2															275.6
									275.8 608.0															275.8
									276.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				276.0 / 607.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE 276.00: Point Load >20KN – No Failure	276.2 276.4 276.6 276.8 277.0 277.2 277.4 277.6 277.8
			0 % Loss				276.2 / 607.6																
							276.4 / 607.4																
							276.6 / 607.2																
							276.8 / 607.0																
							277.0 / 606.8																
							277.2 / 606.6																
							277.4 / 606.4																
							277.6 / 606.2																
							277.8 / 606.0																
			276.12				278.0																
			R107 3.01m (100%) 100%																				

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R107 3.01m (100%) 100%				278.0 / 605.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							278.2 / 605.6																278.2
							278.4 / 605.4																278.4
							278.6 / 605.2																278.6
							278.8 / 605.0																278.8
							279.0 / 604.8																279.0
		279.13					279.2 / 604.6																279.2
		0 % Loss	R108 2.97m (100%) 100%				279.4 / 604.4																279.4
							279.6 / 604.2																279.6
							279.8 / 604.0																279.8
							280.0																

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R108 2.97m (100%) 100%				280.0 603.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 280.00: felsic phenocrysts up to 10 mm				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									280.2 603.6															280.2
									280.4 603.4															280.4
									280.6 603.2															280.6
									280.8 603.0				280.90: mafic xenolith 200 mm											280.8
									281.0 602.8															281.0
									281.2 602.6															281.2
									281.4 602.4															281.4
									281.6 602.2															281.6
									281.8 602.0															281.8
									282.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				282.0 / 601.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE 282.00: Point Load >20KN – No Failure	
							282.2 / 601.6																282.2
							282.4 / 601.4																282.4
							282.6 / 601.2																282.6
							282.8 / 601.0																282.8
							283.0 / 600.8																283.0
							283.2 / 600.6																283.2
							283.4 / 600.4																283.4
							283.6 / 600.2																283.6
							283.8 / 600.0																283.8
							284.0																

282.10
282.85
R109 0.75m (100%) 100%
R110 2.27m (100%) 100%

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Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project: Oven Mountain Pumped Hydro Energy Storage
Client: OMPS Pty Ltd
Site: Site 8
Job No: 30018018

East: 421495.500 m
North: 6591273.500 m
Elevation: 883.800 m
Datum: MGA94 Zone 56/AHD

Start Date: 11/10/2021
End Date: 11/10/2021

Contractor: Mulligan Geotechnical
Rig Type: Boart Longyear DB520
Mounting: track

Inclination: 90°
Azimuth: North
Survey:

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Testing: Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL 0.1, L 0.3, M 1, H 3, VH 10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R110 2.27m (100%) 100%			284.0 / 599.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							284.2 / 599.6																284.2
							284.4 / 599.4																284.4
							284.6 / 599.2																284.6
							284.8 / 599.0																284.8
							285.0 / 598.8															285.00: Point Load >20KN – No Failure	285.0
							285.2 / 598.6																285.2
							285.4 / 598.4																285.4
			0 % Loss	R111 3.04m (100%) 100%			285.6 / 598.2																285.6
							285.8 / 598.0																285.8
							286.0																

285.12

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		R111 3.04m (100%) 100%				286.0 597.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									286.2 597.6															286.2
									286.4 597.4															286.4
									286.6 597.2															286.6
									286.8 597.0															286.8
									287.0 596.8															287.0
									287.2 596.6				287.31: mafic xenolith 60 mm											287.2
									287.4 596.4															287.4
									287.6 596.2															287.6
									287.8 596.0															287.8
									288.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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SMEC 2.10.15 LIB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 12:03 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	288.16				288.0 / 595.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 288.00: Point Load >20KN – No Failure	288.2 288.4 288.6 288.8 289.0 289.2 289.4 289.6 289.8
							288.2 / 595.6															
							288.4 / 595.4															
							288.6 / 595.2															
							288.8 / 595.0															
		0 % Loss	R112.3,00m (100%) 100%				289.0 / 594.8															
							289.2 / 594.6															
							289.4 / 594.4													289.47: JT, 80° HE, PL, RO			
							289.6 / 594.2															
							289.8 / 594.0				289.75-290.52: quartz vein, irregular, 10-40 mm thick dipping at 80°			SA		H				289.48-290.03: Shear, 85° Ca HE, PL, RO			
							290.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R112 3.00m (100%) 100%			290.0 593.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*			SA *(cont)*	F *(cont)*	H *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							290.2 593.6													290.12: JT, 80° HE, PL, RO, Discontinuous.			290.2
							290.4 593.4																290.4
							290.6 593.2									VH				290.31-290.69: Shear, 80° Ca HE, PL			290.6
							290.8 593.0																290.8
							291.0 592.8																291.0
			291.16				291.2 592.6																291.2
			0 % Loss	R113 2.98m (100%) 100%			291.4 592.4																291.4
							291.6 592.2																291.6
							291.8 592.0																291.8
							292.0																

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				292.0 / 591.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							292.2 / 591.6																292.2
							292.4 / 591.4																292.4
							292.6 / 591.2																292.6
							292.8 / 591.0																292.8
							293.0 / 590.8																293.0
							293.2 / 590.6				293.16: mafic xenolith 100 mm												293.2
							293.4 / 590.4																293.4
							293.6 / 590.2																293.6
							293.8 / 590.0													293.86-293.88: VE, 10° Qz HE, PL, 20 mm			293.8
							294.0																

R113 2.98m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	294.14				294.0 / 589.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000		294.57-294.60: VE, 15° Qz HE, UN, 30 mm		CARRAI GRANODIORITE 294.00: Point Load >20KN – No Failure	
		0 % Loss	R114 3.00m (100%) 100%				294.2 / 589.6																294.2
							294.4 / 589.4																294.4
							294.6 / 589.2																294.6
							294.8 / 589.0																294.8
							295.0 / 588.8																295.0
							295.2 / 588.6																295.2
							295.4 / 588.4																295.4
							295.6 / 588.2																295.6
							295.8 / 588.0																295.8
							296.0																

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R114 3.00m (100%) 100%				296.0 / 587.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							296.2 / 587.6																296.2
							296.4 / 587.4																296.4
							296.6 / 587.2																296.6
											296.70: becoming finer grained												
							296.8 / 587.0																296.8
							297.0 / 586.8															297.00: Point Load >20KN – No Failure	297.0
		297.14																					
		0 % Loss	R115 3.02m (100%) 100%				297.2 / 586.6				297.21-297.62: increasing mafic groundmass with felsic phenocrysts up to 20 mm												297.2
							297.4 / 586.4																297.4
							297.6 / 586.2																297.6
							297.8 / 586.0																297.8
							298.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									298.0 585.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									298.2 585.6															298.2
									298.4 585.4															298.4
									298.6 585.2															298.6
									298.8 585.0															298.8
HQ3				0 % Loss	R115 3.02m (100%) 100%				299.0 584.8													298.98: JT, 75° Ca HE, PL, RO 299.00: JT, 75° Ca HE, PL, RO, SA.			299.0
									299.2 584.6															299.2
																						299.33: JT, 75° Ca HE, PL, RO		
									299.4 584.4															299.4
									299.6 584.2															299.6
									299.8 584.0															299.8
									300.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Core Loss (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	300.16				300.0 583.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									300.2 583.6				300.16: increasing abundant of felsic phenocrysts up to 10 mm											300.2
									300.4 583.4															300.4
									300.6 583.2															300.6
									300.8 583.0															300.8
				0 % Loss	R116 2.99m (100%) 100%				301.0 582.8															301.0
									301.2 582.6															301.2
									301.4 582.4															301.4
									301.6 582.2				301.64: becoming finer grained											301.6
									301.8 582.0															301.8
									302.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R116 2.99m (100%) 100%				302.0 581.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	
							302.2 581.6				302.32: becoming coarser grained and porphyritic with felsic phenocrysts up to 15 mm												302.2
							302.4 581.4																302.4
							302.6 581.2																302.6
							302.8 581.0																302.8
							303.0 580.8															303.00: Point Load >20KN – No Failure	303.0
		303.15					303.2 580.6																303.2
		0 % Loss	R117 3.01m (100%) 100%				303.4 580.4																303.4
							303.6 580.2																303.6
							303.8 580.0																303.8
							304.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
									304.0 579.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									304.2 579.6															304.2
									304.4 579.4															304.4
									304.6 579.2															304.6
									304.8 579.0															304.8
HQ3				0 % Loss	R117 3.0 tm (100%) 100%				305.0 578.8															305.0
									305.2 578.6													305.19: JT, 70° Py HE, PL, RO, 1 mm			305.2
									305.4 578.4															305.4
									305.6 578.2															305.6
									305.8 578.0															305.8
									306.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	306.16				306.0 / 577.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE 306.00: Point Load >20KN – No Failure	306.2
							306.2 / 577.6															306.4
							306.4 / 577.4															306.6
							306.6 / 577.2															306.8
		0 % Loss	R118 2.69m (100%) 100%				306.8 / 577.0															307.0
							307.0 / 576.8															307.2
							307.2 / 576.6															307.4
							307.4 / 576.4															307.6
							307.6 / 576.2															307.8
							307.8 / 576.0															
							308.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
							308.0 575.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							308.2 575.6															308.2
							308.4 575.4															308.4
							308.6 575.2															308.6
							308.8 575.0				308.90: becoming finer grained and equigranular											308.8
HQ3			0 % Loss				309.0 574.8															309.0
							309.2 574.6															309.2
							309.4 574.4															309.4
			0 % Loss				309.6 574.2															309.6
							309.8 574.0															309.8
							310.0															

309.05

R118 2.89m (100%) 100%

R119 3.13m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR)	RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3			0 % Loss	R119 3.13m (100%) 100%					310.0 573.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
										310.2 573.6				310.27: becoming coarser grained and porphyritic with felsic phenocrysts up to 15 mm												310.2
										310.4 573.4																310.4
										310.6 573.2																310.6
										310.8 573.0																310.8
										311.0 572.8														311.00: Point Load >20KN – No Failure		311.0
										311.2 572.6																311.2
										311.4 572.4																311.4
										311.6 572.2																311.6
										311.8 572.0																311.8
										312.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				312.0 / 571.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
			0 % Loss				312.2 / 571.6																312.2
							312.4 / 571.4																312.4
							312.6 / 571.2																312.6
							312.8 / 571.0																312.8
							313.0 / 570.8																313.0
							313.2 / 570.6																313.2
							313.4 / 570.4																313.4
							313.6 / 570.2																313.6
							313.8 / 570.0																313.8
							314.0																

312.18

R120 2.99m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

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Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				314.0 / 569.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	
							314.2 / 569.6																314.2
							314.4 / 569.4																314.4
							314.6 / 569.2																314.6
							314.8 / 569.0																314.8
							315.0 / 568.8															315.00: Point Load >20KN – No Failure	315.0
							315.2 / 568.6																315.2
							315.4 / 568.4																315.4
							315.6 / 568.2																315.6
							315.8 / 568.0																315.8
							316.0																

315.17

R120 2.99m (100%) 100%

R121 3.01m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss	R121 3.01m (100%) 100%			316.0 / 567.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	316.2
							316.2 / 567.6																316.4
							316.4 / 567.4																316.6
							316.6 / 567.2																316.8
							316.8 / 567.0																317.0
							317.0 / 566.8																317.2
							317.2 / 566.6																317.4
							317.4 / 566.4																317.6
							317.6 / 566.2																317.8
							317.8 / 566.0																
							318.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				318.0 565.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE 318.00: Point Load >20KN – No Failure	
							318.2 565.6																318.2
							318.4 565.4																318.4
							318.6 565.2																318.6
							318.8 565.0																318.8
							319.0 564.8																319.0
							319.2 564.6																319.2
							319.4 564.4																319.4
							319.6 564.2																319.6
							319.8 564.0																319.8
							320.0																

318.18

0 % Loss

R122 2.98m (100%) 100%

0 % Loss

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R122 2.98m (100%) 100%				320.0 563.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*				320.66: JT, 80° Qz HE, PL, RO, 1 mm, SA.		CARRAI GRANODIORITE	320.2
							320.2 563.6																320.4
							320.4 563.4																320.6
							320.6 563.2																320.8
							320.8 563.0																321.0
							321.0 562.8															321.00: Point Load >20KN – No Failure	321.2
		321.16					321.2 562.6																321.4
		0 % Loss	R123 2.99m (100%) 100%				321.4 562.4																321.6
							321.6 562.2																321.8
							321.8 562.0																
							322.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss		R123 2.99m (100%) 100%				322.0 561.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									322.2 561.6															322.2
									322.4 561.4															322.4
									322.6 561.2															322.6
									322.8 561.0															322.8
									323.0 560.8															323.0
									323.2 560.6															323.2
									323.4 560.4				323.42: mafic xenolith 75 mm											323.4
									323.6 560.2															323.6
									323.8 560.0															323.8
									324.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3		0 % Loss	324.15 R124 2.96m (100%) 100%				324.0 559.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE 324.00: Point Load >20KN – No Failure	
			0 % Loss					324.2 559.6															324.2
								324.4 559.4															324.4
								324.6 559.2															324.6
								324.8 559.0															324.8
								325.0 558.8															325.0
								325.2 558.6															325.2
								325.4 558.4															325.4
								325.6 558.2															325.6
								325.8 558.0															325.8
								326.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				326.0 / 557.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							326.2 / 557.6																326.2
							326.4 / 557.4																326.4
							326.6 / 557.2																326.6
							326.8 / 557.0																326.8
							327.0 / 556.8																327.0
							327.2 / 556.6																327.2
							327.4 / 556.4																327.4
							327.6 / 556.2																327.6
							327.8 / 556.0																327.8
			0 % Loss				328.0																

327.11

R124 2.96m (100%) 100%

R125 3.05m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R125 3.05m (100%) 100%				328.0 555.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									328.2 555.6															328.2
									328.4 555.4															328.4
									328.6 555.2															328.6
									328.8 555.0															328.8
									329.0 554.8															329.0
									329.2 554.6															329.2
									329.4 554.4															329.4
									329.6 554.2															329.6
									329.8 554.0															329.8
									330.0															

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3		0 % Loss				330.0 553.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							330.2 553.6																330.2
							330.4 553.4																330.4
							330.6 553.2																330.6
							330.8 553.0																330.8
			0 % Loss				331.0 552.8																331.0
							331.2 552.6																331.2
							331.4 552.4																331.4
							331.6 552.2																331.6
							331.8 552.0																331.8
							332.0				331.90-332.18: fine grained equigranular felsic layering / intrusion											331.90: Point Load >20KN – No Failure	

330.16
R126 2.98m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

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Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		0 % Loss	R126 2.98m (100%) 100%				332.0 551.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							332.2 551.6													332.29-332.31: VE, 10° HE, PL, RO			332.2
							332.4 551.4																332.4
							332.6 551.2																332.6
							332.8 551.0																332.8
							333.0 550.8															333.00: Point Load >20KN – No Failure	333.0
		333.14					333.2 550.6													333.20: JT, 5° HE, PL, RO			333.2
		0 % Loss	R127 3.00m (100%) 100%				333.4 550.4																333.4
							333.6 550.2																333.6
							333.8 550.0																333.8
							334.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R127 3.00m (100%) 100%				334.0 549.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									334.2 549.6															334.2
									334.4 549.4															334.4
									334.6 549.2															334.6
									334.8 549.0															334.8
									335.0 548.8															335.0
									335.2 548.6															335.2
									335.4 548.4															335.4
									335.6 548.2															335.6
									335.8 548.0															335.8
									336.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3		0 % Loss	336.14				336.0 547.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 336.00: occasional felsic phenocrysts up to 50 mm				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
			10 % Loss	R128 1.05m (100%) 100%				336.2 547.6															336.2
								336.4 547.4															336.4
								336.6 547.2															336.6
								336.8 547.0															336.8
								337.0 546.8														337.00: Point Load >20KN – No Failure	337.0
				337.19				337.2 546.6															337.2
			10 % Loss	R129 2.00m (100%) 100%				337.4 546.4															337.4
								337.6 546.2															337.6
								337.8 546.0															337.8
								338.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R129 2.00m (100%) 100%				338.0 545.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							338.2 545.6																338.2
							338.4 545.4																338.4
							338.6 545.2																338.6
							338.8 545.0																338.8
							339.0 544.8															339.03: Point Load >20KN – No Failure	339.0
		339.19					339.2 544.6																339.2
		10 % Loss	R130 3.12m (100%) 100%				339.4 544.4																339.4
							339.6 544.2																339.6
							339.8 544.0																339.8
							340.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R130 3.12m (100%) 100%				340.0 543.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									340.2 543.6															340.2
									340.4 543.4				340.47: dark grey xenolith > 70 mm											340.4
									340.6 543.2															340.6
									340.8 543.0															340.8
									341.0 542.8															341.0
									341.2 542.6															341.2
									341.4 542.4															341.4
									341.6 542.2															341.6
									341.8 542.0															341.8
									342.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
	HQ3		10 % Loss	R130 3.12m (100%) 100%				342.0 541.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
								342.2 541.6																342.2
			342.31																					
								342.4 541.4																342.4
								342.6 541.2																342.6
								342.8 541.0															342.78: Point Load >20KN – No Failure	342.8
			10 % Loss	R131 2.86m (100%) 100%				343.0 540.8																343.0
								343.2 540.6				343.17: dark grey xenolith 60 mm												343.2
								343.4 540.4																343.4
								343.6 540.2																343.6
								343.8 540.0																343.8
								344.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				344.0 / 539.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							344.2 / 539.6																344.2
							344.4 / 539.4																344.4
							344.6 / 539.2																344.6
							344.8 / 539.0																344.8
							345.0 / 538.8													344.99: JT, 75° Qz HE, UN, 4 mm		345.00: Point Load >20KN – No Failure	345.0
							345.2 / 538.6																345.2
							345.4 / 538.4																345.4
							345.6 / 538.2													345.47-345.65: FT, 70° Qz HE			345.6
							345.8 / 538.0																345.8
							346.0																

345.17

R131 2.86m (100%) 100%

R132 2.95m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss	R132 2.95m (100%) 100%			346.0 537.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							346.2 537.6																346.2
							346.4 537.4																346.4
							346.6 537.2																346.6
							346.8 537.0																346.8
							347.0 536.8																347.0
							347.2 536.6																347.2
							347.4 536.4																347.4
							347.6 536.2																347.6
							347.8 536.0																347.8
							348.0																

Observations and Comments

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Geological & Engineering Log

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Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	348.12				348.0 / 535.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*				348.98: JT, 80° HE, UN, Trace pyrite.		CARRAI GRANODIORITE 348.00: Point Load >20KN – No Failure	
							348.2 / 535.6															348.2
							348.4 / 535.4															348.4
							348.6 / 535.2															348.6
							348.8 / 535.0															348.8
		10 % Loss	R133 3.04m (100%) 100%				349.0 / 534.8															349.0
							349.2 / 534.6				349.23-350.05: fine grained more felsic igneous intrusion / layering											349.2
							349.4 / 534.4															349.4
							349.6 / 534.2															349.6
							349.8 / 534.0															349.8
							350.0															

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R133 3.04m (100%) 100%				350.0 533.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							350.2 533.6																350.2
							350.4 533.4																350.4
							350.6 533.2				350.67-350.75: fine grained felsic igneous intrusion / layering												350.6
							350.8 533.0																350.8
							351.0 532.8															351.00: Point Load >20KN – No Failure	351.0
			351.16				351.2 532.6				351.19-351.26: fine grained felsic igneous intrusion / layering												351.2
							351.4 532.4				351.43-351.51: fine grained felsic igneous intrusion / layering												351.4
		10 % Loss	R134 3.03m (100%) 100%				351.6 532.2																351.6
							351.8 532.0																351.8
							352.0																

Observations and Comments

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
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Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				10 % Loss	R134 3.03m (100%) 100%				352.0 531.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									352.2 531.6															352.2
									352.4 531.4															352.4
									352.6 531.2															352.6
									352.8 531.0															352.8
									353.0 530.8															353.0
									353.2 530.6															353.2
									353.4 530.4															353.4
									353.6 530.2															353.6
									353.8 530.0															353.8
									354.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	354.19				354.0 / 529.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 354.00: Point Load >20KN – No Failure	
		10 % Loss	R135 3.13m (100%) 100%				354.2 / 529.6															354.2
							354.4 / 529.4															354.4
							354.6 / 529.2															354.6
							354.8 / 529.0															354.8
							355.0 / 528.8														355.00: Point Load >20KN – No Failure	355.0
							355.2 / 528.6															355.2
							355.4 / 528.4															355.4
							355.6 / 528.2															355.6
							355.8 / 528.0															355.8
							356.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R135 3.13m (100%) 100%				356.0 / 527.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							356.2 / 527.6																356.2
							356.4 / 527.4																356.4
							356.6 / 527.2																356.6
							356.8 / 527.0																356.8
							357.0 / 526.8															357.00: Point Load >20KN – No Failure	357.0
			357.32				357.2 / 526.6																357.2
							357.4 / 526.4																357.4
		10 % Loss	R136 2.87m (100%) 100%				357.6 / 526.2																357.6
							357.8 / 526.0																357.8
							358.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R136 2.87m (100%) 100%				358.0 525.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									358.2 525.6															358.2
									358.4 525.4															358.4
									358.6 525.2															358.6
									358.8 525.0															358.8
									359.0 524.8															359.0
									359.2 524.6															359.2
									359.4 524.4															359.4
									359.6 524.2															359.6
									359.8 524.0															359.8
									360.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	360.19				360.0 / 523.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
		10 % Loss	R137 3.07m (100%) 100%				360.2 / 523.6																360.2
							360.4 / 523.4																360.4
							360.6 / 523.2																360.6
							360.8 / 523.0																360.8
							361.0 / 522.8				361.04-361.11: fine grained												361.0
							361.2 / 522.6																361.2
							361.4 / 522.4																361.4
							361.6 / 522.2				361.64-361.75: fine grained												361.6
							361.8 / 522.0																361.8
							362.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		10 % Loss	R137 3.07m (100%) 100%				362.0 521.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1 L –0.3 M –1 H –3 VH –10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							362.2 521.6																362.2
							362.4 521.4																362.4
							362.6 521.2																362.6
							362.8 521.0																362.8
							363.0 520.8															363.00: Point Load >20KN – No Failure	363.0
			363.26				363.2 520.6																363.2
							363.4 520.4																363.4
		10 % Loss	R138 2.91m (100%) 100%				363.6 520.2																363.6
							363.8 520.0																363.8
							364.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R138 2.91m (100%) 100%				364.0 519.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									364.2 519.6															364.2
									364.4 519.4															364.4
									364.6 519.2															364.6
									364.8 519.0															364.8
									365.0 518.8															365.0
									365.2 518.6															365.2
									365.4 518.4															365.4
									365.6 518.2															365.6
									365.8 518.0															365.8
									366.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				366.0 / 517.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE 366.00: Point Load >20KN – No Failure	
			366.17				366.2 / 517.6																366.2
							366.4 / 517.4																366.4
							366.6 / 517.2																366.6
							366.8 / 517.0																366.8
			10 % Loss				367.0 / 516.8																367.0
			R139 2.99m (100%) 100%				367.2 / 516.6																367.2
							367.4 / 516.4																367.4
							367.6 / 516.2																367.6
							367.8 / 516.0																367.8
							368.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				368.0 515.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							368.2 515.6																368.2
							368.4 515.4																368.4
							368.6 515.2																368.6
							368.8 515.0																368.8
							369.0 514.8															369.00: Point Load >20KN – No Failure	369.0
							369.2 514.6																369.2
							369.4 514.4															369.35: Point Load >20KN – No Failure	369.4
							369.6 514.2																369.6
							369.8 514.0																369.8
							370.0																

369.16

R139 2.99m (100%) 100%

10 % Loss

R140 3.04m (100%) 100%

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		R140 3.04m (100%) 100%				370.0 513.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									370.2 513.6															370.2
									370.4 513.4				370.39-371.23: fine to medium grained											370.4
									370.6 513.2															370.6
									370.8 513.0															370.8
									371.0 512.8															371.0
									371.2 512.6															371.2
									371.4 512.4															371.4
									371.6 512.2															371.6
									371.8 512.0															371.8
									372.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss		Run (TCR) RQD: 372.20		372.0 / 511.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 372.00-376.00: staining due to core stuck in barrel for 2 months	372.2
			10 % Loss				372.2 / 511.6															372.4
							372.4 / 511.4															372.6
							372.6 / 511.2															372.8
							372.8 / 511.0															373.0
							373.0 / 510.8															373.2
							373.2 / 510.6															373.4
							373.4 / 510.4															373.6
							373.6 / 510.2															373.8
							373.8 / 510.0															
							374.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			10 % Loss				374.0 509.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							374.2 509.6															374.2
							374.4 509.4															374.4
							374.6 509.2															374.6
							374.8 509.0															374.8
							375.0 508.8															375.0
			375.21				375.2 508.6															375.2
							375.4 508.4															375.4
			50 % Loss				375.6 508.2															375.6
							375.8 508.0															375.8
							376.0															

R141 2.96m (100%) 100%

Observations and Comments

Notes

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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			50 % Loss				376.0 / 507.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							376.2 / 507.6															376.2
							376.4 / 507.4															376.4
							376.6 / 507.2															376.6
							376.8 / 507.0															376.8
							377.0 / 506.8															377.0
							377.2 / 506.6															377.2
							377.4 / 506.4															377.4
							377.6 / 506.2															377.6
							377.8 / 506.0															377.8
							378.0															

R141 2.96m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		50 % Loss	378.17				378.0 505.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 378.00: Point Load >20KN – No Failure	
		50 % Loss	R142 3.00m (100%) 100%				378.2 505.6															378.2
							378.4 505.4															378.4
							378.6 505.2															378.6
							378.8 505.0															378.8
							379.0 504.8															379.0
							379.2 504.6															379.2
							379.4 504.4															379.4
							379.6 504.2															379.6
							379.8 504.0															379.8
							380.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			50 % Loss				380.0 / 503.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							380.2 / 503.6																380.2
							380.4 / 503.4																380.4
							380.6 / 503.2																380.6
							380.8 / 503.0																380.8
							381.0 / 502.8															381.00: Point Load >20KN – No Failure	381.0
			381.17				381.2 / 502.6																381.2
							381.4 / 502.4																381.4
			50 % Loss				381.6 / 502.2																381.6
							381.8 / 502.0																381.8
							382.0																

R142 3.00m (100%) 100%

R143 3.00m (100%) 100%

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			50 % Loss				382.0 501.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							382.2 501.6																382.2
							382.4 501.4																382.4
							382.6 501.2																382.6
							382.8 501.0																382.8
							383.0 500.8																383.0
							383.2 500.6																383.2
							383.4 500.4																383.4
							383.6 500.2																383.6
							383.8 500.0																383.8
							384.0																

R143 3.00m (100%) 100%

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			50 % Loss	384.17				384.0 499.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE 384.00: Point Load >20KN – No Failure	
			50 % Loss	R144 2.98m (100%) 100%				384.2 499.6															384.2
								384.4 499.4															384.4
								384.6 499.2															384.6
								384.8 499.0															384.8
								385.0 498.8															385.0
								385.2 498.6															385.2
								385.4 498.4															385.4
								385.6 498.2															385.6
								385.8 498.0															385.8
								386.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		50 % Loss	R144 2.98m (100%) 100%				386.0 497.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							386.2 497.6															386.2
							386.4 497.4															386.4
							386.6 497.2															386.6
							386.8 497.0															386.8
							387.0 496.8															387.0
		387.15					387.2 496.6															387.2
		90 % Loss	R145 2.87m (100%) 100%				387.4 496.4															387.4
							387.6 496.2															387.6
							387.8 496.0															387.8
							388.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial, ○ Diametral) VL -0.1, L -0.3, M -1, H -3, VH -10, EH	Defect Spacing (mm) 20, 60, 200, 600, 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			90 % Loss				388.0 495.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							388.2 495.6															388.2
							388.4 495.4															388.4
							388.6 495.2															388.6
							388.8 495.0															388.8
							389.0 494.8														389.00: Point Load >20KN – No Failure	389.0
							389.2 494.6															389.2
							389.4 494.4															389.4
							389.6 494.2															389.6
							389.8 494.0															389.8
							390.0															

R145 2.87m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
								390.0 493.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
		HQ3		390.92 0 % Loss R146 1.27m (100%) 100%				390.2 493.6			390.2												390.2
								390.4 493.4			390.4												390.4
								390.6 493.2			390.6												390.6
								390.8 493.0			390.8												390.8
								391.0 492.8			391.0												391.0
				391.29				391.2 492.6			391.2												391.2
				0 % Loss R147 1.91m (100%) 100%				391.4 492.4			391.4												391.4
								391.6 492.2			391.6												391.6
								391.8 492.0			391.8												391.8
								392.0															

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			0 % Loss				392.0 / 491.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							392.2 / 491.6																392.2
							392.4 / 491.4																392.4
							392.6 / 491.2																392.6
							392.8 / 491.0																392.8
							393.0 / 490.8																393.0
			393.20				393.2 / 490.6																393.2
							393.4 / 490.4																393.4
			0 % Loss				393.6 / 490.2																393.6
							393.8 / 490.0																393.8
							394.0																

R147 1.91m (100%) 100%

R148 0.98m (100%) 100%

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Loss	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				0 % Loss	R149 1.52m (100%) 100%				394.0 489.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									394.2 489.6															394.2
									394.4 489.4															394.4
									394.6 489.2															394.6
									394.8 489.0															394.8
									395.0 488.8															395.0
									395.2 488.6															395.2
									395.4 488.4															395.4
									395.6 488.2															395.6
				394.18																				
				100 % Loss	R150 3.12m (100%) 100%				395.8 488.0															395.8
				395.70					396.0															

Observations and Comments

Notes
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss				396.0 487.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							396.2 487.6				396.22-396.27: orange to brown staining				SW							
															F							
							396.4 487.4															
							396.6 487.2															
							396.8 487.0															
							397.0 486.8															
							397.2 486.6															
							397.4 486.4															
							397.6 486.2															
							397.8 486.0															
							398.0															

R150 3.12m (100%) 100%

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			100 % Loss	R150 3.12m (100%) 100%			398.0 / 485.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							398.2 / 485.6																398.2
							398.4 / 485.4																398.4
							398.6 / 485.2																398.6
			398.82				398.8 / 485.0																398.8
			75 % Loss	R151 1.84m (100%) 100%			399.0 / 484.8																399.0
							399.2 / 484.6																399.2
							399.4 / 484.4																399.4
							399.6 / 484.2																399.6
							399.8 / 484.0																399.8
							400.0																

Observations and Comments

Notes

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			75 % Loss				400.0 483.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	
							400.2 483.6																400.2
							400.4 483.4																400.4
							400.6 483.2																400.6
							400.8 483.0																400.8
							401.0 482.8																401.0
							401.2 482.6																401.2
							401.4 482.4																401.4
							401.6 482.2																401.6
							401.8 482.0																401.8
							402.0																

75 % Loss — 400.66

R151 1.84m (100%) 100%

R152 1.63m (100%) 100%

Observations and Comments

Notes

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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°
Azimuth	
North	
Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			75 % Loss				402.0 481.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							402.2 481.6															402.2
							402.4 481.4															402.4
							402.6 481.2															402.6
							402.8 481.0															402.8
							403.0 480.8															403.0
							403.2 480.6															403.2
							403.4 480.4															403.4
							403.6 480.2															403.6
							403.8 480.0															403.8
							404.0															

75 % Loss — R152 1.63m (100%) 100% — 402.29
75 % Loss — R153 1.04m (100%) 100% — 403.33
50 % Loss — R154 1.95m (100%) 100%

Observations and Comments

Notes
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			50 % Loss				404.0 / 479.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000		404.34: JT, 60° HE, UN		CARRAI GRANODIORITE	
							404.2 / 479.6																404.2
							404.4 / 479.4																404.4
							404.6 / 479.2																404.6
							404.8 / 479.0																404.8
							405.0 / 478.8																405.0
							405.2 / 478.6																405.2
							405.4 / 478.4																405.4
							405.6 / 478.2																405.6
							405.8 / 478.0																405.8
			25 % Loss				406.0																

405.28

R154 1.95m (100%) 100%

R155 2.99m (100%) 100%

Observations and Comments

Notes

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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			25 % Loss				406.0 / 477.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							406.2 / 477.6															406.2
							406.4 / 477.4															406.4
							406.6 / 477.2															406.6
							406.8 / 477.0															406.8
							407.0 / 476.8															407.0
							407.2 / 476.6															407.2
							407.4 / 476.4															407.4
							407.6 / 476.2															407.6
							407.8 / 476.0															407.8
							408.0															

R155 2.99m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			25 % Loss				408.0 / 475.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 – L 0.3 – M 1 – H 3 – VH 10 – EH	20 – 60 – 200 – 600 – 2000				CARRAI GRANODIORITE	
							408.2 / 475.6																408.2
			25 % Loss		R155 2.99m (100%) 100%		408.27																
							408.4 / 475.4																408.4
							408.6 / 475.2																408.6
							408.8 / 475.0																408.8
							409.0 / 474.8																409.0
			25 % Loss		R156 2.97m (100%) 100%		409.2 / 474.6																409.2
							409.4 / 474.4																409.4
							409.6 / 474.2																409.6
							409.8 / 474.0																409.8
							410.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			25 % Loss	R156 2.97m (100%) 100%			410.0 / 473.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	410.2
							410.2 / 473.6																410.4
							410.4 / 473.4																410.6
							410.6 / 473.2																410.8
							410.8 / 473.0																411.0
							411.0 / 472.8																411.2
							411.2 / 472.6																411.4
			25 % Loss	R157 2.99m (100%) 100%			411.4 / 472.4																411.6
							411.6 / 472.2																411.8
							411.8 / 472.0																
							412.0																

411.24

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			25 % Loss				412.0 / 471.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL 0.1 L 0.3 M 1 H 3 VH 10 EH	20 60 200 600 2000				CARRAI GRANODIORITE	412.2
							412.2 / 471.6																412.4
							412.4 / 471.4																412.6
							412.6 / 471.2																412.8
							412.8 / 471.0																413.0
							413.0 / 470.8																413.2
							413.2 / 470.6																413.4
							413.4 / 470.4																413.6
							413.6 / 470.2																413.8
							413.8 / 470.0																
							414.0																

R157 2.99m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		25 % Loss	R158 3.06m (100%) 100%				414.0 / 469.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
		25 % Loss					414.23															
							414.2 / 469.6															414.2
							414.4 / 469.4															414.4
							414.6 / 469.2															414.6
							414.8 / 469.0															414.8
							415.0 / 468.8															415.0
							415.2 / 468.6															415.2
							415.4 / 468.4															415.4
							415.6 / 468.2															415.6
							415.8 / 468.0															415.8
							416.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			25 % Loss	R158 3.06m (100%) 100% Run (TCR) RQD			416.0 / 467.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	
							416.2 / 467.6																416.2
							416.4 / 467.4																416.4
							416.6 / 467.2																416.6
							416.8 / 467.0																416.8
							417.0 / 466.8																417.0
							417.2 / 466.6																417.2
			417.29																				
							417.4 / 466.4																417.4
			60 % Loss	R159 3.00m (100%) 100%			417.6 / 466.2																417.6
							417.8 / 466.0				417.90-419.15: fine grained												417.8
							418.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss				418.0 / 465.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							418.2 / 465.6																418.2
							418.4 / 465.4																418.4
							418.6 / 465.2																418.6
							418.8 / 465.0																418.8
							419.0 / 464.8																419.0
							419.2 / 464.6																419.2
							419.4 / 464.4																419.4
							419.6 / 464.2																419.6
							419.8 / 464.0																419.8
							420.0																

R159 3.00m (100%) 100%

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss				420.0 463.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)* 420.00: extremely weathered inclusion 20 mm, water loss increased from 25 to 60%				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							420.2 463.6															420.2
							420.4 463.4															420.4
							420.6 463.2															420.6
							420.8 463.0															420.8
							421.0 462.8															421.0
							421.2 462.6															421.2
							421.4 462.4															421.4
							421.6 462.2															421.6
							421.8 462.0															421.8
							422.0															

60 % Loss — 420.29

R159 3.00m (100%) 100%

R160 3.00m (100%) 100%

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Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength (Point Load Is(50) ● Axial ○ Diametral)	Defect Spacing (mm)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R160 3.00m (100%) 100% RQD			422.0 / 461.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*	VL –0.1, L –0.3, M –1, H –3, VH –10, EH	20, 60, 200, 600, 2000				CARRAI GRANODIORITE	
							422.2 / 461.6																422.2
							422.4 / 461.4																422.4
							422.6 / 461.2																422.6
							422.8 / 461.0																422.8
							423.0 / 460.8																423.0
							423.2 / 460.6																423.2
			60 % Loss	R161 3.00m (100%) 100%			423.29																
							423.4 / 460.4																423.4
							423.6 / 460.2																423.6
							423.8 / 460.0																423.8
							424.0																

Observations and Comments

Notes
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	(Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3				60 % Loss	R161 3.00m (100%) 100%				424.0 459.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
									424.2 459.6															424.2
									424.4 459.4															424.4
									424.6 459.2															424.6
									424.8 459.0															424.8
									425.0 458.8															425.0
									425.2 458.6															425.2
									425.4 458.4															425.4
									425.6 458.2															425.6
									425.8 458.0															425.8
									426.0															

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R161 3.00m (100%) 100%			426.0 / 457.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							426.2 / 457.6																426.2
				426.29																			
							426.4 / 457.4																426.4
			60 % Loss	R162 3.00m (100%) 100%			426.6 / 457.2																426.6
							426.8 / 457.0																426.8
							427.0 / 456.8																427.0
							427.2 / 456.6																427.2
							427.4 / 456.4																427.4
							427.6 / 456.2																427.6
							427.8 / 456.0																427.8
							428.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) (● Axial ○ Diametral) VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) 20 60 200 600 2000	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R162 3.00m (100%) 100%			428.0 455.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							428.2 455.6															428.2
							428.4 455.4															428.4
							428.6 455.2															428.6
							428.8 455.0															428.8
							429.0 454.8															429.0
							429.2 454.6															429.2
			429.29																			
							429.4 454.4															429.4
			60 % Loss	R163 3.00m (100%) 100%			429.6 454.2															429.6
							429.8 454.0															429.8
							430.0															

Observations and Comments

Notes
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For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R163 3.00m (100%) 100%			430.0 453.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							430.2 453.6																430.2
							430.4 453.4																430.4
							430.6 453.2																430.6
							430.8 453.0																430.8
							431.0 452.8																431.0
							431.2 452.6																431.2
							431.4 452.4																431.4
							431.6 452.2																431.6
							431.8 452.0																431.8
							432.0																

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss				432.0 / 451.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							432.2 / 451.6															432.2
			R163 3.00m (100%) 100%				432.29															
							432.4 / 451.4															432.4
							432.6 / 451.2															432.6
							432.8 / 451.0															432.8
			60 % Loss				433.0 / 450.8															433.0
			R164 3.00m (100%) 100%				433.2 / 450.6															433.2
							433.4 / 450.4															433.4
							433.6 / 450.2															433.6
							433.8 / 450.0															433.8
							434.0															

Observations and Comments

Notes
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Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R164 3.00m (100%) 100%			434.0 / 449.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*					CARRAI GRANODIORITE	
							434.2 / 449.6															434.2
							434.4 / 449.4															434.4
							434.6 / 449.2															434.6
							434.8 / 449.0															434.8
							435.0 / 448.8															435.0
							435.2 / 448.6															435.2
			435.29																			
							435.4 / 448.4															435.4
			60 % Loss	R165 3.00m (100%) 100%			435.6 / 448.2															435.6
							435.8 / 448.0															435.8
							436.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

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Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R165 3.00m (100%) 100%			436.0 / 447.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							436.2 / 447.6																436.2
							436.4 / 447.4																436.4
							436.6 / 447.2																436.6
							436.8 / 447.0																436.8
							437.0 / 446.8																437.0
							437.2 / 446.6																437.2
							437.4 / 446.4																437.4
							437.6 / 446.2																437.6
							437.8 / 446.0																437.8
							438.0																

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R165 3.00m (100%) 100%				438.0 / 445.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
								438.2 / 445.6															438.2
				438.29																			
			60 % Loss	R166 3.00m (100%) 100%				438.4 / 445.4															438.4
								438.6 / 445.2															438.6
								438.8 / 445.0															438.8
								439.0 / 444.8															439.0
								439.2 / 444.6															439.2
								439.4 / 444.4															439.4
								439.6 / 444.2															439.6
								439.8 / 444.0															439.8
								440.0															

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R166 3.00m (100%) 100%			440.0 / 443.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							440.2 / 443.6																440.2
							440.4 / 443.4																440.4
							440.6 / 443.2																440.6
							440.8 / 443.0																440.8
							441.0 / 442.8																441.0
							441.2 / 442.6																441.2
							441.4 / 442.4																441.4
			60 % Loss	R167 3.02m (100%) 100%			441.6 / 442.2																441.6
							441.8 / 442.0																441.8
							442.0																

441.29

Observations and Comments

Notes
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Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical	Inclination	90°
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520	Azimuth	
Site	Site 8	Elevation	883.800 m			Mounting	track	North	
Job No	30018018	Datum	MGA94 Zone 56/AHD					Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **BH4B**

Method	Support	Casing	Water	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3			60 % Loss	R167 3.02m (100%) 100%			442.0 / 441.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							442.2 / 441.6																442.2
							442.4 / 441.4																442.4
							442.6 / 441.2																442.6
							442.8 / 441.0																442.8
							443.0 / 440.8																443.0
							443.2 / 440.6																443.2
							443.4 / 440.4																443.4
							443.6 / 440.2																443.6
							443.8 / 440.0																443.8
							444.0																

Observations and Comments

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

Logged By	EM/LJ	Date	11/10/2021
Approved By	NP	Date	05/08/2022
Status	3	Page	222 of 223

SMEC 2.10.15 LIB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 12:09 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Geological & Engineering Log

Project	Oven Mountain Pumped Hydro Energy Storage	East	421495.500 m	Start Date	11/10/2021	Contractor	Mulligan Geotechnical
Client	OMPS Pty Ltd	North	6591273.500 m	End Date	11/10/2021	Rig Type	Boart Longyear DB520
Site	Site 8	Elevation	883.800 m			Mounting	track
Job No	30018018	Datum	MGA94 Zone 56/AHD				

Inclination	90°	SMEC	Member of the Surbana Jurong Group
Azimuth	North	Borehole Identifier:	**BH4B**
Survey			

Method	Support Casing	Water (Gain/Loss)	Run (TCR) RQD	Sampling	Testing: Strength SPT, DCP, Is(50) (MPa), PP (UCS kPa), SV (kPa)	Testing: Permeability, Level & Inflow	Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Inferred Rock Strength: Point Load Is(50) ● Axial ○ Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Fabric, Structure & Defect Description	Group Defects	Origin, Stratigraphic Unit & General Observations	Installation
HQ3		60 % Loss	R167 3.02m (100%) 100%				444.0 439.8				GRANODIORITE: pale grey to dark grey, fine to coarse grained, crystalline, massive, equiangular to porphyritic, igneous layering. *(continued)*				F *(cont)*	VH *(cont)*						CARRAI GRANODIORITE	
							444.2 439.6			444.31												444.2
			444.31							439.49	Hole Terminated at 444.31 m											
							444.4 439.4															444.4
							444.6 439.2															444.6
							444.8 439.0															444.8
							445.0 438.8															445.0
							445.2 438.6															445.2
							445.4 438.4															445.4
							445.6 438.2															445.6
							445.8 438.0															445.8
							446.0															

Observations and Comments

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

Logged By	EM/LJ	Date	11/10/2021
Approved By	NP	Date	05/08/2022
Status	3	Page	223 of 223

SMEC 2.10.15 LIB.GLB Log _SMEC HYBRID BOREHOLE LANDSCAPE SMEC GEO SYD 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 05/08/2022 12:09 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 0.00 - 4.00 m



PointID : BH4B Depth Range: 4.00 - 8.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 1/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 8.00 - 12.00 m



PointID : BH4B Depth Range: 12.00 - 16.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 2/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 16.00 - 20.00 m



PointID : BH4B Depth Range: 20.00 - 24.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 3/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 24.00 - 28.00 m



PointID : BH4B Depth Range: 28.00 - 32.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 4/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 32.00 - 36.00 m



PointID : BH4B Depth Range: 36.00 - 40.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 5/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 40.00 - 44.00 m



PointID : BH4B Depth Range: 44.00 - 48.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 6/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 48.00 - 52.00 m



PointID : BH4B Depth Range: 52.00 - 56.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 7/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 56.00 - 60.00 m



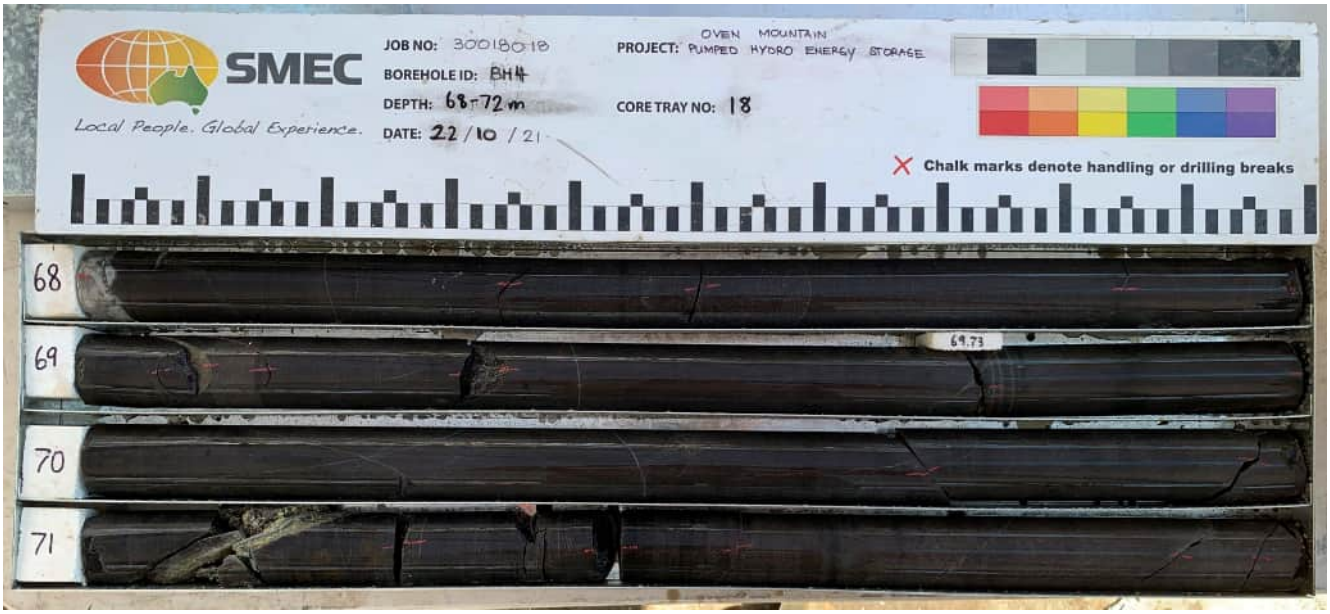
PointID : BH4B Depth Range: 60.00 - 64.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 8/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:12 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 64.00 - 68.00 m



PointID : BH4B Depth Range: 68.00 - 72.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 9/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 72.00 - 76.00 m



PointID : BH4B Depth Range: 76.00 - 80.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 10/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 80.00 - 84.00 m



PointID : BH4B Depth Range: 84.00 - 88.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 11/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 88.00 - 92.00 m



PointID : BH4B Depth Range: 92.00 - 96.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 12/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 96.00 - 100.00 m



PointID : BH4B Depth Range: 100.00 - 104.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 13/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 104.00 - 108.00 m



PointID : BH4B Depth Range: 108.00 - 112.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 14/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 112.00 - 116.00 m



PointID : BH4B Depth Range: 116.00 - 120.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 15/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 120.00 - 124.00 m



PointID : BH4B Depth Range: 124.00 - 128.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 16/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 128.00 - 132.00 m



PointID : BH4B Depth Range: 132.00 - 136.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 17/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 136.00 - 140.00 m



PointID : BH4B Depth Range: 140.00 - 144.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 18/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 144.00 - 148.00 m



PointID : BH4B Depth Range: 148.00 - 152.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 19/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 152.00 - 156.00 m



PointID : BH4B Depth Range: 156.00 - 160.00 m

Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 20/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 160.00 - 164.00 m



PointID : BH4B Depth Range: 164.00 - 168.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 21/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 168.00 - 172.00 m



PointID : BH4B Depth Range: 172.00 - 176.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 22/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 176.00 - 180.00 m



PointID : BH4B Depth Range: 180.00 - 184.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 23/56

SMEC 2.10.13 LIB:GLB GrfxTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 184.00 - 188.00 m



PointID : BH4B Depth Range: 188.00 - 192.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 24/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 192.00 - 196.00 m



PointID : BH4B Depth Range: 196.00 - 200.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 25/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 200.00 - 204.00 m



PointID : BH4B Depth Range: 204.00 - 208.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 26/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 208.00 - 212.00 m



PointID : BH4B Depth Range: 212.00 - 216.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 27/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 216.00 - 220.00 m



PointID : BH4B Depth Range: 220.00 - 224.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 28/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 224.00 - 228.00 m



PointID : BH4B Depth Range: 228.00 - 232.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 29/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 232.00 - 236.00 m



PointID : BH4B Depth Range: 236.00 - 240.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 30/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:13 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 240.00 - 244.00 m



PointID : BH4B Depth Range: 244.00 - 248.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 31/56

SMEC 2.10.13 UB.GLB GrfxTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 248.00 - 252.00 m



PointID : BH4B Depth Range: 252.00 - 256.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 32/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 256.00 - 260.00 m



PointID : BH4B Depth Range: 260.00 - 264.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 33/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 264.00 - 268.00 m



PointID : BH4B Depth Range: 268.00 - 272.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 34/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 272.00 - 276.00 m



PointID : BH4B Depth Range: 276.00 - 280.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 35/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 280.00 - 284.00 m



PointID : BH4B Depth Range: 284.00 - 288.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 36/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 288.00 - 292.00 m



PointID : BH4B Depth Range: 292.00 - 296.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 37/56

SMEC 2.10.13 UB GLB GfxTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 296.00 - 300.00 m



PointID : BH4B Depth Range: 300.00 - 304.00 m

Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 38/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 304.00 - 308.00 m



PointID : BH4B Depth Range: 308.00 - 312.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 39/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 312.00 - 316.00 m



PointID : BH4B Depth Range: 316.00 - 320.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 40/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 320.00 - 324.00 m



PointID : BH4B Depth Range: 324.00 - 328.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 41/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 328.00 - 332.00 m



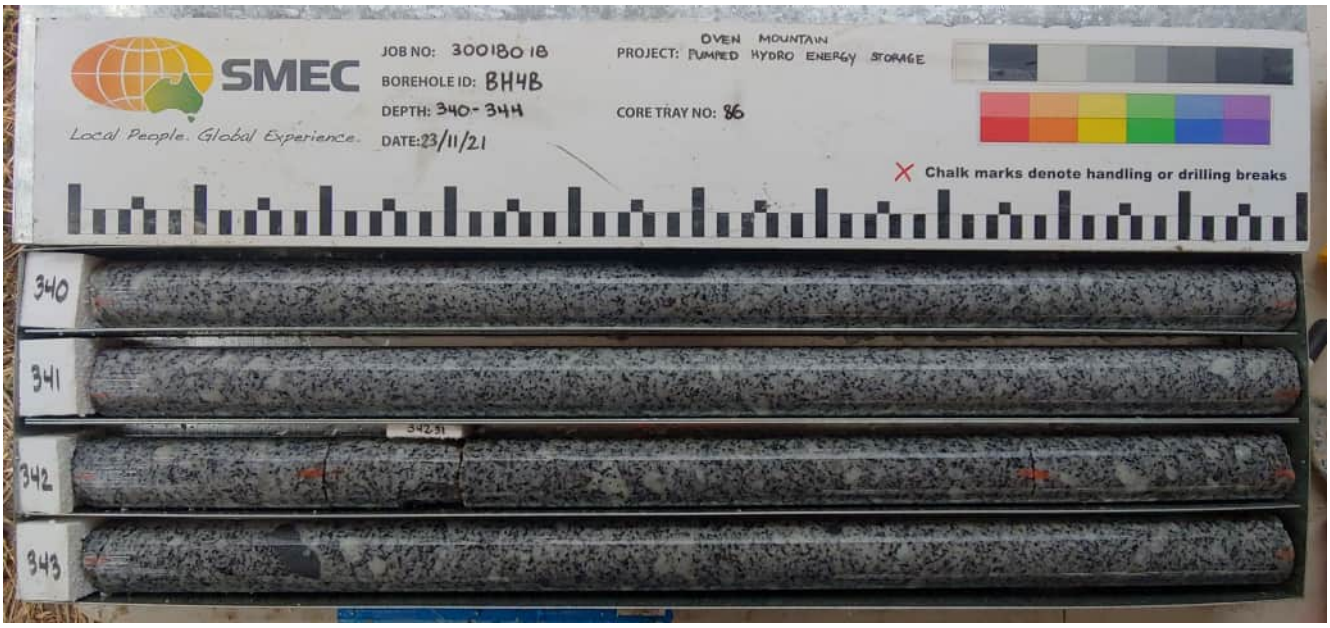
PointID : BH4B Depth Range: 332.00 - 336.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 42/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 336.00 - 340.00 m



PointID : BH4B Depth Range: 340.00 - 344.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 43/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 344.00 - 348.00 m



PointID : BH4B Depth Range: 348.00 - 352.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 44/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



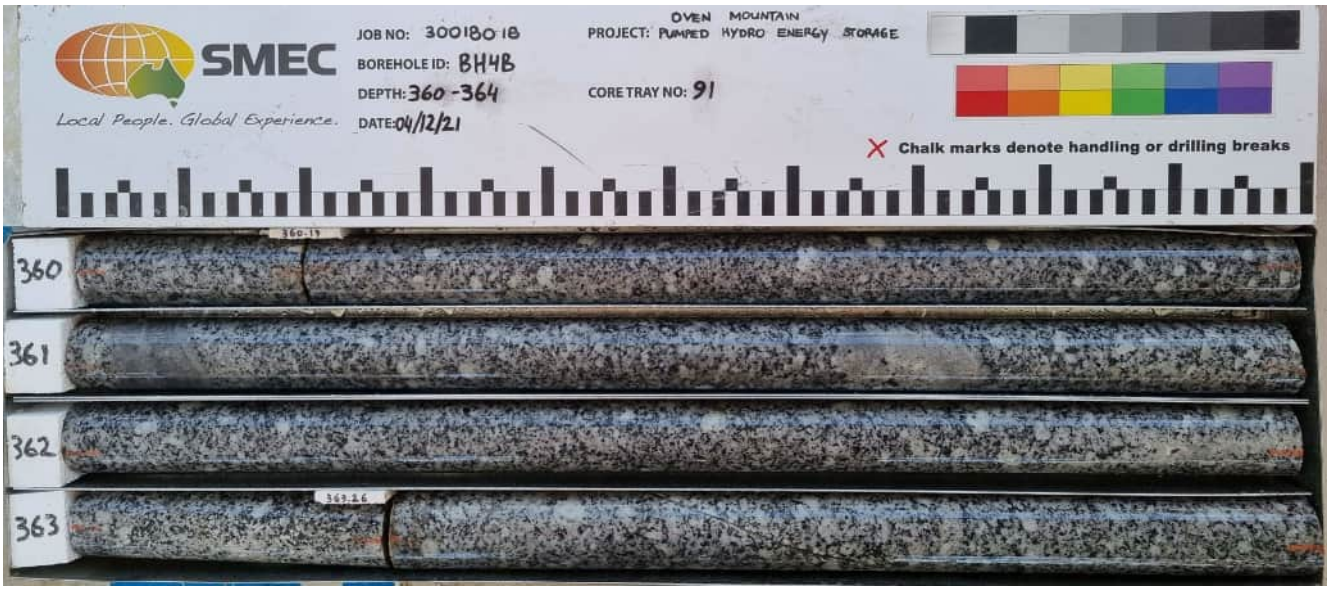
PointID : BH4B Depth Range: 352.00 - 356.00 m



PointID : BH4B Depth Range: 356.00 - 360.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 45/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 360.00 - 364.00 m



PointID : BH4B Depth Range: 364.00 - 368.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 46/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 368.00 - 372.00 m



PointID : BH4B Depth Range: 372.00 - 376.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 47/56

SMEC 2.10.13 LIB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 376.00 - 380.00 m



PointID : BH4B Depth Range: 380.00 - 384.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 48/56

SMEC 2.10.13 LIB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 384.00 - 388.00 m



PointID : BH4B Depth Range: 388.00 - 392.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 49/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 392.00 - 396.00 m



PointID : BH4B Depth Range: 396.00 - 400.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 50/56

SMEC 2.10.13 LIB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:15 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



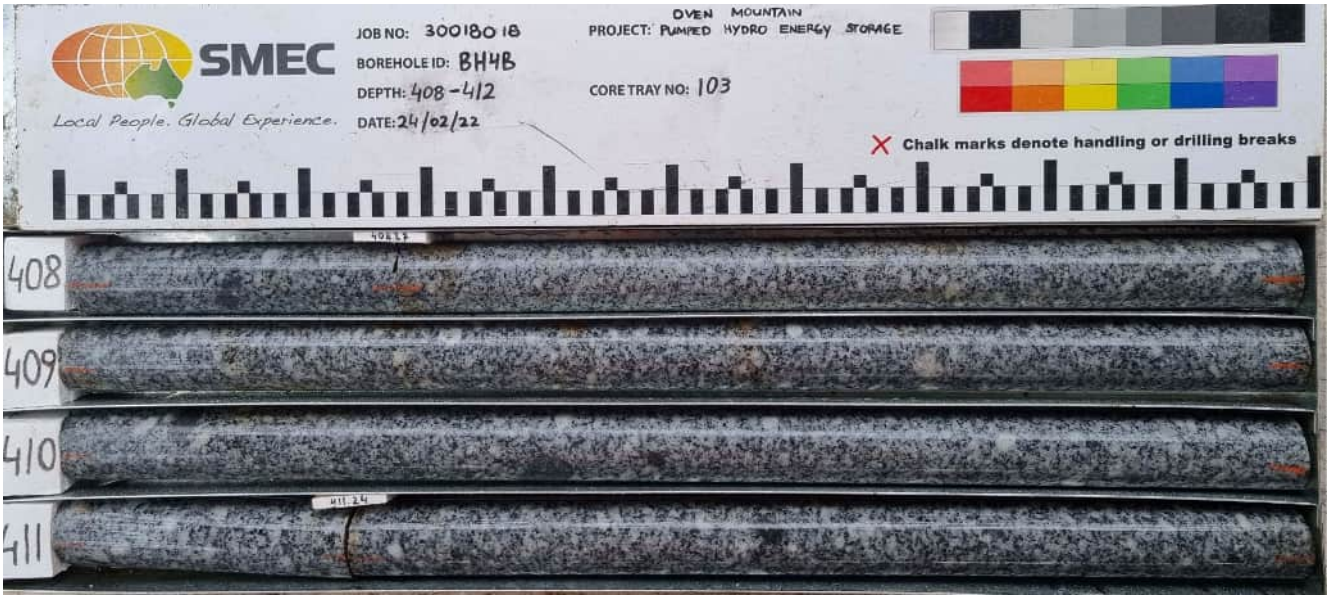
PointID : BH4B Depth Range: 400.00 - 404.00 m



PointID : BH4B Depth Range: 404.00 - 408.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 51/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:16 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 408.00 - 412.00 m



PointID : BH4B Depth Range: 412.00 - 416.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 52/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:16 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 416.00 - 420.00 m



PointID : BH4B Depth Range: 420.00 - 424.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 53/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:16 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 424.00 - 428.00 m



PointID : BH4B Depth Range: 428.00 - 432.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 54/56

SMEC 2.10.13 UB GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:16 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 432.00 - 436.00 m



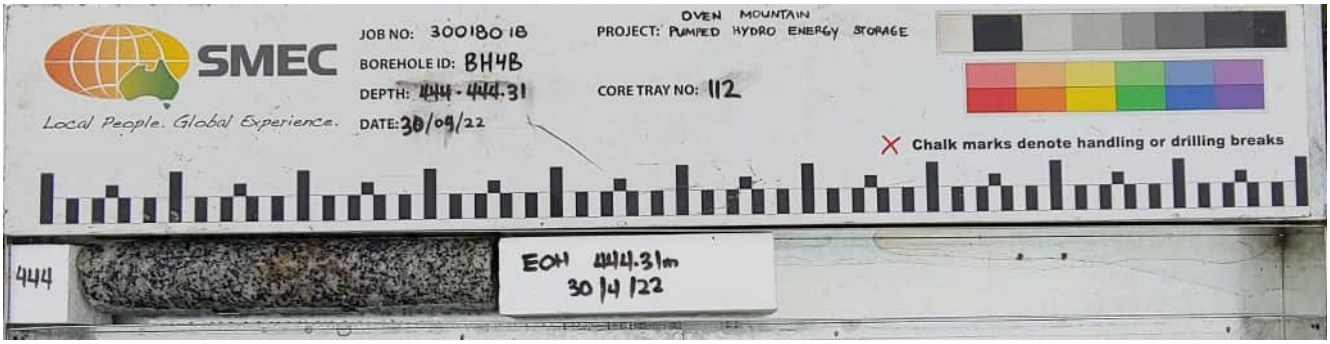
PointID : BH4B Depth Range: 436.00 - 440.00 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 55/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:16 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



PointID : BH4B Depth Range: 440.00 - 444.00 m



PointID : BH4B Depth Range: 444.00 - 444.31 m

SMEC Member of the Surbana Jurong Group	TITLE: OMPS Pty Ltd Oven Mountain Pumped Hydro Energy Storage Core Photo - BH4B	DRAWN: GDM	DATE: 10/05/2022
		CHECKED: LS	DATE: 10/05/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 56/56

SMEC 2.10.13 UB.GLB GrfcTbl DG PHOTO CORE PHOTO 2 PER PAGE A4P 30018018 OVEN MOUNTAIN.GPJ <<DrawingFile>> 10/05/2022 12:16 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Appendix C Point Load Strength Test Results

SMEC
Member of the Surbana Jurong Group

POINT LOAD TEST RESULTS

PROJECT #:	30018018	**TEST DATE:**	Various	**TEST MACHINE:**	26/09/1901
PROJECT:	OMPH	**SAMPLE DATE:**	XX	**LAST CALLIBRATION DATE:**	18/05/2021
LOCATION:	Carrai	**STORAGE HISTORY:**	Core box	**LOADING RATE:**	50kN
TESTING METHOD:	AS4133.4.1	**MOISTURE CONDITION:**	Moist		
TESTED BY:	EM, LJ, LS				
CHECKED BY:	XX				

Test #	Hole or Test Pit	Sample Top	Sample Bottom	Rock Type	Test Type	P Load (KN)	Failure Type	Orientation of Weakness / Failure Comment	L Length (mm)	D Distance (mm)	W Width (mm)	Shape Compliant ?	P Load (KN)	De^2 (mm)	De (mm)	Is (MPa)	Corr. Fact.	Is(50) (MPa)	Rock Strength (MPa) (Based on AS1726-2017 Table 19)
1	BH4B	1.90	2.00	Hornfels	D	2.45	D	Joint	50	61			2.45	3721	61	0.66	1.09	0.72	Medium
2	BH4B	1.95	2.00	Hornfels	A	2.10	D	Joint		55	61		2.10	4272	65	0.49	1.13	0.55	Medium
3	BH4B	2.50	2.58	Hornfels	D	20.93			50	61									
4	BH4B	3.00	3.10	Hornfels	D	8.59	S		50	61			8.59	3721	61	2.31	1.09	2.52	High
5	BH4B	3.05	3.10	Hornfels	A	10.96	S			48	61		10.96	3728	61	2.94	1.09	3.22	Very High
6	BH4B	4.40	4.49	Hornfels	D	20.60	S		50	61			20.60	3721	61	5.54	1.09	6.05	Very High
7	BH4B	5.50	5.61	Hornfels	D	9.74	D	Joint	50	61		YES	9.74	3721	61	2.62	1.09	2.86	High
8	BH4B	6.20	6.30	Quartz	D	1.74	D	Joint	50	61		YES	1.74	3721	61	0.47	1.09	0.51	Medium
9	BH4B	7.00	7.10	Hornfels	D	20.44	BB		50	61		YES	20.44	3721	61	5.49	1.09	6.01	Very High
10	BH4B	7.05	7.10	Hornfels	A	20.00				52	61								
11	BH4B	8.00	8.10	Hornfels	D	20.00			50	61									
12	BH4B	9.40	9.52	Hornfels	D	15.04	BB		50	61		YES	15.04	3721	61	4.04	1.09	4.42	Very High
13	BH4B	10.90	11.00	Hornfels	D	12.43	S		50	61		YES	12.43	3721	61	3.34	1.09	3.65	Very High
14	BH4B	10.94	11.00	Hornfels	A	17.40	S			38	61	YES	17.40	2951	54	5.90	1.04	6.12	Very High
15	BH4B	11.00	11.10	Hornfels	D	16.96	S		50	61		YES	16.96	3721	61	4.56	1.09	4.98	Very High
16	BH4B	11.06	11.10	Hornfels	A	20.00				43	61								
17	BH4B	12.00	12.10	Hornfels	D	20.00			50	61									
18	BH4B	12.04	12.10	Hornfels	A	20.00				58	61								
19	BH4B	13.00	13.10	Hornfels	D	22.00			50	61									
20	BH4B	13.00	13.10	Hornfels	A	9.42	BB			37	61	YES	9.42	2874	54	3.28	1.03	3.38	Very High
21	BH4B	14.90	15.00	Hornfels	D	9.48	BB		50	61		YES	9.48	3721	61	2.55	1.09	2.79	High
22	BH4B	15.90	16.00	Hornfels	D	19.59	D	joint	50	61		YES	19.59	3721	61	5.26	1.09	5.76	Very High
23	BH4B	16.05	16.14	Hornfels	D	19.09	D	Joint	50	61		YES	19.09	3721	61	5.13	1.09	5.61	Very High
24	BH4B	16.40	16.50	Hornfels	D	12.32	BB		50	61		YES	12.32	3721	61	3.31	1.09	3.62	Very High
25	BH4B	17.00	17.10	Hornfels	D	12.40	D	Joint	50	61		YES	12.40	3721	61	3.33	1.09	3.64	Very High
26	BH4B	18.60	18.70	Hornfels	D	22.00			50	61									
27	BH4B	19.62	19.70	Hornfels	D	20.00			50	61									
28	BH4B	19.62	19.70	Hornfels	A	21.43	S			50	61	YES	21.43	3883	62	5.52	1.10	6.09	Very High
29	BH4B	20.90	21.00	Hornfels	D	21.00			50	61									

30	BH4B	20.94	21.00	Hornfels	A	22.00				58	61								
31	BH4B	21.00	21.10	Hornfels	D	21.00			50	61									
32	BH4B	22.00	22.10	Hornfels	D	11.53	S		50	61		YES	11.53	3721	61	3.10	1.09	3.39	Very High
33	BH4B	22.05	22.10	Hornfels	A	18.78				50	61								
34	BH4B	23.45	23.55	Hornfels	D	21.00			50	61									
35	BH4B	24.10	24.18	Hornfels	D	8.84	S		50	61		YES	8.84	3721	61	2.38	1.09	2.60	High
36	BH4B	24.14	24.18	Hornfels	A	17.36				38	61								
37	BH4B	25.00	25.10	Hornfels	D	22.00			50	61									
38	BH4B	26.00	26.08	Hornfels	D	10.27	S		50	61		YES	10.27	3721	61	2.76	1.09	3.02	Very High
39	BH4B	26.04	26.08	Hornfels	A	17.22	S			40	61	YES	17.22	3107	56	5.54	1.05	5.82	Very High
40	BH4B	27.00	27.10	Hornfels	D	20.00			50	61									
41	BH4B	28.00	28.10	Hornfels	D	6.45	BB		50	61		YES	6.45	3721	61	1.73	1.09	1.90	High
42	BH4B	29.00	29.10	Hornfels	D	17.91	BB		50	61		YES	17.91	3721	61	4.81	1.09	5.26	Very High
43	BH4B	29.05	29.10	Hornfels	A	13.82	BB			50	61	YES	13.82	3883	62	3.56	1.10	3.93	Very High
44	BH4B	30.00	30.10	Hornfels	D	21.00			50	61									
45	BH4B	31.51	31.61	Hornfels	D	21.00			50	61									
46	BH4B	31.56	31.61	Hornfels	A	7.84	BB	.		45	61	YES	7.84	3495	59	2.24	1.08	2.42	High
47	BH4B	32.90	33.00	Hornfels, Hydrothermal	D	19.50	BB		50	61		YES	19.50	3721	61	5.24	1.09	5.73	Very High
48	BH4B	33.90	34.00	Hornfels	D	1.95	BB		50	61		YES	1.95	3721	61	0.52	1.09	0.57	Medium
49	BH4B	34.90	35.00	Hornfels	D	16.70	BB		50	61		YES	16.70	3721	61	4.49	1.09	4.91	Very High
50	BH4B	35.17	35.27	Hornfels	D	20.00			50	61									
51	BH4B	36.90	37.00	Hornfels	D	22.00			50	61									
52	BH4B	37.90	38.00	Hornfels	D	20.00			50	61									
53	BH4B	38.85	38.95	Hornfels	D	24.00			50	61									
54	BH4B	39.68	39.78	Hornfels	D	23.00			50	61									
55	BH4B	40.90	41.00	Hornfels	D	20.00			50	61									
56	BH4B	41.83	41.93	Hornfels	D	20.00			50	61									
57	BH4B	42.90	43.00	Hornfels	D	20.00			50	61									
58	BH4B	43.83	43.93	Hornfels	D	24.00			50	61									
59	BH4B	44.89	44.99	Hornfels	D	20.00			50	61									
60	BH4B	45.90	46.00	Hornfels	D	21.00			50	61									
61	BH4B	46.90	47.00	Hornfels	D	19.00	BB		50	61		YES	19.00	3721	61	5.11	1.09	5.58	Very High
62	BH4B	47.90	48.00	Hornfels	D	22.00			50	61									
63	BH4B	48.00	48.13	Hornfels	D	23.28			50	61									
64	BH4B	48.75	48.79	Hornfels	A	15.87	D	Joint, pyrite veneer		35	61	NO	15.87	2718	52	5.84	1.02	5.95	Very High

65	BH4B	49.00	49.10	Hornfels	D	23.37			50	61									
66	BH4B	50.62	50.75	Hornfels	D	16.96	S		40	61		YES	16.96	3721	61	4.56	1.09	4.98	Very High
67	BH4B	51.60	51.70	Hornfels	D	18.69	S		40	61		YES	18.69	3721	61	5.02	1.09	5.49	Very High
68	BH4B	51.60	51.64	Hornfels	A	16.05	S			38	61	YES	16.05	2951	54	5.44	1.04	5.65	Very High
69	BH4B	53.32	53.72	Hornfels	D	20.00			200	61									
70	BH4B	55.00	55.18	Hornfels	D	20.00			90	61									
71	BH4B	56.80	57.00	Hornfels	D	20.00			100	61									
72	BH4B	59.72	60.00	Hornfels	D	20.00			140	61									
73	BH4B	60.77	61.00	Hornfels	D	20.00			110	61									
74	BH4B	63.80	64.00	Hornfels	D	20.00			100	61									
75	BH4B	64.00	64.09	Hornfels	D	20.61			40	61									
76	BH4B	66.36	66.50	Hornfels	D	20.20			50	61									
77	BH4B	67.85	68.00	Hornfels	D	15.28	S		50	61		YES	15.28	3721	61	4.11	1.09	4.49	Very High
78	BH4B	67.95	68.00	Hornfels	A	11.31	S			50	61	YES	11.31	3883	62	2.91	1.10	3.22	Very High
79	BH4B	68.90	69.00	Hornfels	D	21.00			50	61									
80	BH4B	69.90	70.00	Hornfels	D	20.00			50	61									
81	BH4B	71.20	71.30	Hornfels	D	7.23	S		50	61		YES	7.23	3721	61	1.94	1.09	2.12	High
82	BH4B	71.25	71.30	Hornfels	A	11.57	S			57	61	YES	11.57	4427	67	2.61	1.14	2.97	High
83	BH4B	72.74	72.84	Hornfels	D	20.80			50	61									
84	BH4B	73.78	73.88	Hornfels	D	22.00	S		50	61		YES	22.00	3721	61	5.91	1.09	6.47	Very High
85	BH4B	73.83	73.88	Hornfels	A	21.08	S			40	61	YES	21.08	3107	56	6.79	1.05	7.13	Very High
86	BH4B	74.90	75.00	Hornfels	D	20.00			50	61									
87	BH4B	75.86	75.96	Hornfels	D	12.80	S		50	61		YES	12.80	3721	61	3.44	1.09	3.76	Very High
88	BH4B	76.90	77.00	Hornfels	D	20.57			50	61									
89	BH4B	77.90	78.00	Hornfels	D	20.81			50	61									
90	BH4B	78.00	78.05	Hornfels	A	20.76	S			55	61	YES	20.76	4272	65	4.86	1.13	5.48	Very High
91	BH4B	79.90	80.00	Hornfels	D	20.82			50	61									
92	BH4B	80.85	80.95	Hornfels	D	24.00			50	61									
93	BH4B	81.90	82.00	Hornfels	D	20.00			50	61									
94	BH4B	82.90	83.00	Hornfels	D	21.00			50	61									
95	BH4B	81.14	81.24	Hornfels	D	21.00			50	61									
96	BH4B	83.90	84.00	Hornfels	D	22.00			50	61									
97	BH4B	84.78	84.89	Hornfels	D	2.72	D	7 degrees, pyrite	50	61		YES	2.72	3721	61	0.73	1.09	0.80	Medium
98	BH4B	85.84	85.92	Hornfels	D	23.73			50	61									
99	BH4B	86.80	86.90	Hornfels	D	23.25			50	61									
100	BH4B	87.15	87.25	Hornfels	D	20.00			50	61									
101	BH4B	88.80	88.90	Hornfels	D	18.22			50	61									

102	BH4B	89.58	89.68	Hornfels	D	20.00			50	61									
103	BH4B	90.58	90.68	Hornfels	D	12.88	S	.	50	61		YES	12.88	3721	61	3.46	1.09	3.79	Very High
104	BH4B	91.69	91.79	Hornfels	D	20.00			50	61									
105	BH4B	92.90	93.00	Hornfels	D	20.00			50	61									
106	BH4B	93.78	93.83	IG	A	23.00				48	61								
107	BH4B	93.90	94.00	IG	D	25.00			50	61									
108	BH4B	94.90	95.00	IG	D	21.00			50	61									
109	BH4B	96.40	96.62	IG	D	20.00			110	61									
110	BH4B	99.69	99.94	IG	D	20.00			120	61									
111	BH4B	102.58	103.00	IG	D	20.00			210	61									
112	BH4B	105.65	106.00	IG	D	20.00			175	61									
113	BH4B	107.63	108.00	IG	D	20.00			190	61									
114	BH4B	108.30	108.43	IG	D	16.36	S		50	61		YES	16.36	3721	61	4.40	1.09	4.81	Very High
115	BH4B	108.30	108.35	IG	A	20.52				50	61								
116	BH4B	109.00	109.15	IG	D	23.10			50	61									
117	BH4B	110.03	110.13	IG	D	14.27	S		50	61		YES	14.27	3721	61	3.83	1.09	4.19	Very High
118	BH4B	110.03	110.08	IG	A	20.77				50	61								
119	BH4B	111.00	111.12	IG	D	22.11			50	61									
120	BH4B	114.82	115.00	IG	D	20.00			90	61									
121	BH4B	116.90	117.00	IG	D	20.00			50	61									
122	BH4B	117.90	118.00	IG	D	21.00			50	61									
123	BH4B	120.71	121.00	IG	D	20.00			140	61									
124	BH4B	123.70	124.00	IG	D	20.00			150	61									
125	BH4B	124.90	125.00	IG	D	25.00			50	61									
126	BH4B	125.90	126.00	IG	D	20.00			50	61									
127	BH4B	126.90	127.00	IG	D	21.00			50	61									
128	BH4B	127.90	128.00	IG	D	24.00			50	61									
129	BH4B	128.88	128.98	IG	D	22.00			50	61									
130	BH4B	129.90	130.00	IG	D	21.00			50	61									
131	BH4B	130.90	131.00	IG	D	22.00			50	61									
132	BH4B	131.90	132.00	IG	D	22.00			50	61									
133	BH4B	134.53	134.62	IG	D	22.14			50	61									
134	BH4B	135.30	135.40	IG	D	20.66			50	61									
135	BH4B	136.00	136.08	IG	D	20.14			40	61									
136	BH4B	137.00	137.05	IG	A	23.20				54	61								
137	BH4B	141.00	141.16	IG	D	22.17			50	61									
138	BH4B	142.89	142.94	IG	A	23.96				51	61								
139	BH4B	146.00	146.13	IG	D	23.41			50	61									
140	BH4B	146.00	146.05	IG	A	21.64				62	61								
141	BH4B	148.17	148.27	IG	D	3.35	S		50	61		YES	3.35	3721	61	0.90	1.09	0.98	Medium
142	BH4B	148.17	148.22	IG	A	3.38	S			50	61	YES	3.38	3883	62	0.87	1.10	0.96	Medium
143	BH4B	153.00	153.17	IG	D	21.25			50	61									
144	BH4B	153.95	154.00	IG	A	20.89				42	61								
145	BH4B	156.83	157.00	IG	D	22.39			50	61									
146	BH4B	163.89	164.00	IG	D	22.41			50	61									
147	BH4B	165.00	165.12	IG	D	20.25			50	61									
148	BH4B	170.54	170.68	IG	D	20.75			50	61									
149	BH4B	173.52	173.62	IG	D	20.85			50	61									

150	BH4B	174.00	174.10	IG	D	20.65			50	61									
151	BH4B	176.74	177.00	IG	D	21.10			50	61									
152	BH4B	182.67	182.77	IG	D	23.09			50	61									
153	BH4B	189.00	189.13	IG	D	21.42			50	61									
154	BH4B	191.95	192.00	IG	A	20.86				55	61								
155	BH4B	194.00	194.10	IG	D	21.60			50	61									
156	BH4B	197.83	198.00	IG	D	20.77			50	61									
157	BH4B	201.00	201.10	IG	D	25.63			50	61									
158	BH4B	204.87	205.00	IG	D	22.88			50	61									
159	BH4B	206.95	207.00	IG	A	20.97				50	61								
160	BH4B	211.00	211.04	IG	A	20.77				36	61								
161	BH4B	211.04	211.26	IG	D	21.91			50	61									
162	BH4B	214.00	214.10	IG	D	20.08			50	61									
163	BH4B	219.00	219.11	IG	D	20.65			50	61									
164	BH4B	221.07	221.25	IG	D	21.33			50	61									
165	BH4B	222.00	222.04	IG	A	20.08				40	61								
166	BH4B	225.62	225.71	IG	D	6.76	D	healed joint	50	61		YES	6.76	3721	61	1.82	1.09	1.99	High
167	BH4B	225.94	225.98	IG	A	20.62	S			45	61	YES	20.62	3495	59	5.90	1.08	6.36	Very High
168	BH4B	228.00	228.14	IG	D	20.99			50	61									
169	BH4B	231.08	231.12	IG	A	19.11	S			35	61	NO	19.11	2718	52	7.03	1.02	7.16	Very High
170	BH4B	237.00	237.14	IG	D	20.71			50	61									
171	BH4B	240.00	240.19	IG	D	20.06			50	61									
172	BH4B	246.00	246.13	IG	D	20.82			50	61									
173	BH4B	249.00	249.16	IG	D	21.67			50	61									
174	BH4B	252.00	252.13	IG	D	20.74			50	61									
175	BH4B	255.00	255.05	IG	A	21.69				55	61								
176	BH4B	258.00	258.14	IG	D	20.67			50	61									
177	BH4B	261.00	261.18	IG	D	21.36			50	61									
178	BH4B	264.27	264.42	IG	D	21.49			50	61									
179	BH4B	264.42	264.46	IG	A	23.16				50	61								
180	BH4B	270.00	270.12	IG	D	23.59			50	61									
181	BH4B	273.00	273.12	IG	D	12.80	D	joint	50	61		YES	12.80	3721	61	3.44	1.09	3.76	Very High
182	BH4B	273.00	273.05	IG	A	20.00				50	61								
183	BH4B	276.00	276.12	IG	D	20.53			50	61									
184	BH4B	282.00	282.10	IG	D	21.11			50	61									
185	BH4B	285.00	285.12	IG	D	21.80			50	61									
186	BH4B	288.00	288.16	IG	D	21.71			50	61									
187	BH4B	294.00	294.14	IG	D	20.94			50	61									
188	BH4B	294.00	294.05	IG	A	20.73				48	61								
189	BH4B	297.00	297.14	IG	D	23.31			50	61									
190	BH4B	303.00	303.15	IG	D	21.03			50	61									
191	BH4B	306.00	306.16	IG	D	21.70			50	61									
192	BH4B	311.00	311.15	IG	D	20.49			50	61									
193	BH4B	315.00	315.17	IG	D	20.21			50	61									
194	BH4B	318.00	318.18	IG	D	21.36			50	61									
195	BH4B	321.00	321.16	IG	D	21.89			50	61									
196	BH4B	324.00	324.15	IG	D	21.22			50	61									
197	BH4B	331.90	332.00	IG	D	22.22			50	61									
198	BH4B	333.00	333.14	IG	D	20.53			50	61									

199	BH4B	337.00	337.20	IG	D	20.00			100	61									
200	BH4B	339.03	339.19	IG	D	20.00			80	61									
201	BH4B	342.78	343.00	IG	D	20.00			110	61									
202	BH4B	345.00	345.17	IG	D	20.00			85	61									
203	BH4B	348.00	348.12	IG	D	20.00			60	61									
204	BH4B	351.00	351.16	IG	D	20.00			80	61									
205	BH4B	354.00	354.19	IG	D	20.00			95	61									
206	BH4B	355.00	355.28	IG	D	20.00			140	61									
207	BH4B	357.00	357.32	IG	D	20.00			160	61									
208	BH4B	363.00	363.26	IG	D	22.04			50	66									
209	BH4B	366.00	366.17	IG	D	20.78			50	66									
210	BH4B	369.00	369.16	IG	D	23.86			50	66									
211	BH4B	369.35	369.41	IG	A	23.38				60	66								
212	BH4B	378.00	378.17	IG	D	22.48			50	61									
213	BH4B	381.00	381.17	IG	D	25.41			50	61									
214	BH4B	384.00	384.17	IG	D	21.05			50	61									
215	BH4B	389.00	389.05	IG	A	21.21				53	61								
216	BH4B																		
217	BH4B																		
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ROCK TYPE:

Appendix D Laboratory Testing Certificates

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DIRECT SHEAR TEST REPORT

ASTM D5607 - Standard Test Method for Performing Laboratory Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force

Client	Macquarie Geotechnical Pty Ltd	**Report No.**	22011310-DS
		Workorder No	0009451
Address	Unit 7 & 8 / 10 Bradford Street, Alexandria NSW 2015	**Test Date**	1/02/2022
		Report Date	1/02/2022
Project	S21430-1 Oven Mountain (30018018)		
Client ID	S73010 - BH4B	**Depth (m)**	93.41-93.77
Description	-	**Sample Type**	Single individual rock core specimen - INTACT.

SAMPLE DETAILS

Specimen Condition	As Received
Specimen Dimensions (mm)	64.95*60.99
Rate of Strain (mm/min)	0.100
Initial Moisture Content (%)	0.1
Initial Wet Density(t/m^3)	2.60

TEST RESULTS

RESIDUAL RESULTS

Residual Shear Angle (o)	51.4	Residual Cohesion (kPa)	954.6	R^2	0.937

	Displacement (mm)	Constant Normal Stress (kPa)	Corrected Shear Stress (kPa)
Stage 1	11.40	1197.0	1772.6
Stage 2	7.36	2505.6	5132.1
Stage 3	4.60	5028.9	6904.8

PEAK RESULTS

Peak Shear Angle (o)	46.4	Peak Cohesion (kPa)	2884.3	R^2	0.999

	Displacement (mm)	Constant Normal Stress (kPa)	Corrected Shear Stress (kPa)
Stage 1	1.95	1202.1	4194.2
Stage 2	2.75	2501.5	5433.8
Stage 3	3.51	5025.2	8180.3

INTACT STRENGTH

	Displacement (mm)	Constant Normal Stress (kPa)	Corrected Shear Stress (kPa)
Stage 1	1.77	1202.1	7311.9

Notes/Remarks:

Note: Sample tested under constant normal stress, area correction based on eliptical sample equation.
Sample/s supplied by the client

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Tested at Trilab Brisbane Laboratory

Authorised Signatory
C. Purvis

NATA
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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

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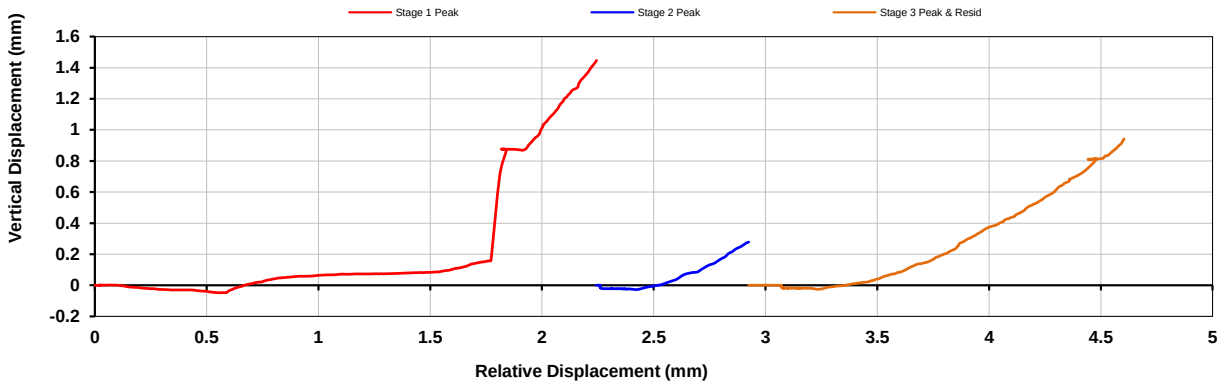
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DIRECT SHEAR TEST REPORT

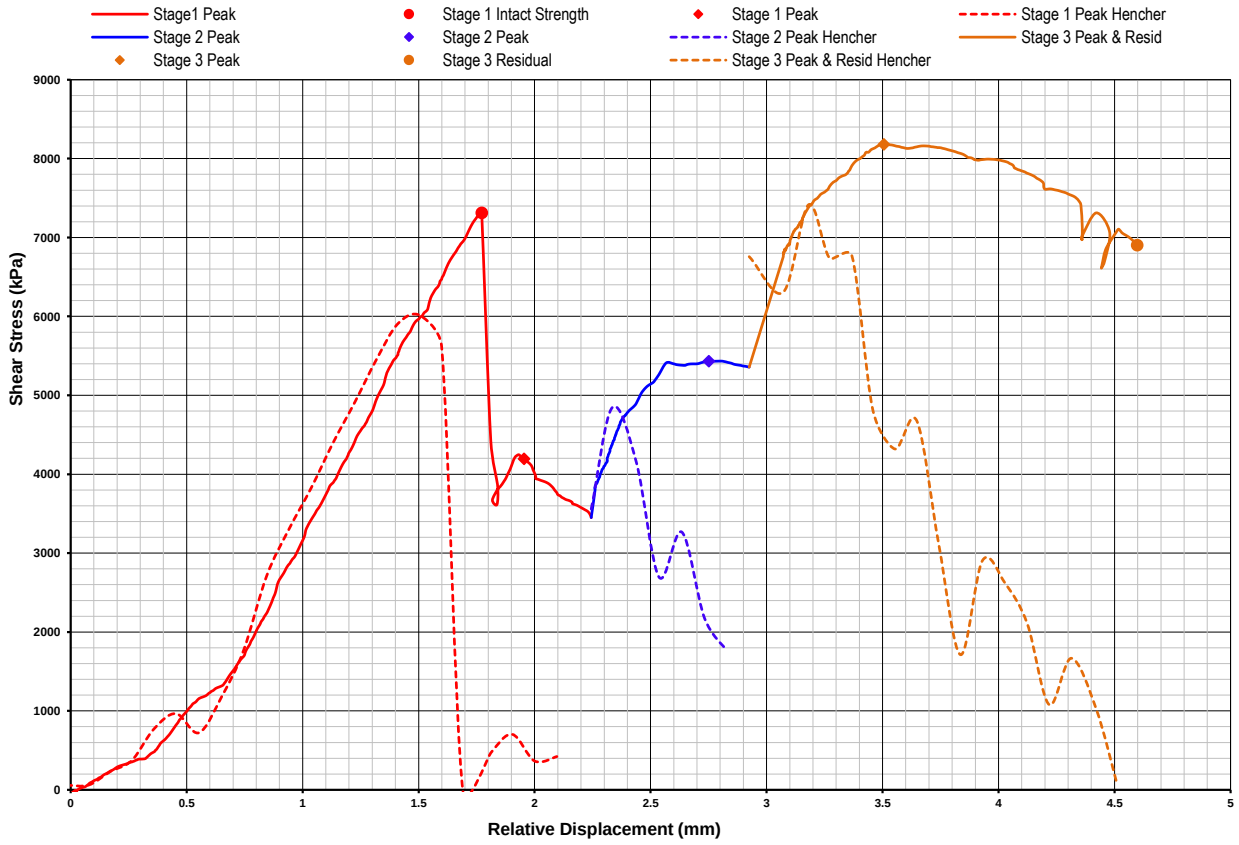
ASTM D5607 - Standard Test Method for Performing Laboratory Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force

Client	Macquarie Geotechnical Pty Ltd	**Report No.**	22011310-DS

Peak Vertical Displacement/Relative Displacement Plot



Shear Stress/Relative Displacement Plot



Notes/Remarks:

Note: Sample tested under constant normal stress, area correction based on eliptical sample equation.

Graph not to scale

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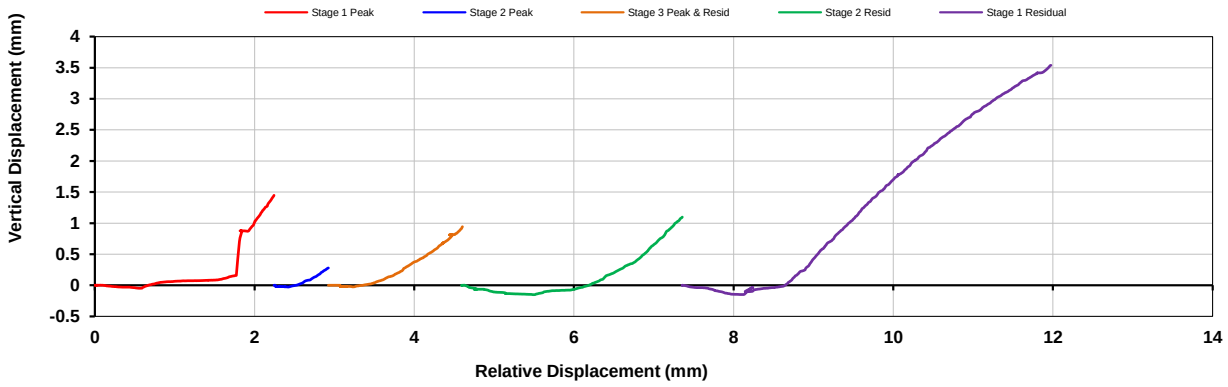
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DIRECT SHEAR TEST REPORT

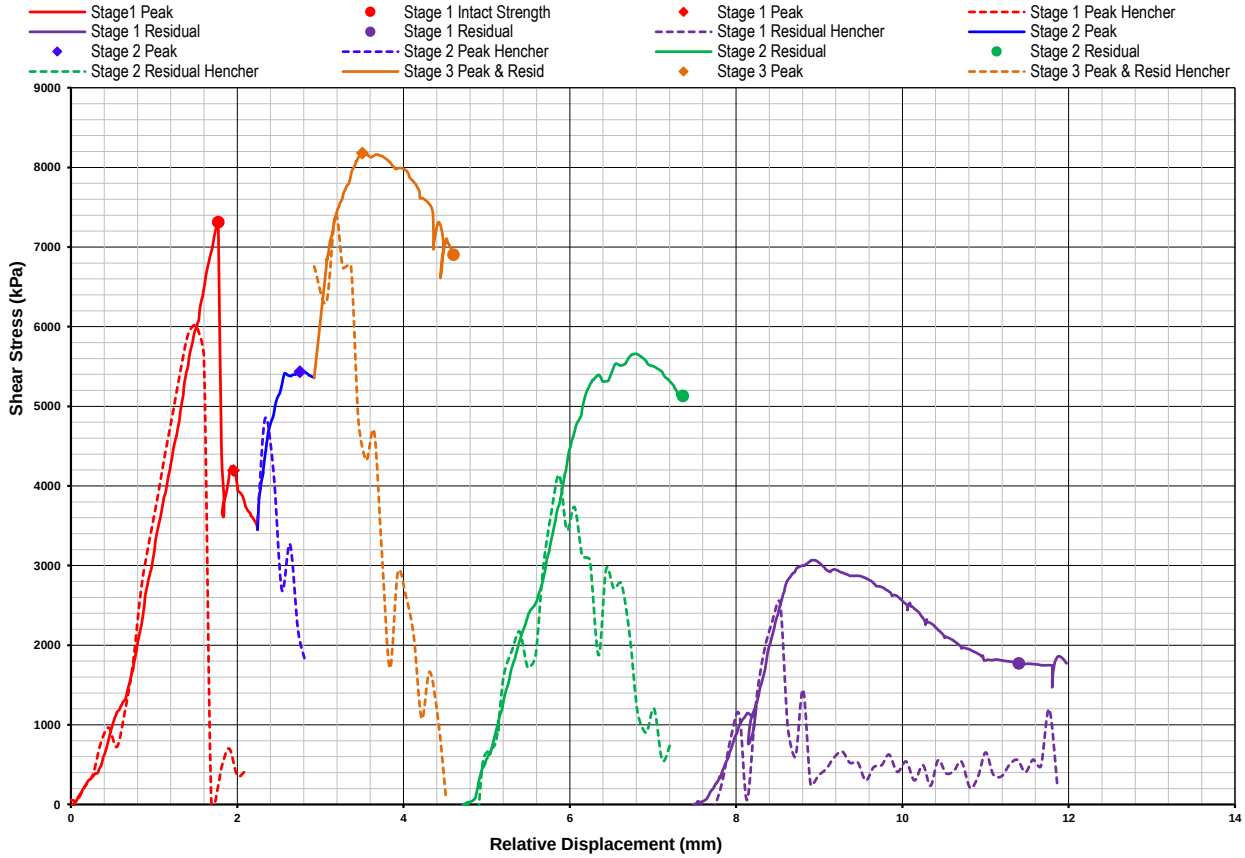
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Client	Macquarie Geotechnical Pty Ltd	**Report No.**	22011310-DS

Peak & Residual Vertical Displacement/Relative Displacement Plot



Shear Stress/Relative Displacement Plot



Notes/Remarks:

Note: Sample tested under constant normal stress, area correction based on eliptical sample equation.

Graph not to scale

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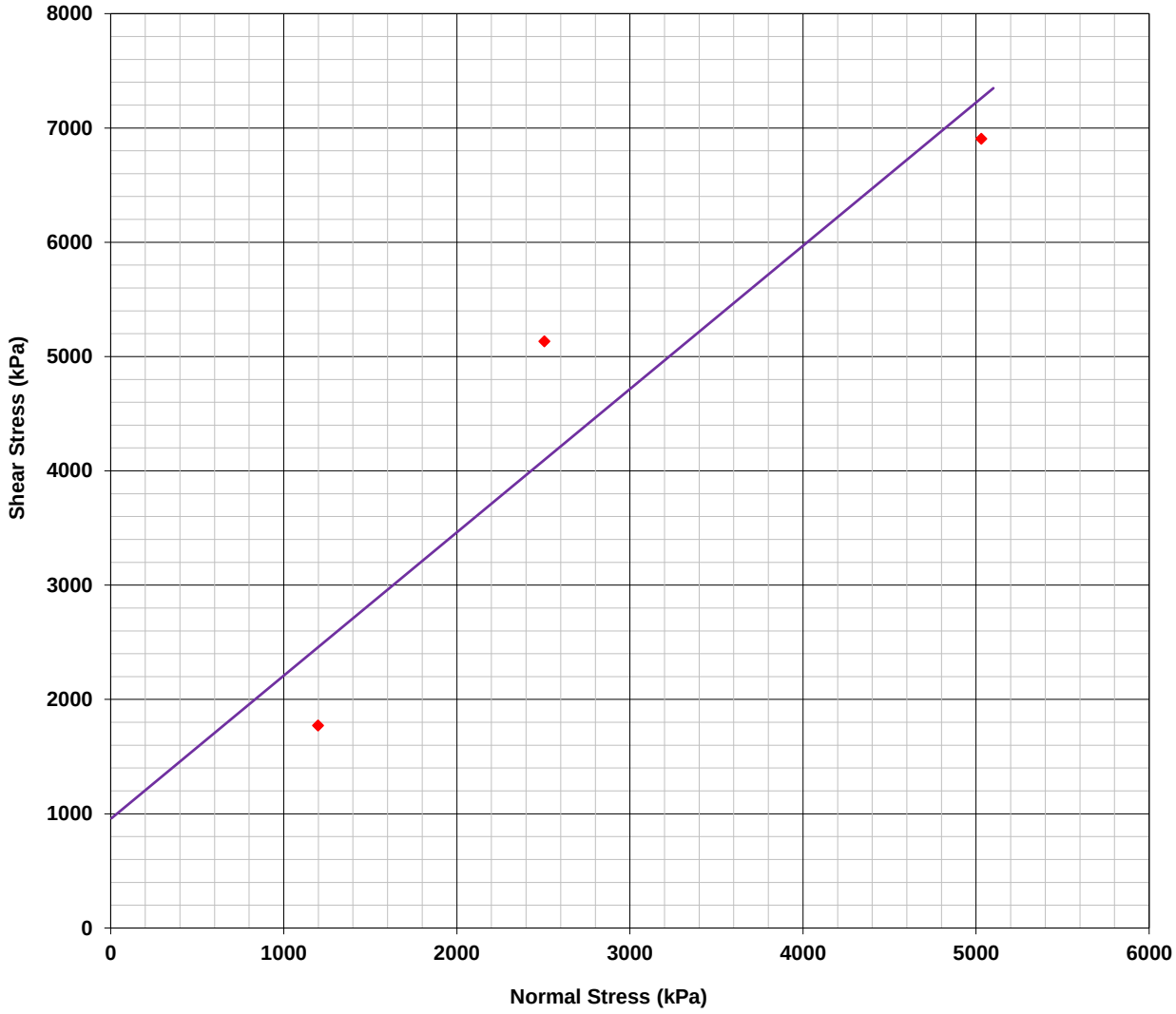
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DIRECT SHEAR TEST REPORT

ASTM D5607 - Standard Test Method for Performing Laboratory Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force

Client	Macquarie Geotechnical Pty Ltd	**Report No.**	22011310-DS

Residual - Corrected Normal Stress vs Corrected Shear Stress



Residual Shear Angle (°) 51.4		**Residual Cohesion (kPa)** 954.6	**R^2** 0.937
	Displacement (mm)	Constant Normal Stress (kPa)	Corrected Shear Stress (kPa)
Stage 1	11.40	1197.0	1772.6
Stage 2	7.36	2505.6	5132.1
Stage 3	4.60	5028.9	6904.8

Notes/Remarks:

Note: Sample tested under constant normal stress, area correction based on eliptical sample equation.

Graph not to scale

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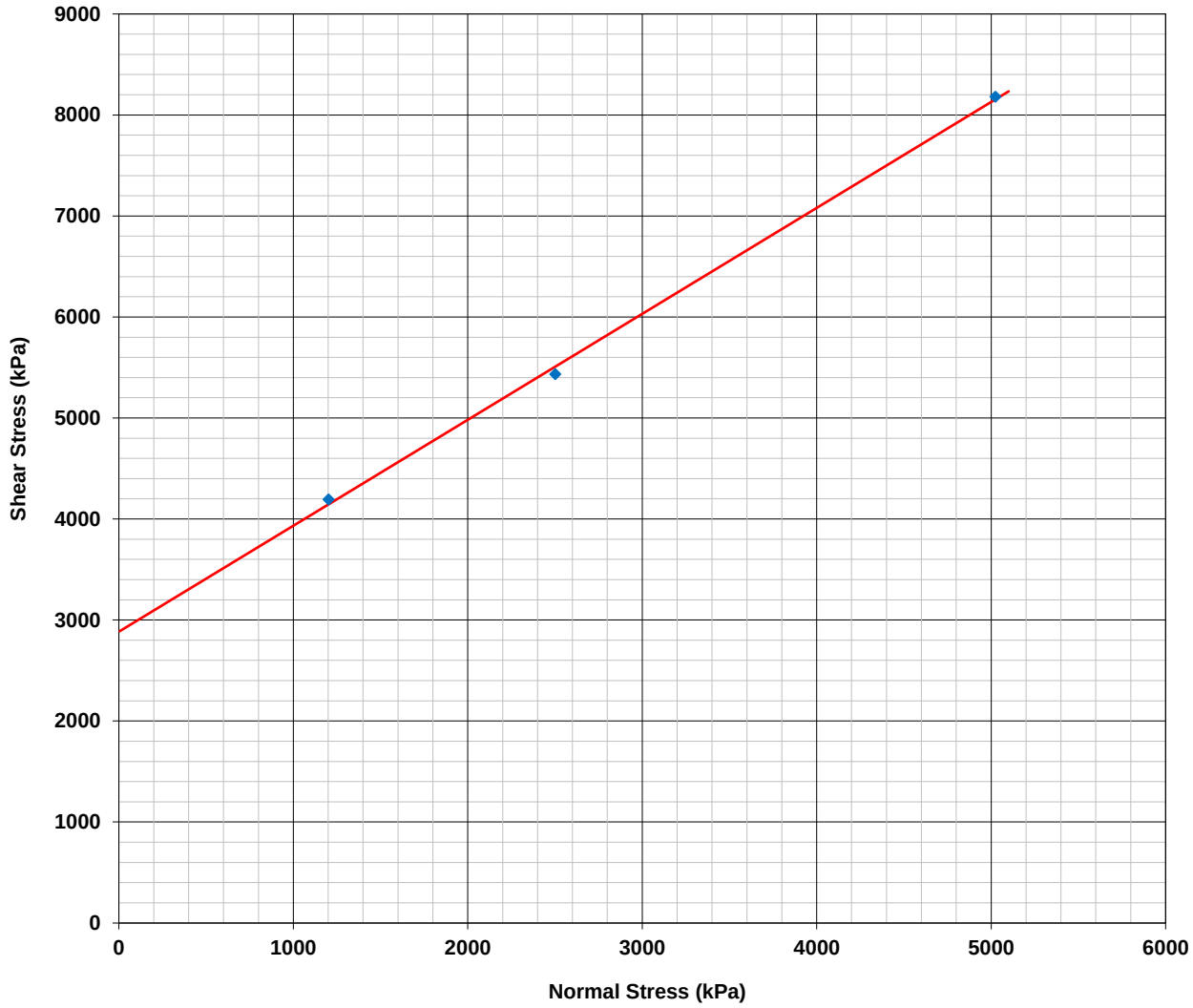
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DIRECT SHEAR TEST REPORT

ASTM D5607 - Standard Test Method for Performing Laboratory Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force

Client	Macquarie Geotechnical Pty Ltd	**Report No.**	22011310-DS

Peak - Corrected Normal Stress vs Corrected Shear Stress



Peak Shear Angle (°)	46.4	Peak Cohesion (kPa) 2884.3	R^2 0.999
	Displacement (mm)	Constant Normal Stress (kPa)	Corrected Shear Stress (kPa)
Stage 1	1.95	1202.1	4194.2
Stage 2	2.75	2501.5	5433.8
Stage 3	3.51	5025.2	8180.3

Notes/Remarks:

Note: Sample tested under constant normal stress, area correction based on eliptical sample equation.

Graph not to scale

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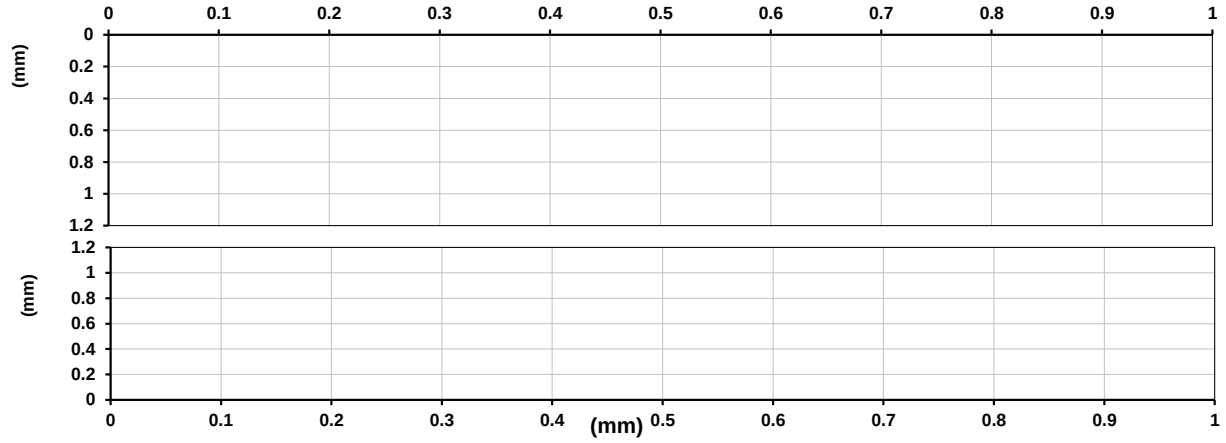
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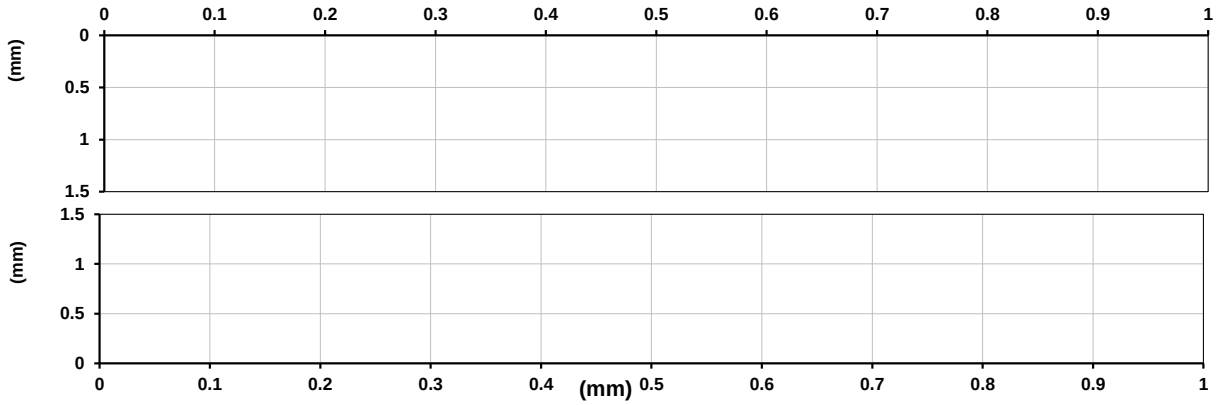
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Report No. 22011310-DS

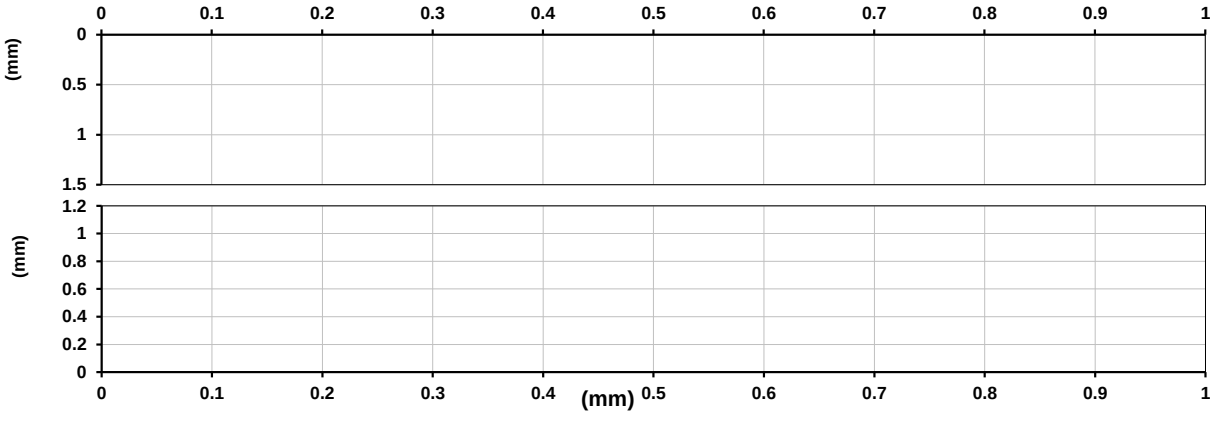
Top and Bottom Profile - Position 1 - Prior to Shearing



Top and Bottom Profile - Position 2 - Prior to Shearing



Top and Bottom Profile - Position 3 - Prior to Shearing



Graph not to scale

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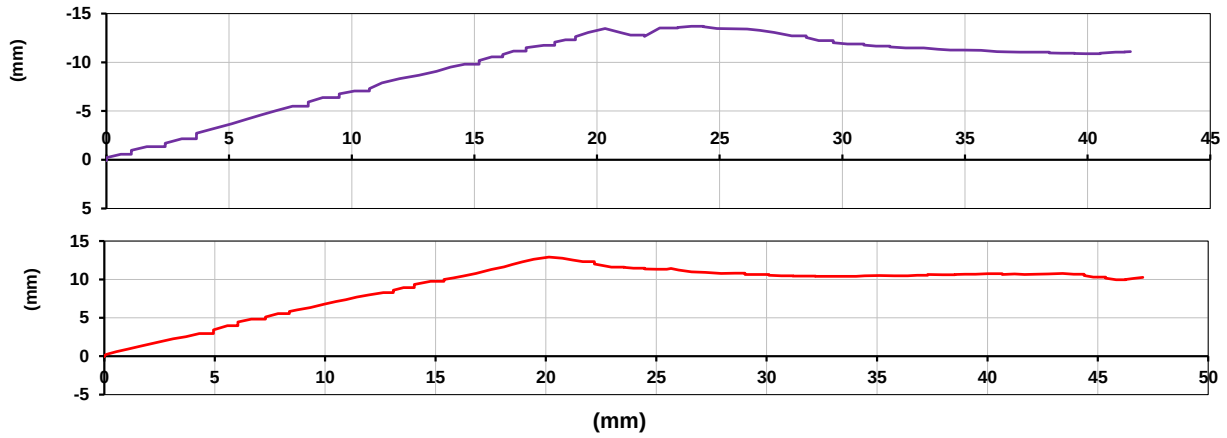
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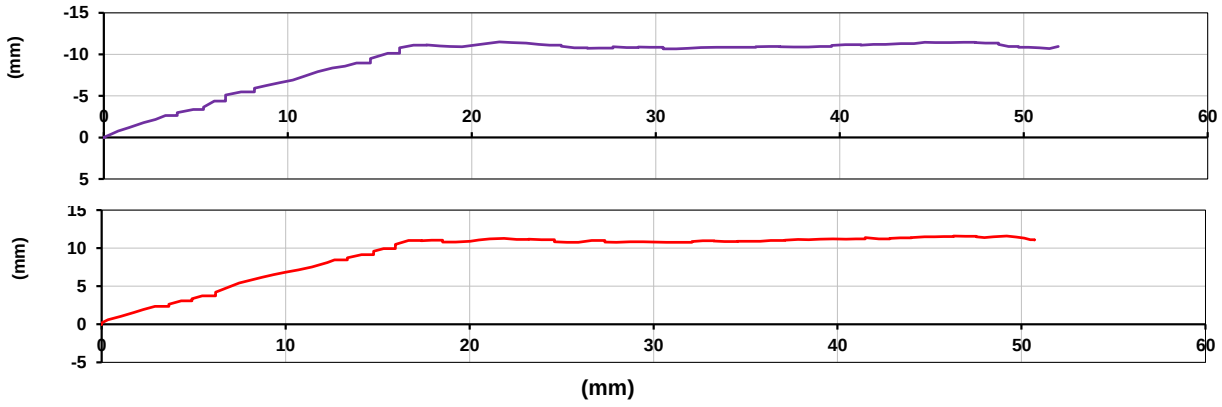
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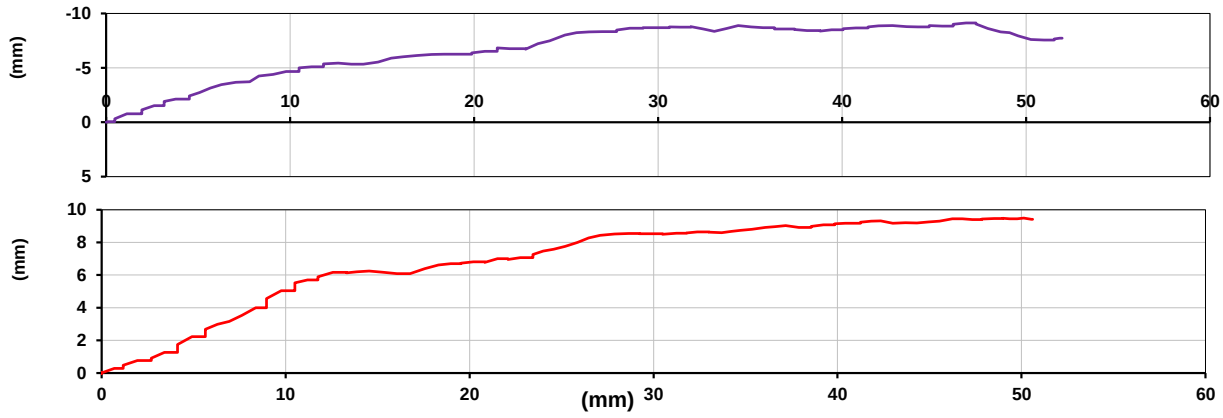
Top and Bottom Profile - Position 1 - After Shearing



Top and Bottom Profile - Position 2 - After Shearing



Top and Bottom Profile - Position 3 - After Shearing



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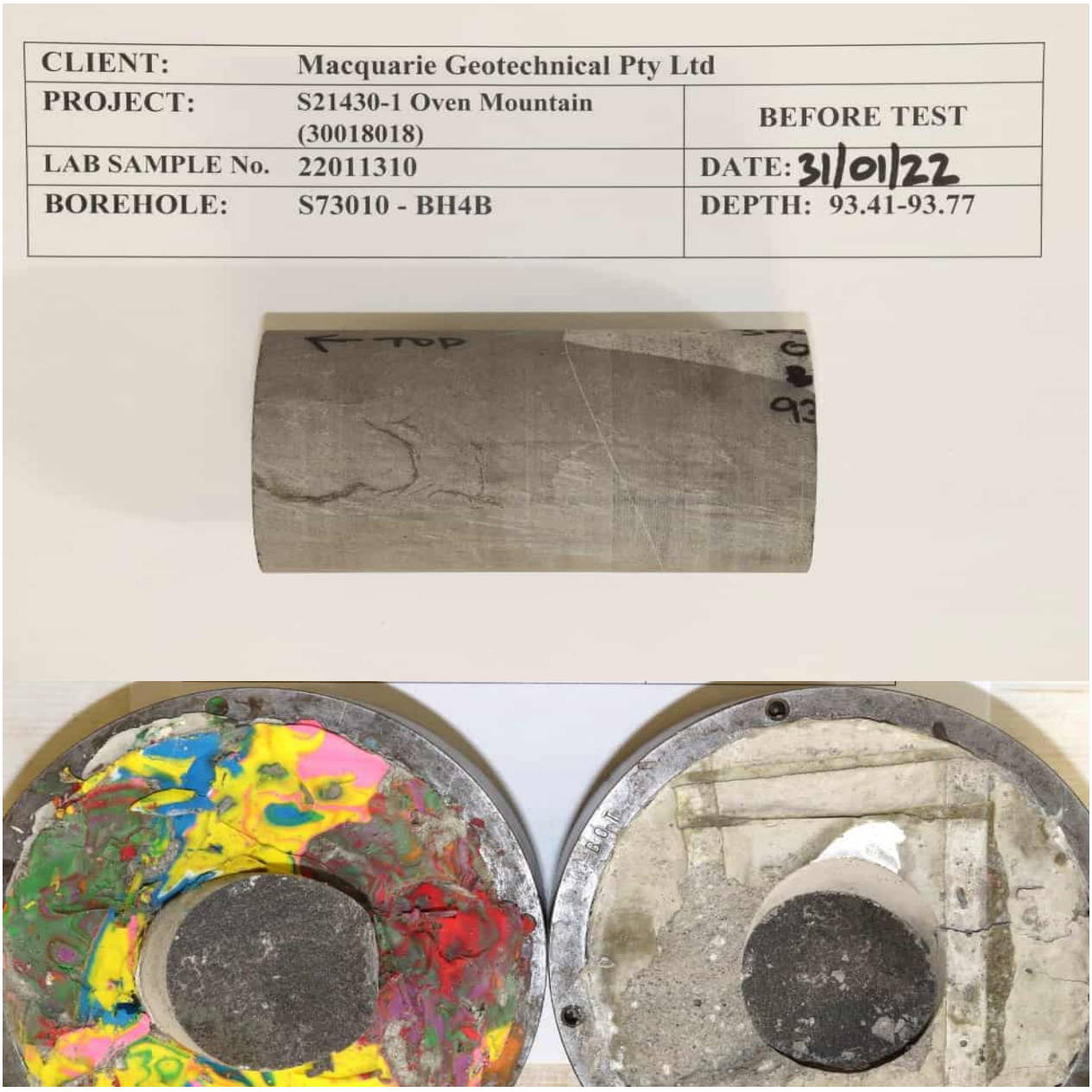
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ASTM D5607 - Standard Test Method for Performing Laboratory Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force

Client	Macquarie Geotechnical Pty Ltd	**Report No.**	22011310-DS



Notes/Remarks:

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

ABN 25 065 630 506
PETROGRAPHIC, GEOLOGICAL & GEOCHEMICAL CONSULTANTS

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Email: info@geochempet.com
www.geochempet.com

PETROGRAPHIC REPORT ON A CORE SAMPLE (S73000) FROM OVEN MOUNTAIN

prepared for

MACQUARIE GEOTECH ALEXANDRIA, NSW

Purchase Order: S21430

Invoice Number: G2202524

Client Ref: Jasper Haines

Issued by

D. P. Franks
BSc, MMinRes
9 February 2022

Reviewed by

K. E. Spring
B.Sc. (Hons), MAppSc
9 February 2022

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GEOCHEMPET SERVICES, BRISBANE

Mac Geo Lab #:	S73000	**Date Sampled:**	15/11/2021
Geo Sample ID:	G22010033	**Date Received:**	14/01/2022
Sample Type:	Drill Core	**Borehole No.**:	BH4b
Project:	Oven Mountain (30018018)	**Depth**:	18.00 – 18.14 m

Work Requested Petrographic analysis and quartz content

Methods Adapted from ASTM C295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete* and the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)*

Identification Hornfels

Description

The supplied sample consisted of a small drill core specimen of essentially unweathered, hard, robust, medium grey hornfels. The rock can only be lightly scratched by a steel tool.



Image 1: Photograph of the supplied core sample.

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In order to permit detailed microscopic examination in transmitted, polarised light, a thin section was prepared from the drill core specimen. An approximate composition of the rock, expressed in volume percent and based on a brief count of 100 widely-spaced points in thin section, is:

Hard, durable minerals

41%	quartz
24%	feldspar
3%	cordierite
1%	hornblende
trace	epidote, opaque oxide

Weak, soft or deleterious minerals

21%	biotite
5%	chlorite
4%	sericite
1%	pyrite

Thin Section Description

The rock displays mosaic, decussate, foliated, and spotted poikiloblastic textures of thermal metamorphic style. The grains are of mosaic style and are mainly in the size range 0.05 to 0.2 mm and are silty in thin lenses at an acute angle across the slide. The poikiloblastic grains are 0.2 to 0.5 mm in size. Mica flakes are about 0.01 to 0.1 mm in size.

The mosaic grains appear to be unstrained to mildly-strained quartz and subordinate plagioclase feldspar showing minor twinning and albitization in some places. The poikiloblastic grains seem to be cordierite, but they are difficult to distinguish quantitatively from quartz, and appear quite altered. Other hard minerals present in low abundance comprise hornblende, and traces of epidote and opaque oxide (magnetite and/or ilmenite), often in association with poikiloblasts.

Common brown biotite forms randomly orientated (decussate) small flakes and aggregates of flakes throughout the fabric of the rock. Chlorite and sericite grains are observed, often in association with poikiloblastic grains and pyrite. Thin, roughly straight, and occasionally lensoidal quartz veins also contain a few pyrite grains, with associated chlorite, sericite, and epidote.

Comments and Interpretations

The supplied drill core sample (labelled S73000) from BH4b at 18.00 – 18.14 m at the Oven Mountain Project is interpreted to be hornfels. The hornfels is a contact metamorphic rock, generated by thermal recrystallization of former mudstone/siltstone in the vicinity of an igneous intrusion.

For engineering purposes, the rock represented in the supplied drill core sample may be summarised as:

- **hornfels** (a contact or thermal metamorphic rock)
- finely crystalline
- foliated
- spotted by porphyroblasts
- non-porous

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- essentially unweathered
- carrying an average of about 30% of soft, weak minerals (21% biotite, 5% chlorite, 4% sericite)
- contains about 1% pyrite
- **hard**
- **strong**

The hornfels is predicted to be **essentially durable**. The rock does carry an average of about 25% mica, but the cleavage weakness and the flexibility of the mica is substantially offset by the decussate texture – it occurs as small, randomly orientated flakes, many of which are included within hard strong, tough grains of quartz and feldspar.

Free Silica Content

The rock has a free silica content of about 41%.

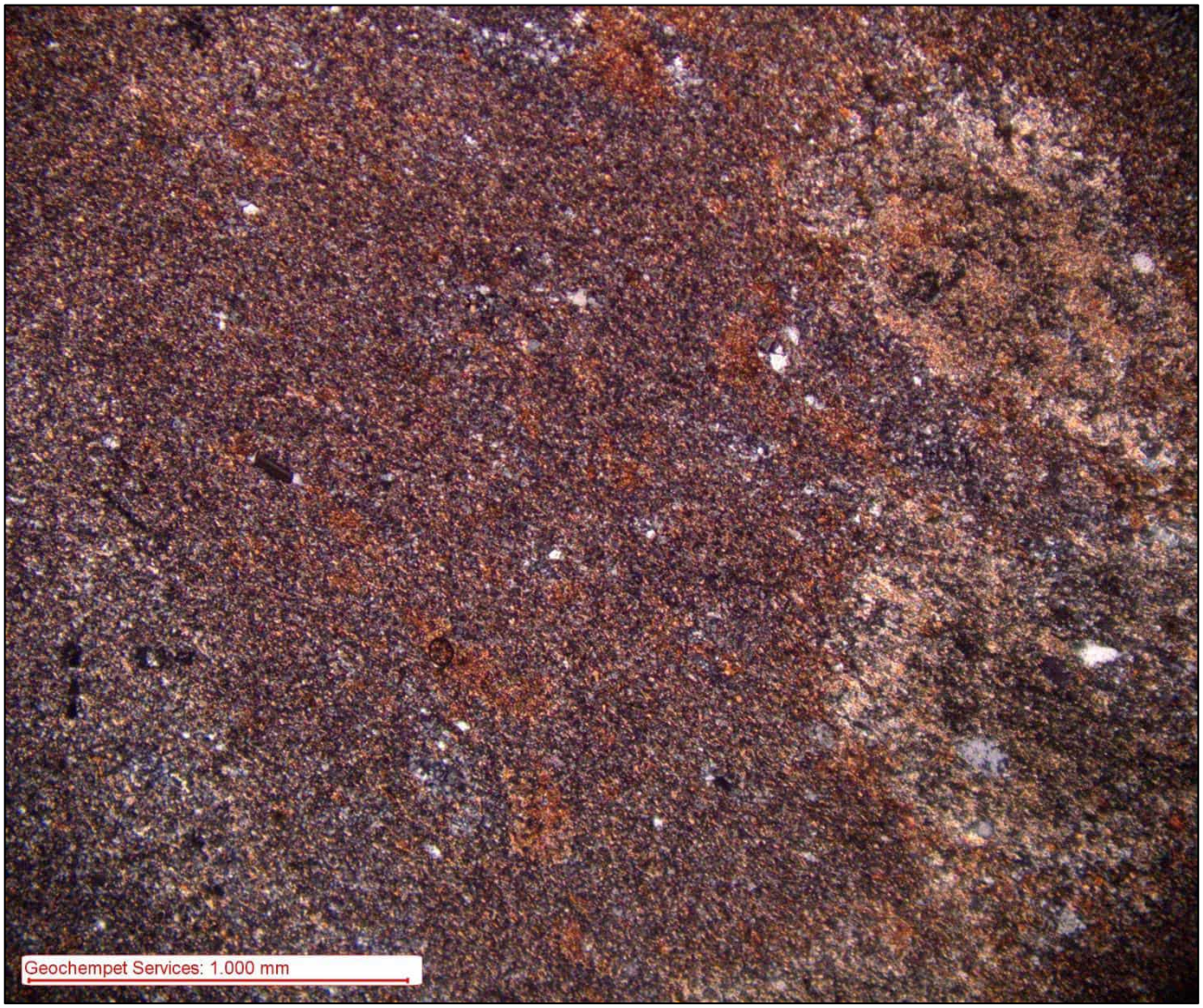


Image 2: Micrograph taken at low magnification under transmitted, cross-polarised light of the sample, which is dominated by quartz and biotite grains. Note the poikiloblasts at the right of the image.

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XRF ANALYSIS ON A CORE SAMPLE (S73000) FROM OVEN MOUNTAIN

prepared for

MACQUARIE GEOTECH ALEXANDRIA, NSW

Purchase Order: S21430

Invoice Number: G2202524

Client Ref: Jasper Haines

Issued by

D. P. Franks
BSc, MMinRes
9 February 2022

Reviewed by

K. E. Spring
B.Sc. (Hons), MAppSc
9 February 2022

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GEOCHEMPET SERVICES, BRISBANE

XRF ANALYSIS
ON A CORE SAMPLE (S73000)

Mac Geo Lab #:	S73000	**Date Sampled:**	15/11/2021
Geo Sample ID:	G22010033	**Date Received:**	14/01/2022
Sample Type:	Drill Core	**Borehole No.**:	BH4b
Project:	Oven Mountain (30018018)	**Depth**:	18.00 – 18.14 m

Work Requested X-ray fluorescence analysis on the rock sample

Method

A sub-sample of the rock spalls was sent to ALS on 14/01/2022. The sub-samples were pulped and then investigated by X-ray fluorescence analysis through ALS Chemex. The XRF whole rock analysis determines the major oxides content of the rock as well as sulphides and loss of ignition. The XRF whole rock analysis determined the elemental oxide content within the rock using the ME-XRF26 method, along with loss of ignition using the ME-GRA05 method.

Results

The elemental oxide XRF results are (in weight percent):

Al2O3	15.73%
BaO	0.07%
CaO	1.87%
Cr2O3	0.01%
Fe2O3	6.33%
K2O	3.51%
MgO	2.62%
MnO	0.1%
Na2O	3.11%
P2O5	0.15%
SO3	0.29%
SiO2	63.91%
SrO	0.04%
TiO2	0.78%
Loss on ignition	1.06%

- composition is determined in weight % and is calculated from a very small sub-sample of the original rock sample.
- determining composition of a rock by XRF is complicated by some minerals which have a continuous range of compositions dependent on elemental variations and the same oxides being present in more than one mineral and in different combinations.

The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services

- Combinations of more than three minerals in a rock sample can make identification of the mineral assemblage extremely difficult (ie. prone to misidentification of minerals)

Comments

The supplied core sample from Oven Mountain is considered to crushed and screened from hornfels, contact metamorphosed former sedimentary rock. From XRF analysis, the rock content is composed of 63.91% SiO2, representing a former mudstone/siltstone rock type, likely from the quartz and feldspar minerals, 15.73% of Al2O3, 3.11% of Na2O and the 1.87% of CaO are likely from feldspar and mica minerals and the 6.33% Fe2O3, 3.51% of K2O, and 2.62% MgO from the biotite. The 0.29% SO3 probably represents pyrite. The 1.06% loss on ignition is likely to represent water loss from soft, weak minerals.

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PETROGRAPHIC REPORT ON A CORE SAMPLE (S73006) FROM OVEN MOUNTAIN

prepared for

MACQUARIE GEOTECH ALEXANDRIA, NSW

Purchase Order: S21430

Invoice Number: G2202524

Client Ref: Jasper Haines

Issued by

D. P. Franks
BSc, MMinRes
9 February 2022

Reviewed by

K. E. Spring
B.Sc. (Hons), MAppSc
9 February 2022

The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services

GEOCHEMPET SERVICES, BRISBANE

Mac Geo Lab #:	S73006	**Date Sampled:**	15/11/2012
Geo Sample ID:	G22010034	**Date Received:**	14/01/2022
Sample Type:	Drill Core	**Borehole No.**:	BH4b
Project:	Oven Mountain (30018018)	**Depth**:	94.64 – 94.86 m

Work Requested Petrographic analysis and quartz content

Methods Adapted from ASTM C295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete* and the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)*

Identification Leucocratic granite

Description

The drill core specimen consists of a broadly light grey rock; in more detail the rock displays a mixture of light grey to pale grey feldspar, darker transparent grains of quartz and a few scattered darker biotite and opaque oxide grains in a slightly porphyritic rock of shallow intrusive style. The rock can only be very lightly scratched by a steel tool.

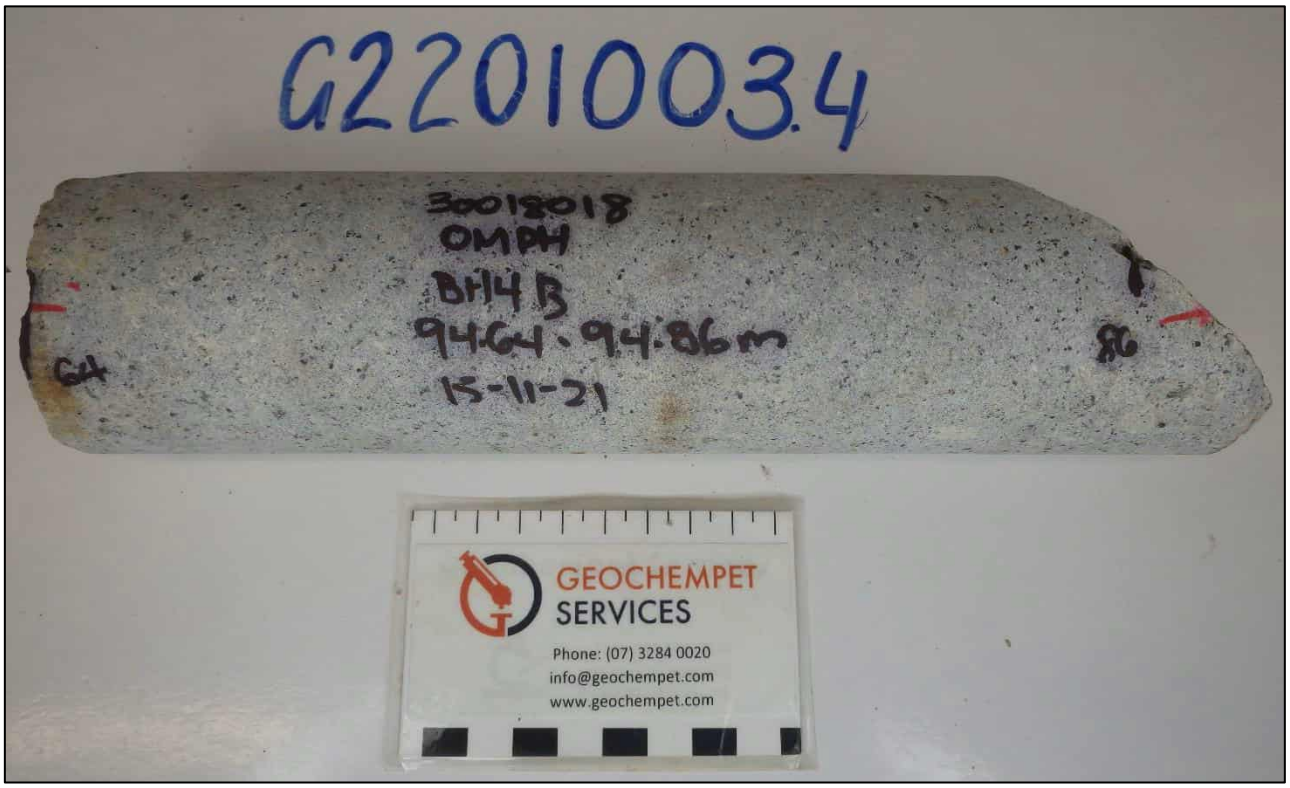


Image 1: Photograph of the supplied core sample.

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In order to permit detailed microscopic examination in transmitted, polarised light, a thin section was prepared from the drill core specimen. An approximate composition of the rock, expressed in volume percent and based on a brief count of 100 widely-spaced points in thin section, is:

Primary Minerals

40%	K-feldspar (orthoclase)
33%	quartz
19%	plagioclase feldspar
3%	biotite
<1%	opaque oxide
trace	zircon

Secondary Minerals

3%	chlorite
2%	sericite/muscovite
<1%	pyrite
trace	epidote

Thin Section Description

In thin section, the rock display slightly porphyritic textures (phenocrysts around 5 mm size) in an allotriomorphic groundmass (mainly around 0.2 to 3 mm grainsize) of mainly medium-grained, crystalline textures of granitic style involving anhedral grains.

The most common primary minerals are generally fresh, micro-perthitic orthoclase feldspars, which in some cases have inverted to microcline in small patches. Common anhedral quartz grains show mostly mild straining, with some appearing to be in subtly micro-graphic intergrowths with feldspars. Plagioclase grains are generally fresh, but show some light sericite alteration, along with a few overprinting biotite flakes and opaque oxide grains. Accessory minerals occur as small pale brownish zircons.

Chlorite alteration of primary biotite flakes is present, along with some sericite/muscovite, and rare pyrite grains. Traces of epidote are also present, associated with chloritic alteration. There appears to be no evidence of metamorphic banding or schistosity.

Comments and Interpretations

The supplied drill core sample (labelled S73006) from BH4b at 94.64 – 94.86 m at the Oven Mountain Project is interpreted to be a leucocratic type of mainly medium-grained, crystalline, acid igneous rock which qualifies for broad identification as granite (using both International Union of Geological Sciences nomenclature and older established British/Australian conventions). The granite has been subject to strain but is regarded as lacking obvious metamorphic features such as foliation, however its leucocratic, largely quartzofeldspathic character may not tend to reveal the usual indications of metamorphism.

For engineering purposes, the rock in the supplied drill core sample may be summarised as:

- broadly **granite** or specifically **leuco-granite** (an intrusive acid igneous rock)
- mainly medium-grained
- holocrystalline

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- essentially unweathered
- slightly altered
- having a secondary mineral content of about 5% (chlorite, sericite, pyrite, and a trace of robust epidote)
- **hard**
- **strong**

The rock is predicted to be **durable**.

Free Silica Content

The rock has a free silica content of about 33%.

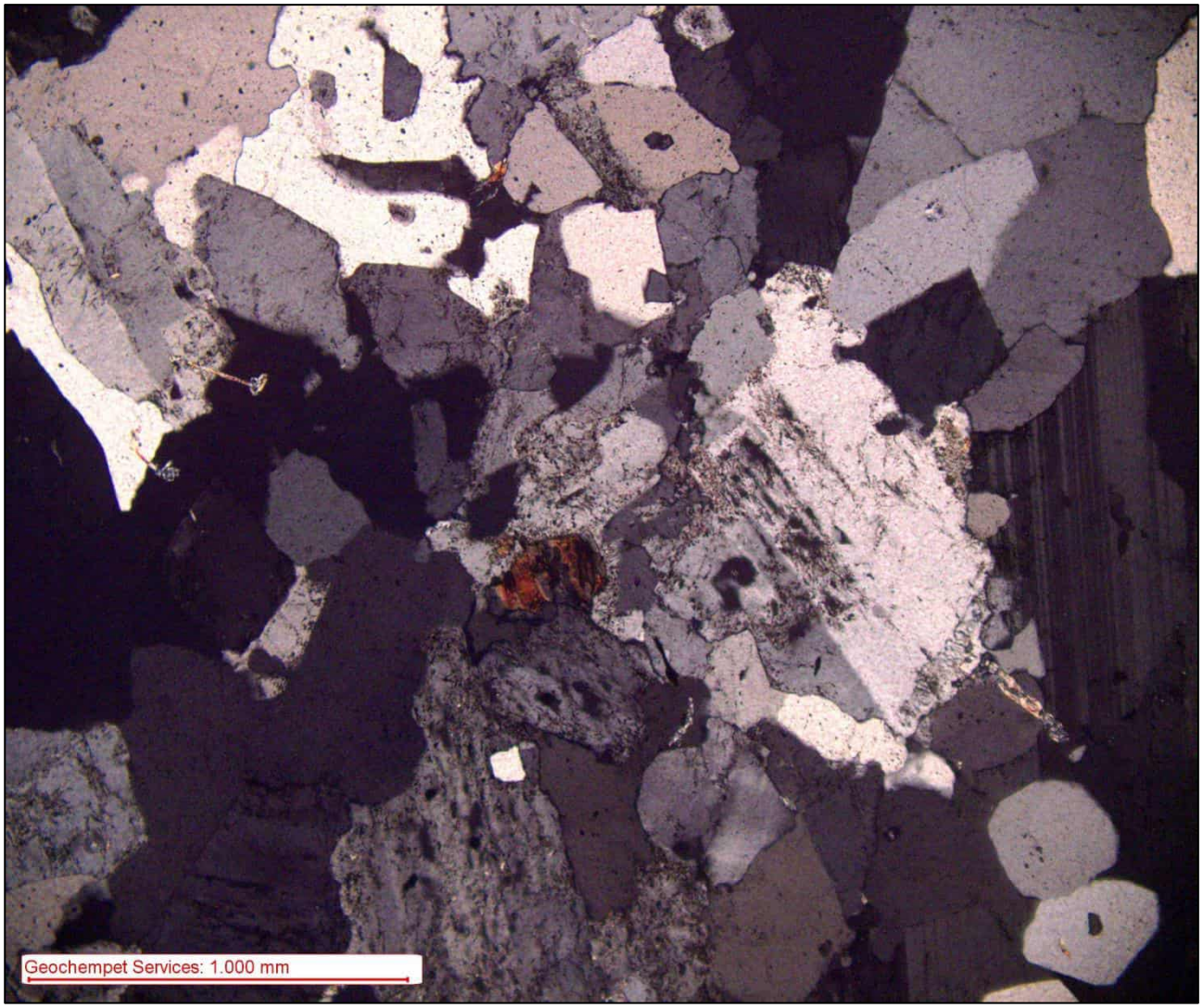


Image 2: Micrograph taken at low magnification with cross polarised transmitted light. Image shows the representative mineralogy, which is dominated by K-feldspar, quartz, and plagioclase. Note the biotite/chlorite grain in centre of image.

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XRF ANALYSIS ON A CORE SAMPLE (S73006) FROM OVEN MOUNTAIN

prepared for

MACQUARIE GEOTECH ALEXANDRIA, NSW

Purchase Order: S21430

Invoice Number: G2202524

Client Ref: Jasper Haines

Issued by

D. P. Franks
BSc, MMinRes
9 February 2022

Reviewed by

K. E. Spring
B.Sc. (Hons), MAppSc
9 February 2022

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GEOCHEMPET SERVICES, BRISBANE

XRF ANALYSIS
ON A CORE SAMPLE (S73006)

Mac Geo Lab #:	S73006	**Date Sampled:**	14/11/2021
Geo Sample ID:	G22010034	**Date Received:**	14/01/2022
Sample Type:	Drill Core	**Borehole No.**:	BH4b
Project:	Oven Mountain (30018018)	**Depth**:	94.64 – 94.86 m

Work Requested X-ray fluorescence analysis on the rock sample

Method

A sub-sample of the rock spalls was sent to ALS on 08/09/2021. The sub-samples were pulped and then investigated by X-ray fluorescence analysis through ALS Chemex. The XRF whole rock analysis determines the major oxides content of the rock as well as sulphides and loss of ignition. The XRF whole rock analysis determined the elemental oxide content within the rock using the ME-XRF26 method, along with loss of ignition using the ME-GRA05 method.

Results

The elemental oxide XRF results are (in weight percent):

Al2O3	12%
BaO	0.03%
CaO	0.83%
Cr2O3	<0.01%
Fe2O3	1.46%
K2O	4.98%
MgO	0.44%
MnO	0.03%
Na2O	2.75%
P2O5	0.04%
SO3	0.22%
SiO2	77.09%
SrO	0.01%
TiO2	0.2%
Loss on ignition	0.43%

- composition is determined in weight % and is calculated from a very small sub-sample of the original rock sample.
- determining composition of a rock by XRF is complicated by some minerals which have a continuous range of compositions dependent on elemental variations and the same oxides being present in more than one mineral and in different combinations.

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- Combinations of more than three minerals in a rock sample can make identification of the mineral assemblage extremely difficult (ie. prone to misidentification of minerals)

Comments

The supplied core sample from Oven Mountain is considered to crushed and screened from granite, a crystalline, acid igneous rock. From XRF analysis, the rock content is composed of 77.09% SiO2, representing an acid igneous rock type, likely from the feldspars and quartz minerals, 12.0% of Al2O3, 4.98% K2O, 2.75%, Na2O, and 0.83% CaO are likely from feldspar and mica minerals and 1.45% Fe2O3 and 0.44% MgO from the biotite and chlorite. The 0.22% SO3 probably represents pyrite. The 0.43% loss on ignition is likely to represent water loss from soft, weak minerals.

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GEOCHEMPET SERVICES

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PETROGRAPHIC REPORT ON A CORE SAMPLE (S73419) FROM OVEN MOUNTAIN

prepared for

MACQUARIE GEOTECH ALEXANDRIA, NSW

Purchase Order: S21430

Invoice Number: G2202524

Client Ref: Jasper Haines

Issued by

D. P. Franks
BSc, MMinRes
9 February 2022

Reviewed by

K. E. Spring
B.Sc. (Hons), MAppSc
9 February 2022

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GEOCHEMPET SERVICES, BRISBANE

Mac Geo Lab #:	S73419	**Date Sampled:**	Unknown
Geo Sample ID:	G22010035	**Date Received:**	14/01/2022
Sample Type:	Drill Core	**Borehole No.**:	BH4b
Project:	Oven Mountain (30018018)	**Depth**:	213.00 – 213.17 m

Work Requested Petrographic analysis and quartz content

Methods Adapted from ASTM C295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete* and the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)*

Identification Leucocratic granite

Description

The drill core specimen consists of a broadly light grey rock; in more detail the rock displays a mixture of light grey to pale grey feldspar, darker transparent grains of quartz and a few scattered darker biotite and opaque oxide grains in a slightly porphyritic rock of shallow intrusive style. The rock can only be very lightly scratched by a steel tool.

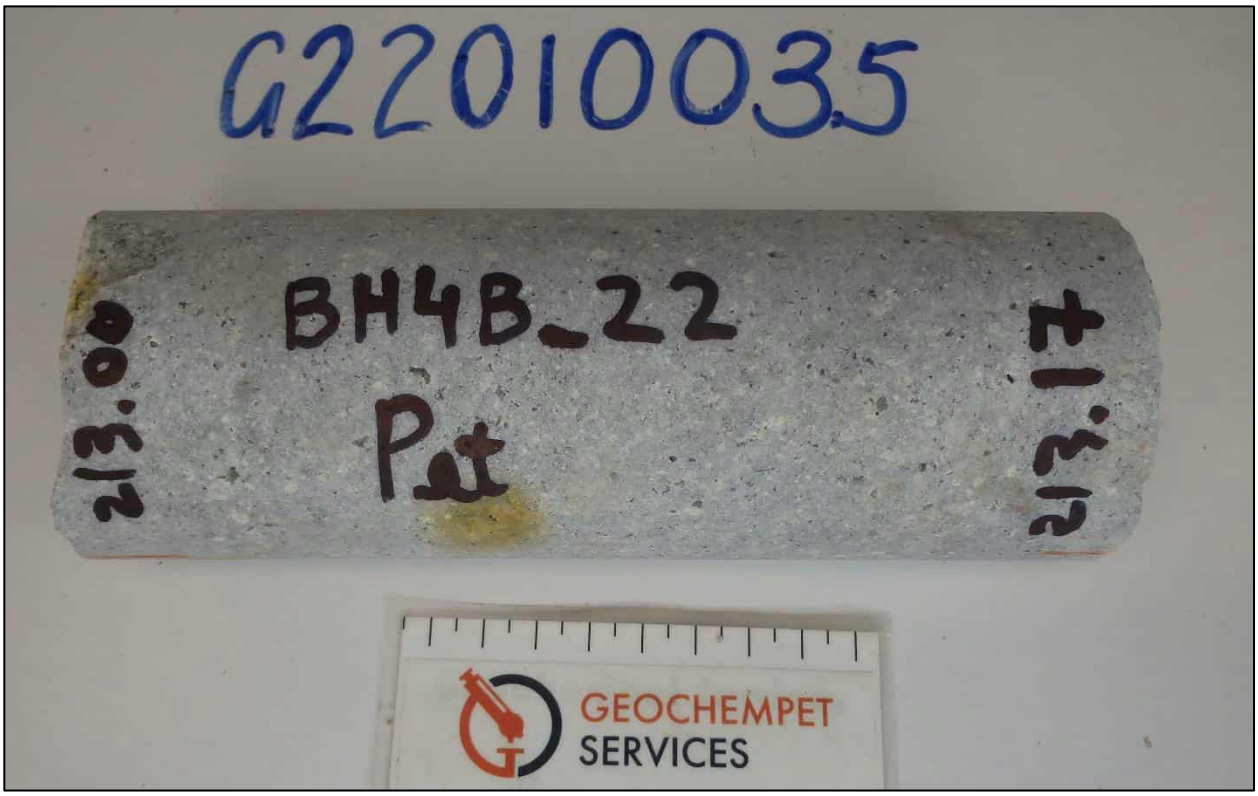


Image 1: Photograph of the supplied core sample.

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In order to permit detailed microscopic examination in transmitted, polarised light, a thin section was prepared from the drill core specimen. An approximate composition of the rock, expressed in volume percent and based on a brief count of 100 widely-spaced points in thin section, is:

Primary Minerals

47%	K-feldspar (orthoclase)
32%	quartz
15%	plagioclase feldspar
4%	biotite
<1%	opaque oxide
trace	zircon

Secondary Minerals

2%	chlorite
<1%	sericite/muscovite
trace	pyrite, epidote

Thin Section Description

In thin section, the rock display slightly porphyritic textures (phenocrysts around 5 mm size) in an allotriomorphic groundmass (mainly around 0.2 to 3 mm grainsize) of mainly medium-grained, crystalline textures of granitic style involving anhedral grains.

The most common primary minerals are generally fresh, micro-perthitic orthoclase feldspars, which in some cases have inverted to microcline in small patches. Common anhedral quartz grains show mostly mild straining, with some appearing to be in subtly micro-graphic intergrowths with feldspars. Plagioclase grains are generally fresh, but show some light sericite alteration, along with a few overprinting biotite flakes and opaque oxide grains. Accessory minerals occur as small pale brownish zircons.

Chlorite alteration of primary biotite flakes is present, along with some minor sericite/muscovite, and rare pyrite grains. Traces of epidote are also present, associated with chloritic alteration. There appears to be no evidence of metamorphic banding or schistosity.

Comments and Interpretations

The supplied drill core sample (labelled S73419) from BH4b at 213.00 – 213.17 m at the Oven Mountain Project is interpreted to be a leucocratic type of mainly medium-grained, crystalline, acid igneous rock which qualifies for broad identification as granite (using both International Union of Geological Sciences nomenclature and older established British/Australian conventions). The granite has been subject to strain but is regarded as lacking obvious metamorphic features such as foliation, however its leucocratic, largely quartzofeldspathic character may not tend to reveal the usual indications of metamorphism.

For engineering purposes, the rock in the supplied drill core sample may be summarised as:

- broadly **granite** or specifically **leuco-granite** (an intrusive acid igneous rock)
- mainly medium-grained
- holocrystalline
- essentially unweathered

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- slightly altered
- having a secondary mineral content of about 2% (chlorite, sericite, pyrite, and a trace of robust epidote)
- **hard**
- **strong**

The rock is predicted to be **durable**.

Free Silica Content

The rock has a free silica content of about 32%.

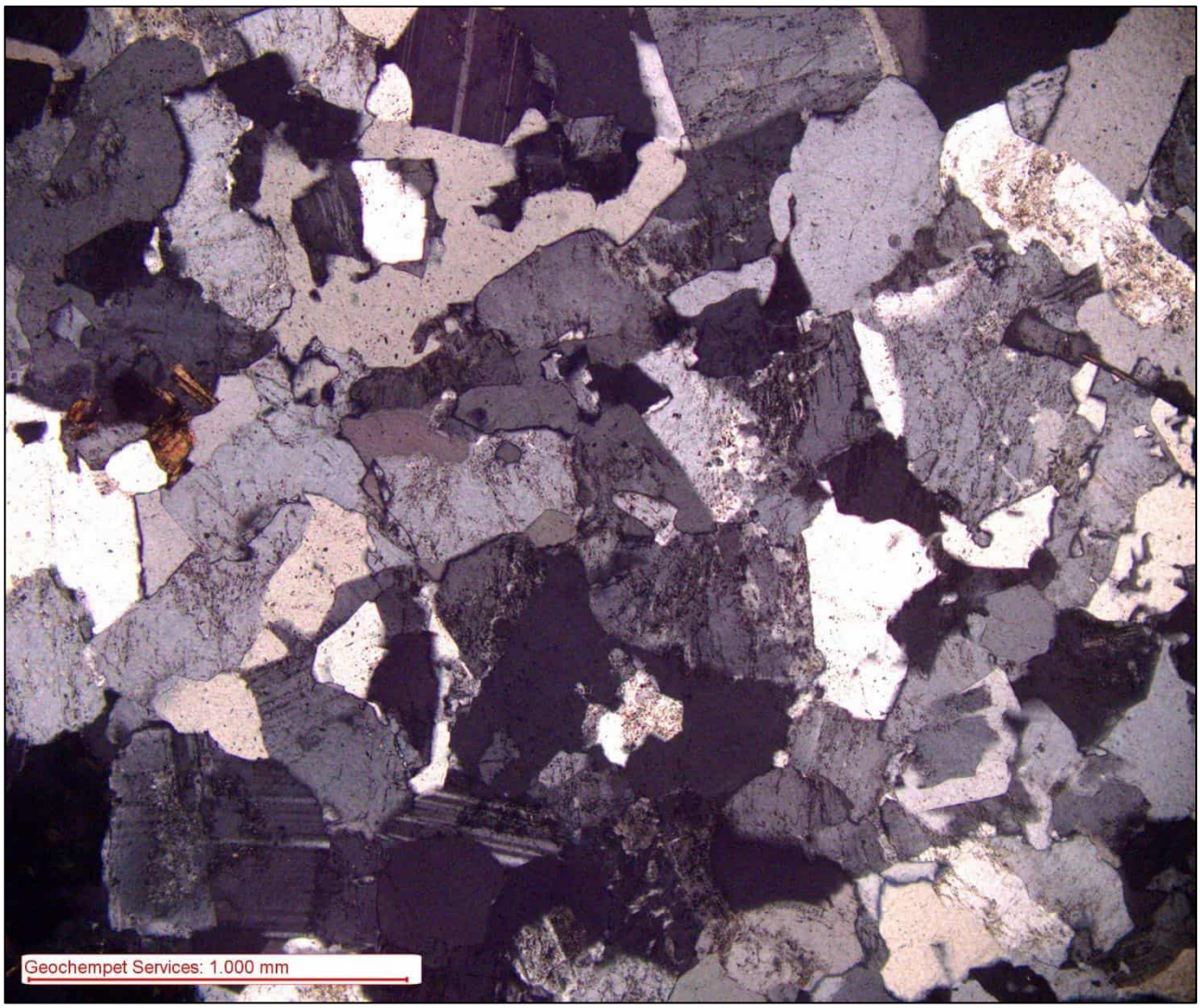


Image 2: Micrograph taken at low magnification with cross polarised transmitted light. Image shows the representative mineralogy, which is dominated by K-feldspar, quartz, and plagioclase. Note the biotite grain at left of image.

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XRF ANALYSIS ON A CORE SAMPLE (S73419) FROM OVEN MOUNTAIN

prepared for

MACQUARIE GEOTECH ALEXANDRIA, NSW

Purchase Order: S21430

Invoice Number: G2202524

Client Ref: Jasper Haines

Issued by

D. P. Franks
BSc, MMinRes
9 February 2022

Reviewed by

K. E. Spring
B.Sc. (Hons), MAppSc
9 February 2022

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GEOCHEMPET SERVICES, BRISBANE

XRF ANALYSIS
ON A ROCK SAMPLE (WOGQ-21/02562-Q01)

Mac Geo Lab #:	S73419	**Date Sampled:**	Unknown
Geo Sample ID:	G22010035	**Date Received:**	14/01/2022
Sample Type:	Drill Core	**Borehole No.**:	BH4b
Project:	Oven Mountain (30018018)	**Depth**:	213.00 – 213.17 m
Work Requested	X-ray fluorescence analysis on the rock sample		

Method

A sub-sample of the rock spalls was sent to ALS on 08/09/2021. The sub-samples were pulped and then investigated by X-ray fluorescence analysis through ALS Chemex. The XRF whole rock analysis determines the major oxides content of the rock as well as sulphides and loss of ignition. The XRF whole rock analysis determined the elemental oxide content within the rock using the ME-XRF26 method, along with loss of ignition using the ME-GRA05 method.

Results

The elemental oxide XRF results are (in weight percent):

Al2O3	12.24%
BaO	0.03%
CaO	0.54%
Cr2O3	<0.01%
Fe2O3	2%
K2O	5.05%
MgO	0.23%
MnO	0.03%
Na2O	3.21%
P2O5	0.02%
SO3	0.04%
SiO2	76.45%
SrO	0.01%
TiO2	0.11%
Loss on ignition	0.16%

- composition is determined in weight % and is calculated from a very small sub-sample of the original rock sample.
- determining composition of a rock by XRF is complicated by some minerals which have a continuous range of compositions dependent on elemental variations and the same oxides being present in more than one mineral and in different combinations.

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- Combinations of more than three minerals in a rock sample can make identification of the mineral assemblage extremely difficult (ie. prone to misidentification of minerals)

Comments

The supplied core sample from Oven Mountain is considered to crushed and screened from granite, a crystalline, acid igneous rock. From XRF analysis, the rock content is composed of 76.45% SiO_2, representing an acid igneous rock type, likely from the feldspars and quartz minerals, 12.24% of Al_2O_3, 5.05% K_2O, 3.21%, Na_2O, and 0.54% CaO are likely from feldspar and mica minerals and 2.0% Fe_2O_3 and 0.23% MgO from the biotite and chlorite. The 0.04% SO_3 probably represents a trace of pyrite. The 0.16% loss on ignition is likely to represent water loss from soft, weak minerals.

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Slake Durability Index Report

Client	SMEC	**Source**	BH4b 5.00-5.26m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S72997-SD
Job No.	S21430-1	**Lab No.**	S72997

Test Procedure	AS 4133.3.4 Rock swelling and slake durability tests-Determination of the slake durability index rock samples		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Preparation	Prepared in accordance with the test method	**Date Tested**	29/12/2021

Slake Durability Index (Second Cycle)	99.6 %
Slake Durability Index (First Cycle)	99.8 %
Nature of Slaking Fluid	Sydney Tap Water
Temperature of Slaking Fluid	29.2 ^{o}C
Appearance of Fragments Retained in Drum	Angular
Appearance of Material Passing Through Drum	Cloudy Water, Fine to Medium Grained Material

Notes

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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
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Results relate only to the samples tested.

NATA Accredited Laboratory Number: 14874

Authorised Signatory: Date:



19/01/2022

Chris Lloyd

Macquarie Geotechnical

U7/8 10 Bradford Street
Alexandria NSW 2015

Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 9.56-9.90m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S72998-UCS
Job No.	S21430-1	**Lab No.**	S72998
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 142 MPa

Date Tested:	20/12/2021		Moisture Content:	0.2	%
Specimen Height:	173.7	mm	Duration of Test:	750	seconds
Average Specimen Diameter:	61.0	mm			
Failure Type:	Tensile dominated				
Other Pertinent Observations:					

Notes

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NATA Accredited Laboratory Number: 14874

Authorised Signatory

Date 21/12/2021

Chris Lloyd

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 16.15-16.40m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S72999-UCS
Job No.	S21430-1	**Lab No.**	S72999
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 121 MPa

Date Tested:	20/12/2021		Moisture Content:	0.2	%
Specimen Height:	175.8	mm	Duration of Test:	681	seconds
Average Specimen Diameter:	61.0	mm			
Failure Type:	Tensile dominated				
Other Pertinent Observations:					

Notes

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NATA Accredited Laboratory Number: 14874

Authorised Signatory: Chris Lloyd

Date: 21/12/2021

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 46.01-46.27m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73003-UCS
Job No.	S21430-1	**Lab No.**	S73003
Test Procedure	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 113 MPa

Date Tested:	20/12/2021		Moisture Content:	0.1	%
Specimen Height:	122.7	mm	Duration of Test:	672	seconds
Average Specimen Diameter:	61.0	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Tensile dominated				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

Notes

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NATA Accredited Laboratory Number: 14874

Authorised Signatory

Chris Lloyd

Date

21/12/2021

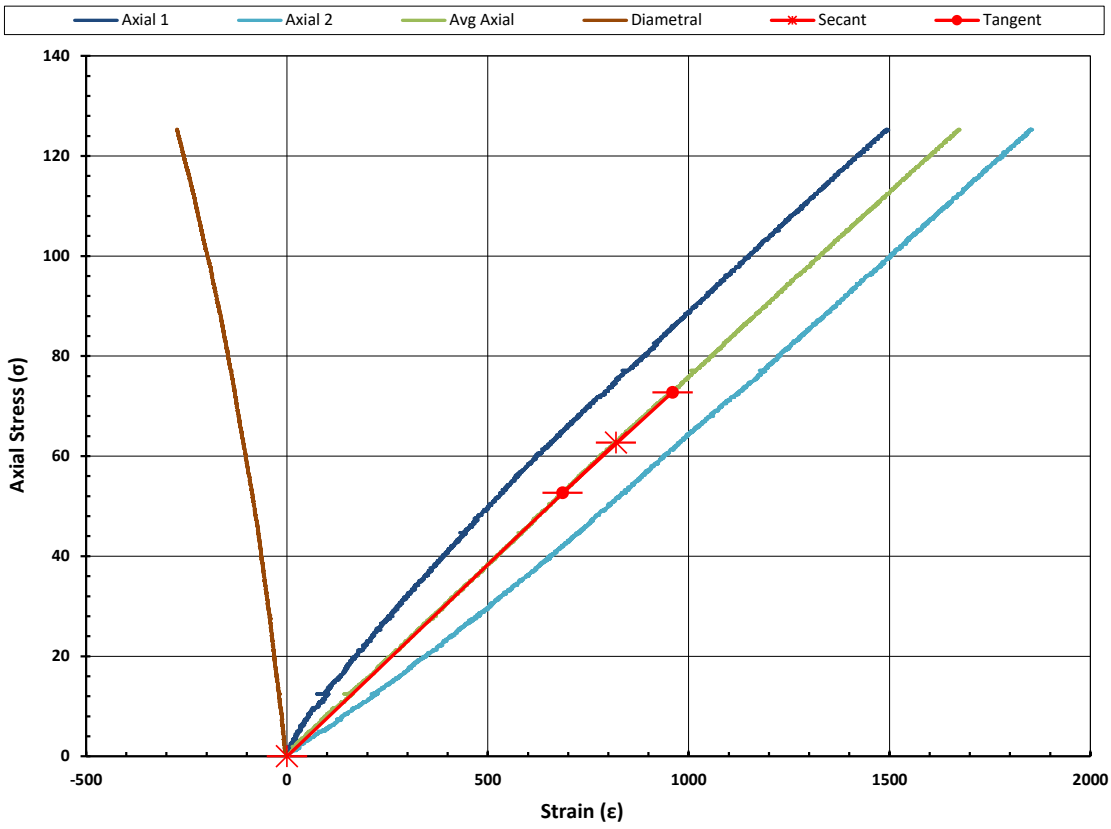
Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

Deformability of Rock Materials in Uniaxial Compression

Client	SMEC	**Sample Source**	BH4b 66.00-66.36m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report #**	S73004-MOD
Job #	S21430-1	**Sample #**	S73004

Test Procedure	AS 4133.4.3.1 Deformability of rock materials in uniaxial compression-Strengths of 50 MPa and greater		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Axial Stress vs Strain Plots



Uniaxial Compressive Strength **143** **MPa**

	Young's Modulus	Poisson's Ratio	
Tangent	73.3 GPa	0.13	from 42 % to 58 % of Max UCS
Secant	76.6 GPa	0.13	from 0 % to 50 % of Max UCS

Notes

Graphical representation of stress/ strain data by extensometer measurement is limited due to fracturing within the specimen.

NATA

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

Date: 4/01/2022

MACQUARIE GEOTECH

Unit 7 & 8, 10 Bradford Street
Alexandria NSW 2015

Deformability of Rock Materials in Uniaxial Compression

Client	SMEC	**Sample Source**	BH4b 66.00-66.36m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report #**	S73004-MOD
Job #	S21430-1	**Sample #**	S73004

Test Procedure	AS 4133.4.3.1 Deformability of rock materials in uniaxial compression-Strengths of 50 MPa and greater		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Average Specimen Diameter (mm)	61.0	**Moisture Content (%)**	0
Average Specimen Height (mm)	173	**Wet Density (t/m^3)**	2.70
Length to Diameter Ratio	2.8	**Dry Density (t/m^3)**	2.70
Duration of Test (min)	50.30	**Rate of Loading (MPa/min):**	2.4918356
Date of Test:	20/12/21	**Specimen Curing**	-
Mode of Failure	Tensile dominated	**Test Apparatus**	VJ Tech Triplex Load Frame with Axial and Circumferential Extensometers



Before Test



After Test

Uniaxial Compressive Strength **143** **MPa**

	Young's Modulus	Poisson's Ratio	
Tangent	73.3 GPa	0.13	from 42 % to 58 % of Max UCS
Secant	76.6 GPa	0.13	from 0 % to 50 % of Max UCS

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Authorised Signatory:

Chris Lloyd

Date: 4/01/2022

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Sound Velocity by Ultrasonic Pulse Transmission Technique Report

Client	SMEC	**Source**	BH4b 66.00-66.36m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Rock Type**	Rock Core
Project	Oven Mountain (30018018)	**Report No**	S73004-SV
Job No	S21430-1	**Lab No**	S73004

Test Procedure	ISRM Suggested Method for Determining Sound Velocity by Ultrasonic Pulse Transmission Technique		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Preparation	Prepared in accordance with AS 4133.4.3.2	**Date Tested**	17/12/21

Specimen Details		**Test Details**	
Specimen Condition	Moist	Testing Apparatus	Proceq Pundit PL-2
Storage History	Sealed		
Curing & Environment	Sealed at as-received moisture condition	Calibration Date	17/12/2021
Specimen Shape	Cylinder	Calibration Method	Reference Rod
Specimen Diameter *mm*	61.0	Transducer Configuration	Direct Transmission
Specimen Height *mm*	173.0	Coupling Medium	Ultrasound Gel
Moisture Content *%*	0.0	Coupling Type	Manual
Wet Density t/m^3	2.7	Level of Coupling Force	Firm

Test Results	
P-wave Velocity *m/s*	5871
S-wave Velocity *m/s*	3640

Notes

Authorised Signatory: Date



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Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 89.00-89.36m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73005-UCS
Job No.	S21430-1	**Lab No.**	S73005
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 173 MPa

Date Tested:	20/12/2021		Moisture Content:	0.1	%
Specimen Height:	174.4	mm	Duration of Test:	803	seconds
Average Specimen Diameter:	61.0	mm			
Failure Type:	Tensile dominated				
Other Pertinent Observations:					

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Slake Durability Index Report

Client	SMEC	**Source**	BH4b 98.00-98.31m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73007-SD
Job No.	S21430-1	**Lab No.**	S73007

Test Procedure	AS 4133.3.4 Rock swelling and slake durability tests-Determination of the slake durability index rock samples		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Preparation	Prepared in accordance with the test method	**Date Tested**	29/12/2021

Slake Durability Index (Second Cycle)	99.8 %
Slake Durability Index (First Cycle)	99.9 %
Nature of Slaking Fluid	Sydney Tap Water
Temperature of Slaking Fluid	29.3 ^{o}C
Appearance of Fragments Retained in Drum	Angular
Appearance of Material Passing Through Drum	Lightly Cloudy Water, Fine to Medium Grained Material

Notes

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Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 129.10-129.31m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73008-UCS
Job No.	S21430-1	**Lab No.**	S73008
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 123 MPa

Date Tested:	20/12/2021		Moisture Content:	0.4	%
Specimen Height:	176.1	mm	Duration of Test:	688	seconds
Average Specimen Diameter:	61.0	mm			
Failure Type:	Tensile dominated				
Other Pertinent Observations:					

Notes

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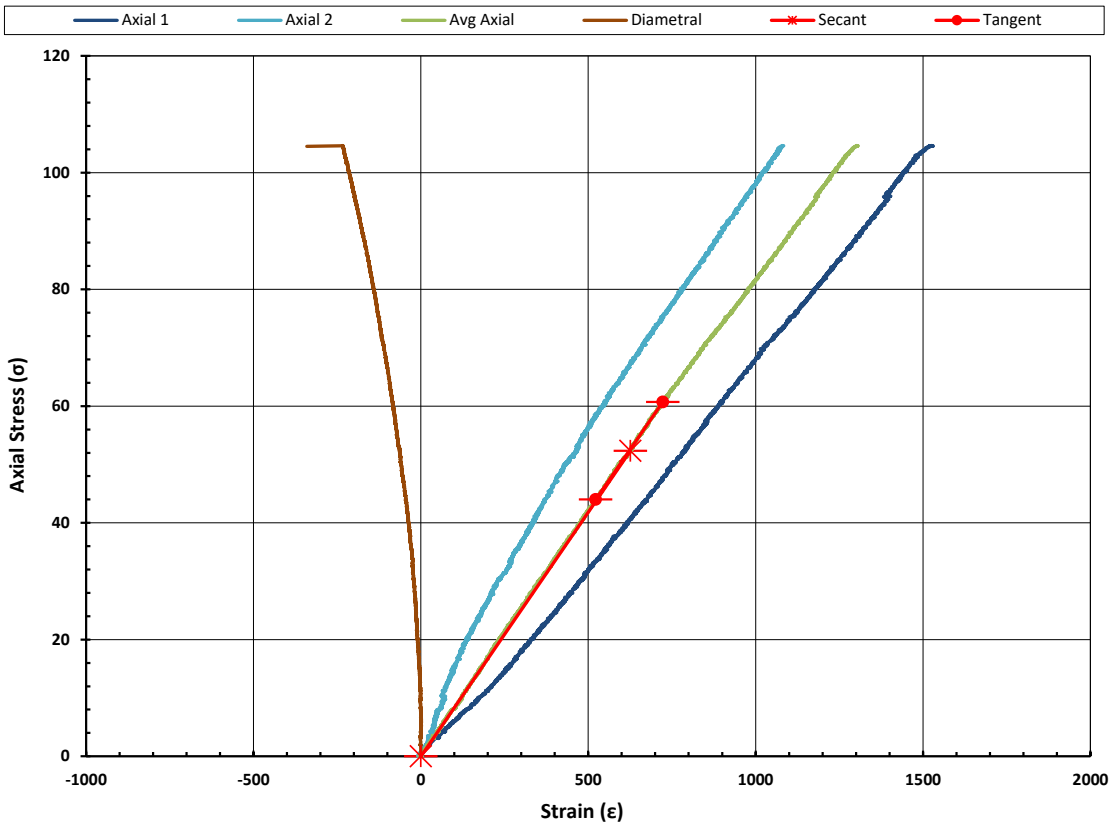
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Deformability of Rock Materials in Uniaxial Compression

Client	SMEC	**Sample Source**	BH4b 126.00-126.27m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report #**	S73009-MOD
Job #	S21430-1	**Sample #**	S73009

Test Procedure	AS 4133.4.3.1 Deformability of rock materials in uniaxial compression-Strengths of 50 MPa and greater		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Axial Stress vs Strain Plots



Uniaxial Compressive Strength **126** **MPa**

	Young's Modulus	Poisson's Ratio	
Tangent	83.2 GPa	0.12	from 42 % to 58 % of Max UCS
Secant	83.6 GPa	0.10	from 0 % to 50 % of Max UCS

Notes

Graphical representation of stress/ strain data by extensometer measurement is limited due to fracturing within the specimen.

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Deformability of Rock Materials in Uniaxial Compression

Client	SMEC	**Sample Source**	BH4b 126.00-126.27m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report #**	S73009-MOD
Job #	S21430-1	**Sample #**	S73009

Test Procedure	AS 4133.4.3.1 Deformability of rock materials in uniaxial compression-Strengths of 50 MPa and greater		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Average Specimen Diameter (mm)	61.0	**Moisture Content (%)**	0
Average Specimen Height (mm)	177	**Wet Density (t/m^3)**	2.65
Length to Diameter Ratio	2.9	**Dry Density (t/m^3)**	2.64
Duration of Test (min)	49.98	**Rate of Loading (MPa/min):**	2.0934645
Date of Test:	21/12/21	**Specimen Curing**	-
Mode of Failure	Tensile dominated	**Test Apparatus**	Matest Compression Machine with Axial and Circumferential Extensometers.



Before Test



After Test

Uniaxial Compressive Strength **126** **MPa**

	Young's Modulus	Poisson's Ratio	
Tangent	83.2 GPa	0.12	from 42 % to 58 % of Max UCS
Secant	83.6 GPa	0.10	from 0 % to 50 % of Max UCS

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Sound Velocity by Ultrasonic Pulse Transmission Technique Report

Client	SMEC	**Source**	BH4b 126.00-126.27m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Rock Type**	Rock Core
Project	Oven Mountain (30018018)	**Report No**	S73009-SV
Job No	S21430-1	**Lab No**	S73009

Test Procedure	ISRM Suggested Method for Determining Sound Velocity by Ultrasonic Pulse Transmission Technique		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Preparation	Prepared in accordance with AS 4133.4.3.2	**Date Tested**	17/12/21

Specimen Details		**Test Details**	
Specimen Condition	Moist	Testing Apparatus	Proceq Pundit PL-2
Storage History	Sealed		
Curing & Environment	Sealed at as-received moisture condition	Calibration Date	17/12/2021
Specimen Shape	Cylinder	Calibration Method	Reference Rod
Specimen Diameter *mm*	61.0	Transducer Configuration	Direct Transmission
Specimen Height *mm*	177.0	Coupling Medium	Ultrasound Gel
Moisture Content *%*	0.0	Coupling Type	Manual
Wet Density t/m^3	2.65	Level of Coupling Force	Firm

Test Results	
P-wave Velocity *m/s*	5671
S-wave Velocity *m/s*	3708

Notes

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Slake Durability Index Report

Client	SMEC	**Source**	BH4b 64.19-64.61m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73012-SD
Job No.	S21430-1	**Lab No.**	S73012

Test Procedure	AS 4133.3.4 Rock swelling and slake durability tests-Determination of the slake durability index rock samples		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Preparation	Prepared in accordance with the test method	**Date Tested**	29/12/2021

Slake Durability Index (Second Cycle)	99.7 %
Slake Durability Index (First Cycle)	99.8 %
Nature of Slaking Fluid	Sydney Tap Water
Temperature of Slaking Fluid	25 ^{o}C
Appearance of Fragments Retained in Drum	Angular
Appearance of Material Passing Through Drum	Lightly Cloudy Water, Minor Fine Grained Material

Notes

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Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 134.62-135m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Sandstone
Project	Oven Mountain (30018018)	**Report No.**	S73013-UCS
Job No.	S21430-1	**Lab No.**	S73013
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 103 MPa

Date Tested:	20/12/2021	Moisture Content:	0.2 %
Specimen Height:	175.3 mm	Duration of Test:	640 seconds
Average Specimen Diameter:	61.0 mm		
Failure Type:	Tensile dominated		
Other Pertinent Observations:			

Notes

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Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 173.62-174.00m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73415-UCS
Job No.	S21430-1	**Lab No.**	S73415
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 163 MPa

Date Tested:	17/12/2021		Moisture Content:	0.4	%
Specimen Height:	173.6	mm	Duration of Test:	754	seconds
Average Specimen Diameter:	61.0	mm			
Failure Type:	Tensile dominated				
Other Pertinent Observations:					

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SPLITTING TENSILE STRENGTH OF ROCK REPORT

Client	SMEC	**Source**	BH4b 182.77-183.00m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	
Project	Oven Mountain (30018018)	**Report No.**	S73416-IT
Job No.	S21430-1	**Lab No.**	S73416

Test Procedure ☑ ASTM D3967-16 Standard Test Method for Splitting Tensile Strength of Intact Rock Core Specimens

Sampling Sampled by Client - results apply to the sample as received **Date Sampled** Unknown

Preparation Prepared in accordance with the test method

Date Tested:	17/12/2021
Sample Storage Environment:	Sealed
Type of Contact Between the Specimen and the Loading Platens	Curved bearing plates



Before Test



After Test

TEST RESULTS

Average Diameter (mm)	Average Thickness (mm)	Thickness/ Diameter Ratio	Specimen Moisture Condition	Rate of Loading (MPa/s)	Duration of Test (s)	Type and Location of Failure	Moisture Content at Time of Test (%)	Splitting Tensile Strength (MPa)
61.0	36.3	0.6	As received	0.01	493	Vertical	0.4	**6.49**

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Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 200.85-201.00m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73418-UCS
Job No.	S21430-1	**Lab No.**	S73418
Test Procedure	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 221 MPa

Date Tested:	17/12/2021		Moisture Content:	0.5	%
Specimen Height:	129.9	mm	Duration of Test:	866	seconds
Average Specimen Diameter:	61.0	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

Notes

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SPLITTING TENSILE STRENGTH OF ROCK REPORT

Client	SMEC	**Source**	BH4b 301.30-301.60m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73420-IT
Job No.	S21430-1	**Lab No.**	S73420

Test Procedure ☑ ASTM D3967-16 Standard Test Method for Splitting Tensile Strength of Intact Rock Core Specimens

Sampling Sampled by Client - results apply to the sample as received **Date Sampled** Unknown

Preparation Prepared in accordance with the test method

Date Tested:	17/12/2021
Sample Storage Environment:	Sealed
Type of Contact Between the Specimen and the Loading Platens	Curved bearing plates



Before Test



After Test

TEST RESULTS

Average Diameter (mm)	Average Thickness (mm)	Thickness/ Diameter Ratio	Specimen Moisture Condition	Rate of Loading (MPa/s)	Duration of Test (s)	Type and Location of Failure	Moisture Content at Time of Test (%)	Splitting Tensile Strength (MPa)
61.0	33.6	0.6	As received	0.01	521	Vertical	0.4	**7.41**

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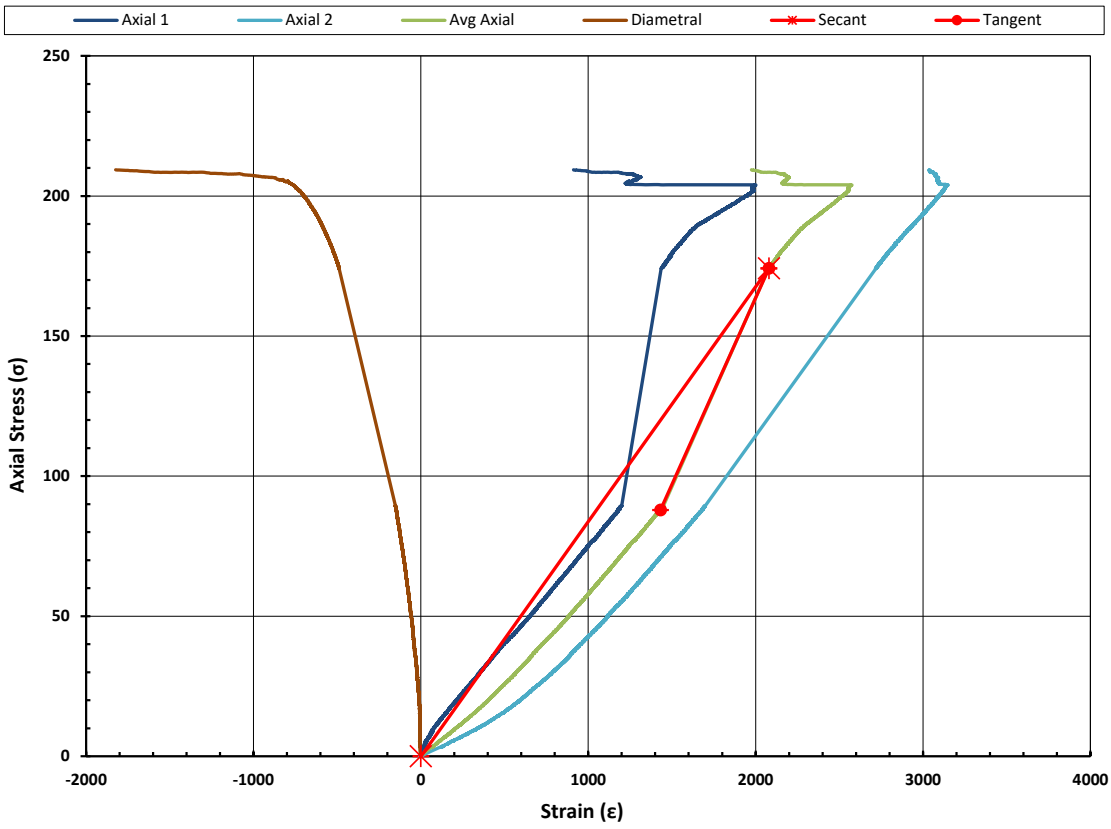
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Deformability of Rock Materials in Uniaxial Compression

Client	SMEC	**Sample Source**	BH4b 301.00-301.30m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report #**	S73420-MOD
Job #	S21430-1	**Sample #**	S73420

Test Procedure	AS 4133.4.3.1 Deformability of rock materials in uniaxial compression-Strengths of 50 MPa and greater		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Axial Stress vs Strain Plots



Uniaxial Compressive Strength	**209**	**MPa**

	Young's Modulus	Poisson's Ratio	
Tangent	133.0 GPa	0.24	from 42 % to 58 % of Max UCS
Secant	83.8 GPa	0.24	from 0 % to 50 % of Max UCS

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Deformability of Rock Materials in Uniaxial Compression

Client	SMEC	**Sample Source**	BH4b 301.00-301.30m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report #**	S73420-MOD
Job #	S21430-1	**Sample #**	S73420

Test Procedure	AS 4133.4.3.1 Deformability of rock materials in uniaxial compression-Strengths of 50 MPa and greater		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Average Specimen Diameter (mm)	61.0	**Moisture Content (%)**	0
Average Specimen Height (mm)	173	**Wet Density (t/m^3)**	2.61
Length to Diameter Ratio	2.8	**Dry Density (t/m^3)**	2.60
Duration of Test (min)	100.47	**Rate of Loading (MPa/min):**	2.083706
Date of Test:	21/12/21	**Specimen Curing**	-
Mode of Failure	Mixed mode	**Test Apparatus**	Matest Compression Machine with Axial and Circumferential Extensometers.



Before Test


After Test

Uniaxial Compressive Strength **209** **MPa**

	Young's Modulus	Poisson's Ratio	
Tangent	133.0 GPa	0.24	from 42 % to 58 % of Max UCS
Secant	83.8 GPa	0.24	from 0 % to 50 % of Max UCS

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Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 301.60-302.00m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73420-UCS
Job No.	S21430-1	**Lab No.**	S73420
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 176 MPa

Date Tested:	17/12/2021		Moisture Content:	0.4	%
Specimen Height:	174.2	mm	Duration of Test:	795	seconds
Average Specimen Diameter:	61.0	mm			
Failure Type:	Mixed mode				
Other Pertinent Observations:					

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Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 264.00-264.20m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73421-UCS
Job No.	S21430-1	**Lab No.**	S73421
Test Procedure	AS 4133.4.2.1 Determination of uniaxial compressive strength of 50 MPa and greater		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 148 MPa

Date Tested:	17/12/2021	Moisture Content:	0.4 %
Specimen Height:	172.1 mm	Duration of Test:	711 seconds
Average Specimen Diameter:	61.0 mm		
Failure Type:	Single shear plane		
Other Pertinent Observations:			

Notes

Accredited for compliance with ISO/IEC 17025 - Testing.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
This document shall not be reproduced, except in full.
Results relate only to the samples tested.

NATA Accredited Laboratory Number: 14874

Authorised Signatory: Chris Lloyd

Date: 21/12/2021

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

Uniaxial Compressive Strength

Client	SMEC	**Sample Source**	BH4b 268.00-268.31m
Address	Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia	**Sample Description**	Rock Core
Project	Oven Mountain (30018018)	**Report No.**	S73424-UCS
Job No.	S21430-1	**Lab No.**	S73424
Test Procedure	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine	Matest 2000 kN Compression Machine	**Sample Curing**	-
Sampling Method	Sampled by Client - results apply to the sample as received	**Date Sampled**	Unknown
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition





Uniaxial Compressive Strength 118 MPa

Date Tested:	17/12/2021		Moisture Content:	0.3	%
Specimen Height:	173.6	mm	Duration of Test:	629	seconds
Average Specimen Diameter:	61.0	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					

Notes

Accredited for compliance with ISO/IEC 17025 - Testing.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
This document shall not be reproduced, except in full.
Results relate only to the samples tested.

NATA Accredited Laboratory Number: 14874

Authorised Signatory: Chris Lloyd

Date: 21/12/2021

MACQUARIE GEOTECH

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

Bamford Rock Testing Services

239 Arden Street, North Melbourne, Vic 3051 Australia
Telephone : (03) 9329 2818 email : tests@bamfordrocks.com.au ABN : 78 167 341 693

NATA Accredited Facility No. 19523 Accredited for compliance with ISO/IEC 17025 - Testing

REPORT 1606
ON
ROCK TESTING

(BRTS JOB NUMBER 1606)

Client : Macquarie Geotechnical

Project : Oven Mountain – 30018018

Reference : S21430

17th January, 2022

BRTS
Bamford Rock Testing Services

239 ARDEN STREET, NORTH MELBOURNE, 3051 AUSTRALIA
NATA Accredited Facility No. 19523

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Test Request No. : 1606
Date Received: 21 December 2021
Client: Macquarie Geotechnical
Project: Oven Mountain
Location: 30018018
Reference: S21430

CERCHAR Abrasiveness Index Test

(ASTM D7625-10)

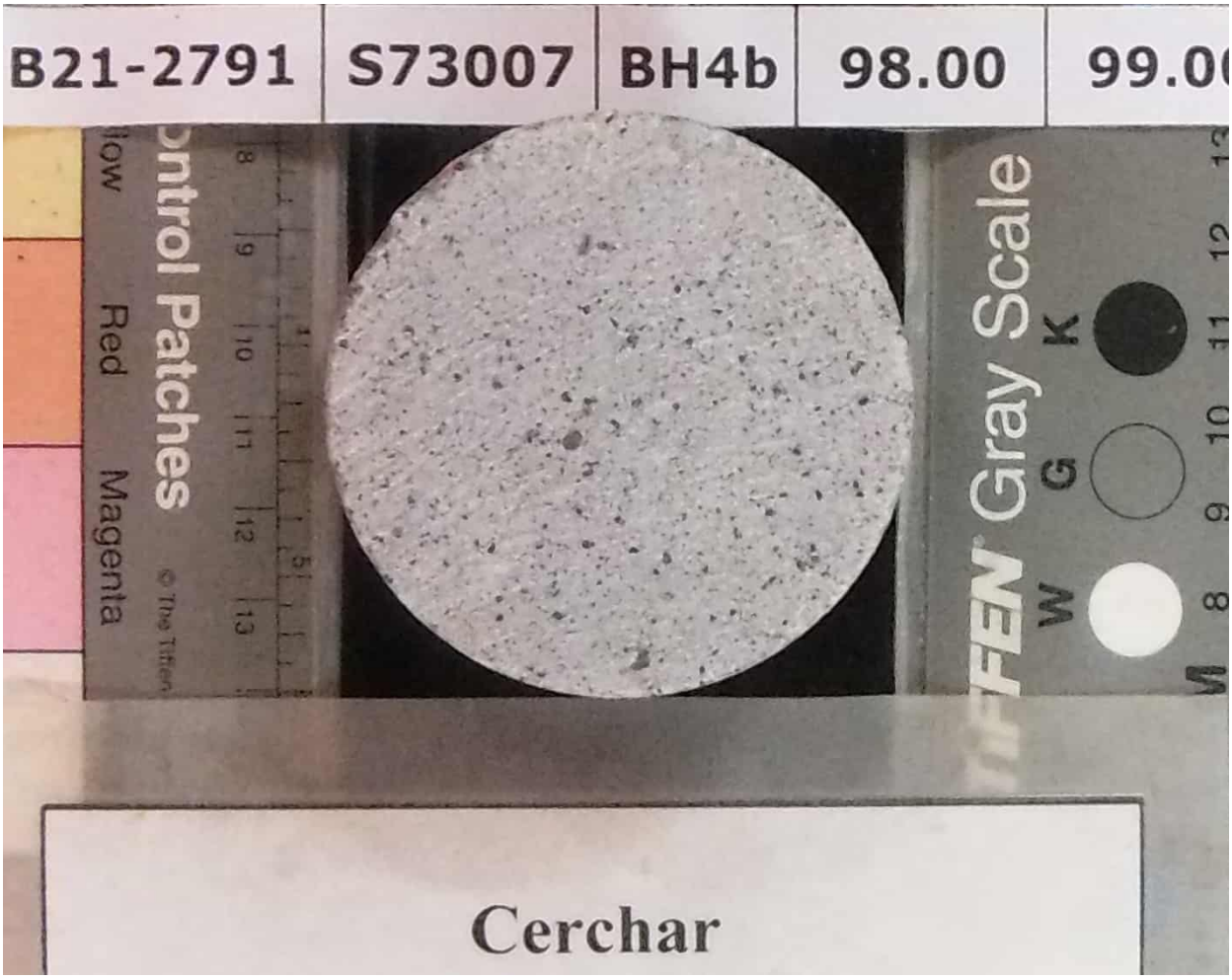
BRTS Sample Number	B21-2791	B21-2792	B21-2793
Client's Sample Number	S73007	S73012	S73417
Lithology	Granite	Granite	Granite
Borehole	BH4b	BH4b	BH4b
Depth from (m)	98.00	64.19	200.00
Depth to (m)	99.00	66.00	200.85
CERCHAR Abrasivity Index (CAI)	**6 ± 0.1**	**4.3 ± 0.1**	**5.7 ± 0.1**
Sandvik Mining Test Classification of CAI (2007)	*Extremely Abrasive*	*Highly Abrasive*	*Extremely Abrasive*
ASTM D7625-10 Classification of CAI (2010)	*Extreme Abrasiveness*	*Extreme Abrasiveness*	*Extreme Abrasiveness*
Mohs Hardness (Approximate)	*5.6*	*5.2*	*5.6*

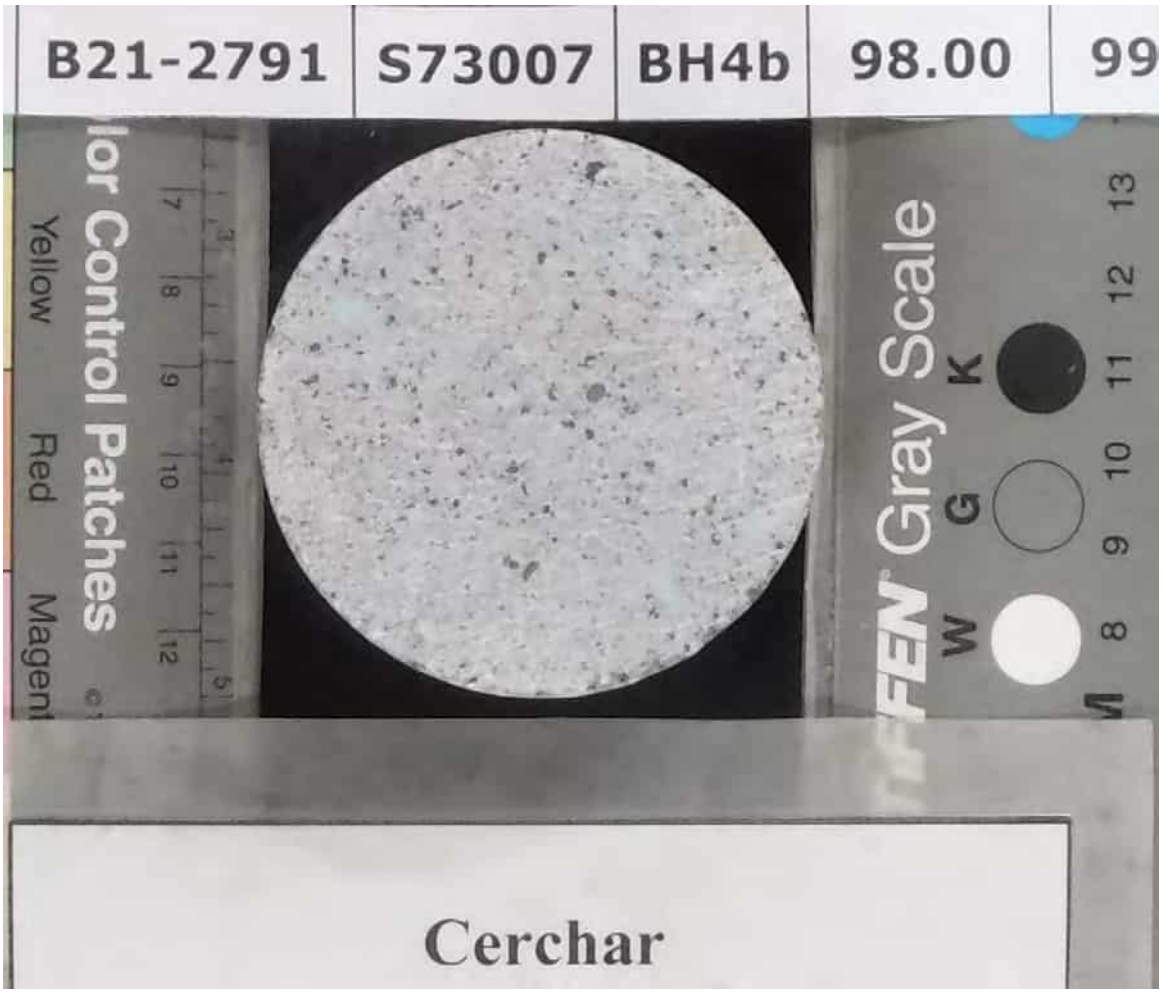
Rockwell Hardness HRC of stylus = 55 ± 1

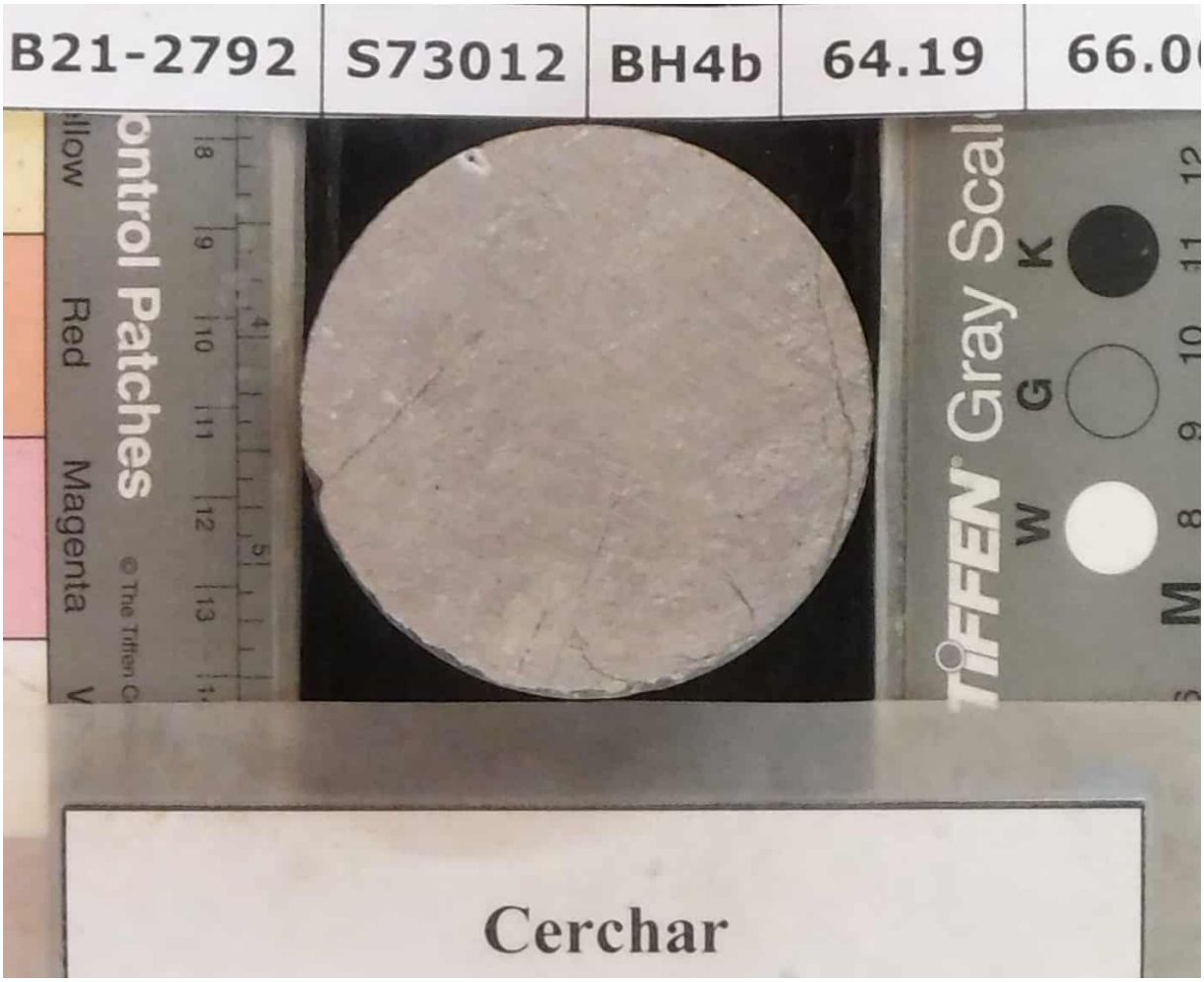
Date tested: 13/01/2022 - 14/01/2022

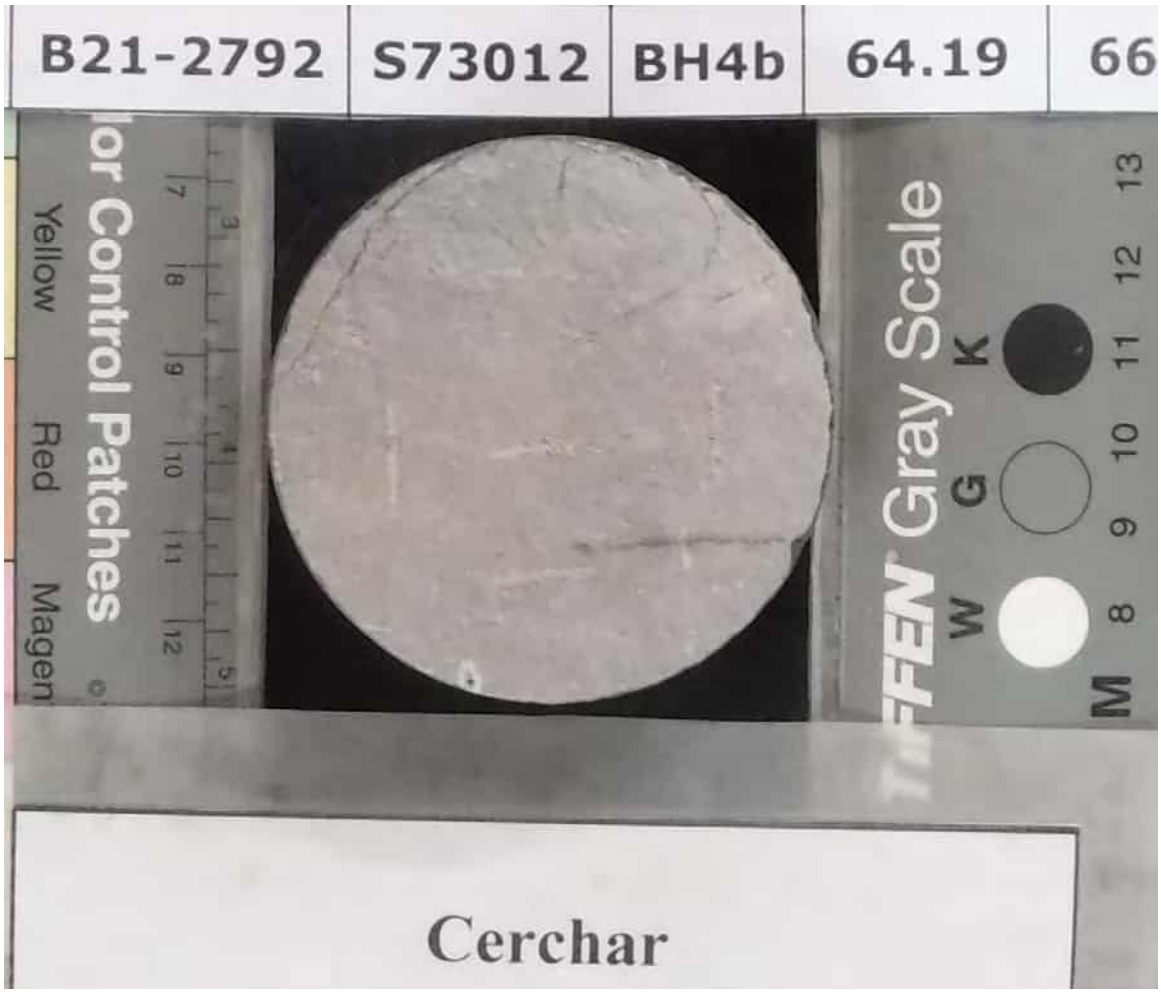
X
Dr W.E. Bamford
Director

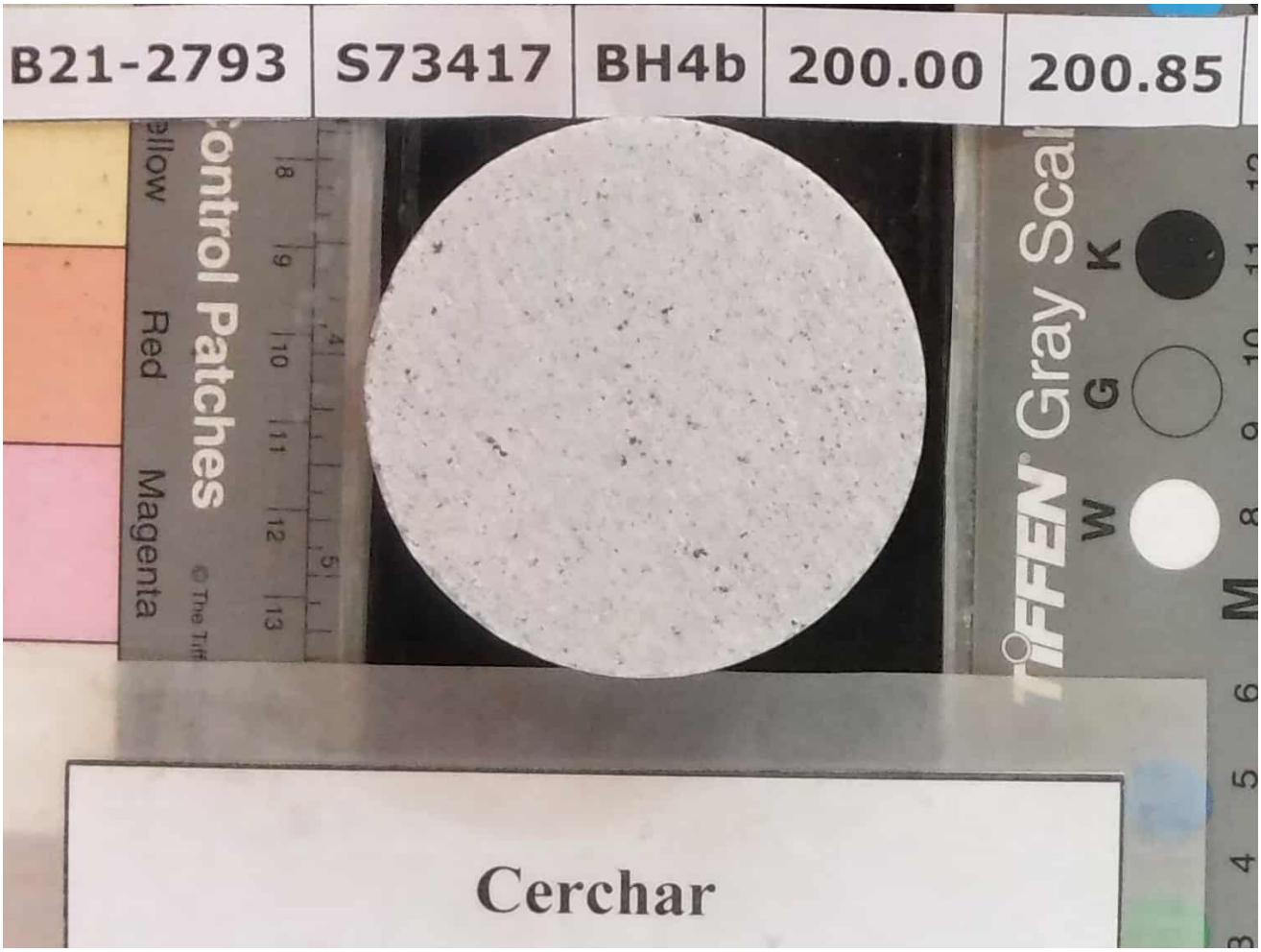
X
Dr D. Palamakumbure
Lab Manager

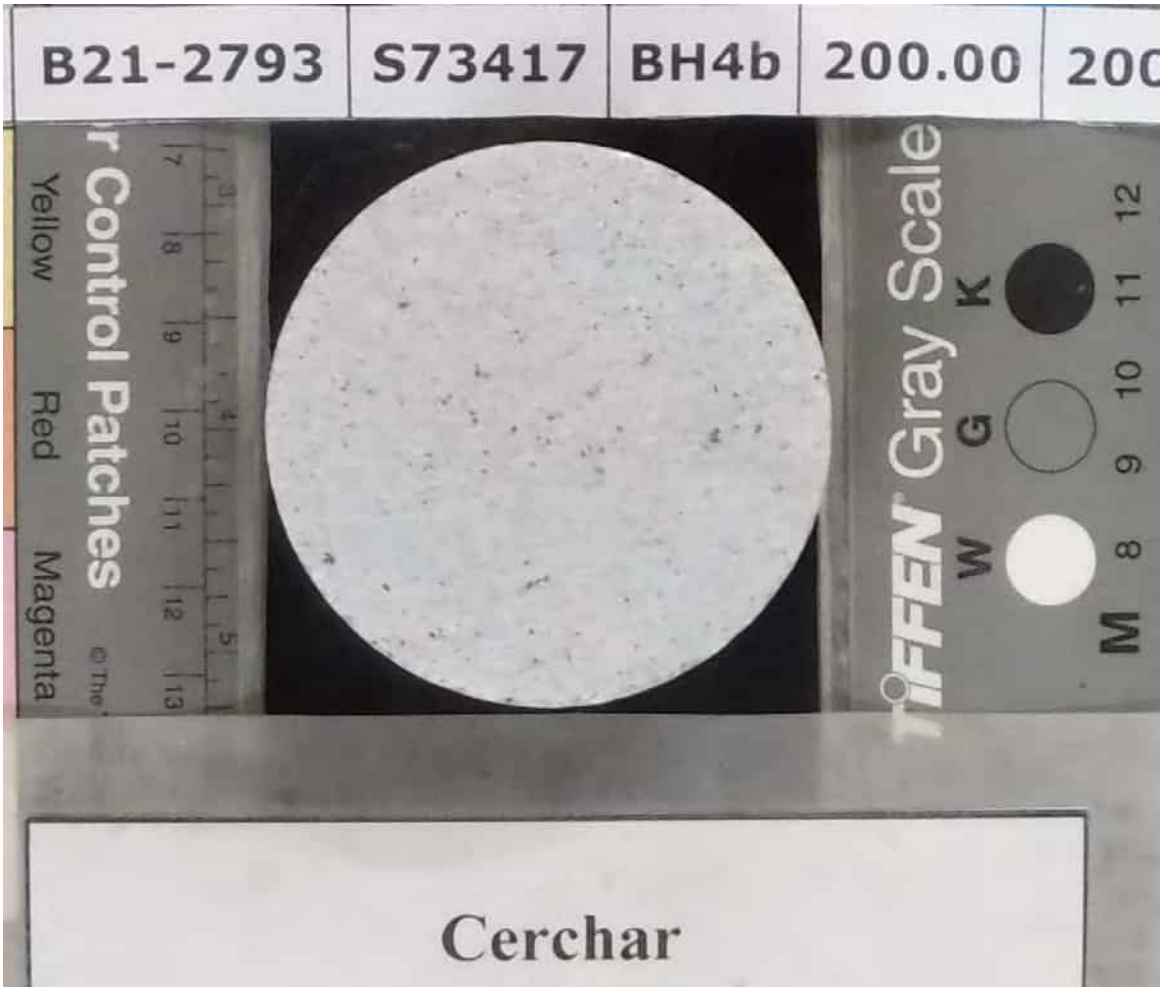

B21-2791
S73007
BH4b
98.00
Control Patches
Red
Magenta
Gray Scale
K
G
W
Cerchar


B21-2791
S73007
BH4b
98.00
Yellow
Red
Gray Scale
K
G
W
Cerchar


B21-2792
S73012
BH4b
64.19
Control Patches
Gray Scale
Cerchar


B21-2792
S73012
BH4b
64.19
Control Patches
Yellow
Red
Gray Scale
Cerchar


B21-2793
S73417
BH4b
200.00
200.85
Control Patches
Yellow
Red
Magenta
TIFFEN Gray Scale
W
G
K
M
Cerchar


B21-2793
S73417
BH4b
200.00
Control Patches
Yellow
Red
Magenta
TIFFEN Gray Scale
W
G
K
M
Cerchar

Bamford Rock Testing Services
239 ARDEN STREET, NORTH MELBOURNE, 3051 AUSTRALIA
NATA Accredited Facility No. 19523

Test Request No. : 1606
Date Received: 21 December 2021
Client: Macquarie Geotechnical
Project: Oven Mountain
Location: 30018018
Reference: S21430

SIEVERS J-VALUE (SJ) TEST RESULTS

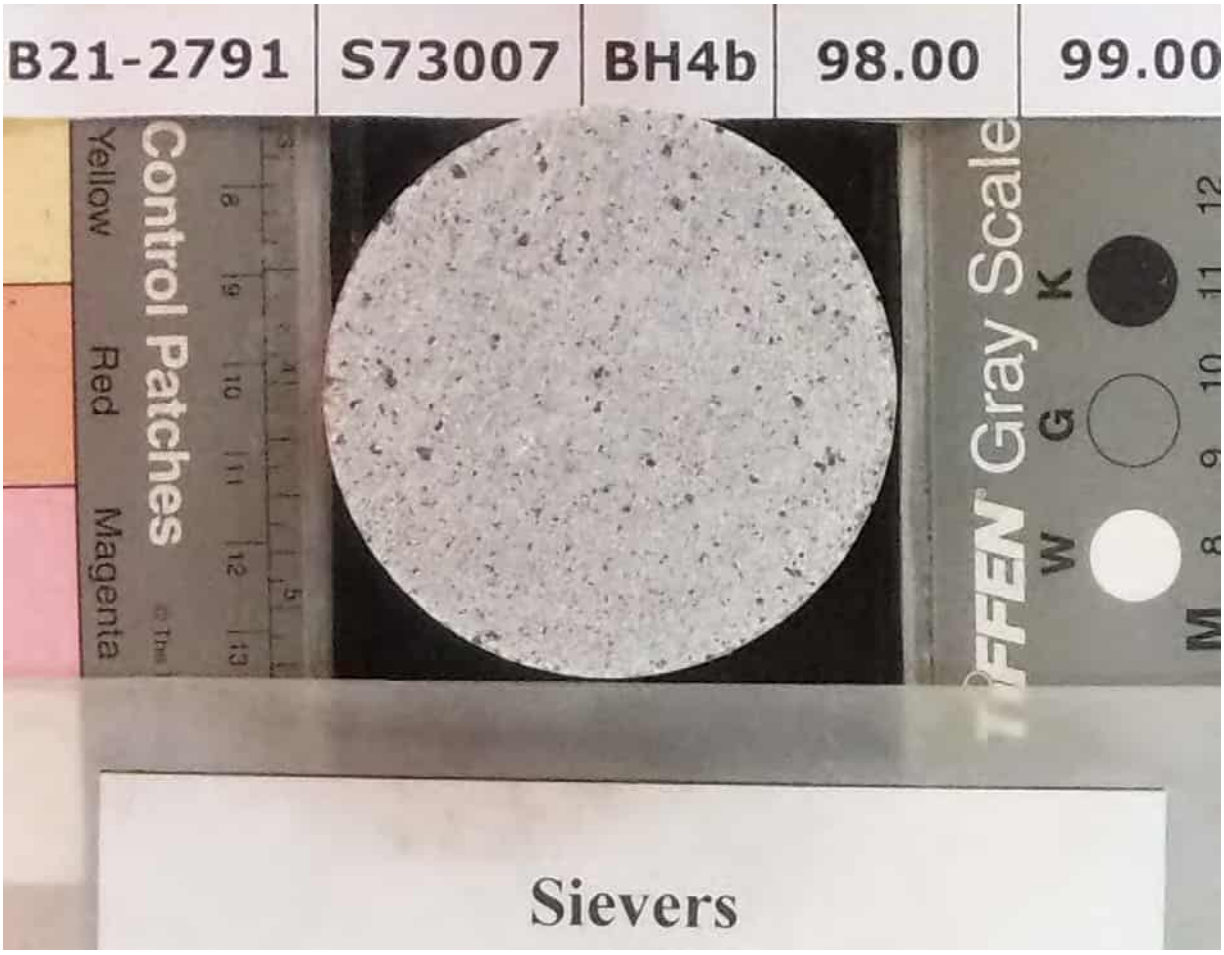
(BRTS In House Test Method SIEVERS)

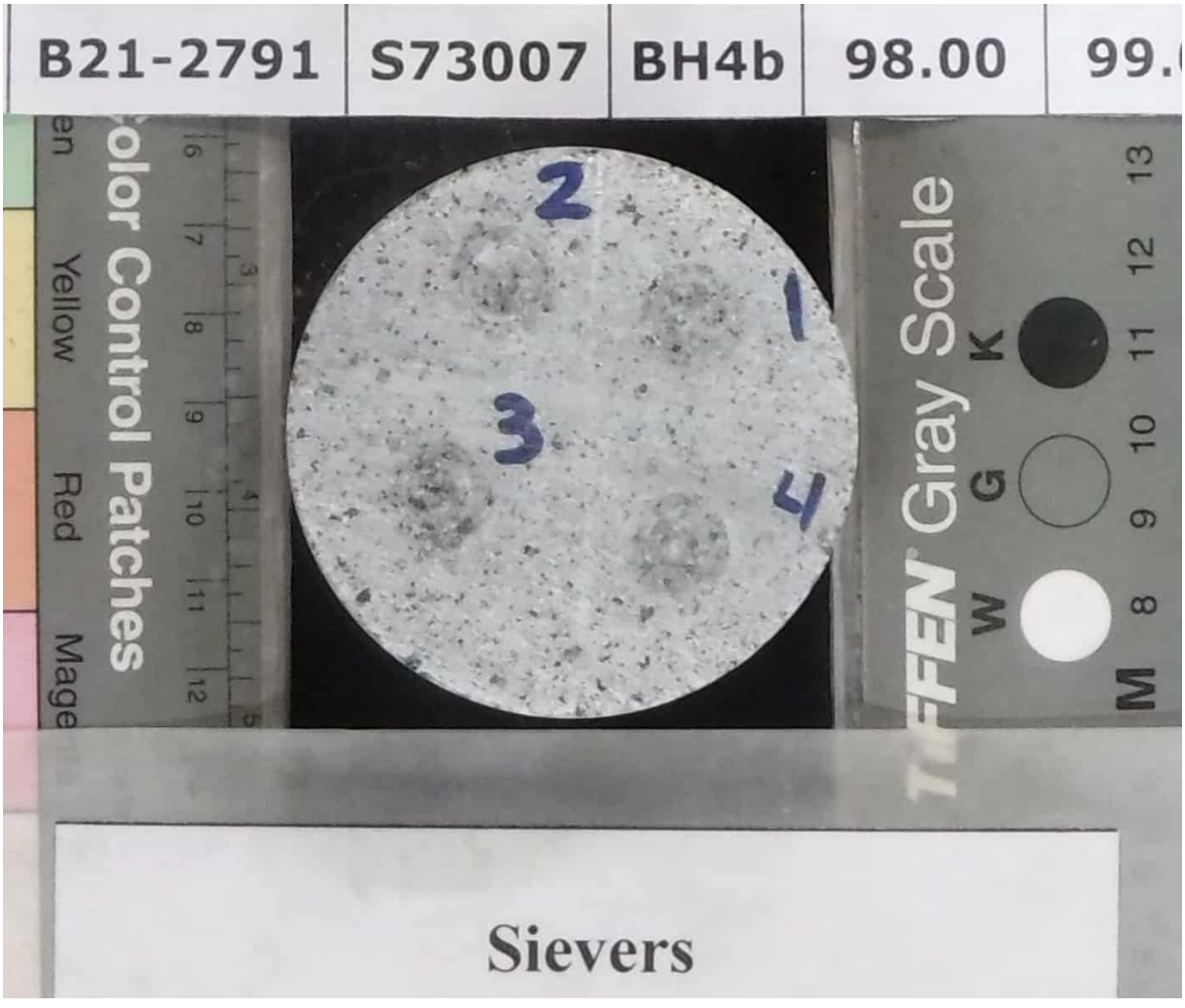
BRTS Sample Number	B21-2791	B21-2792	B21-2793
Client's Sample Number	S73007	S73012	S73417
Lithology	Granite	Granite	Granite
Borehole	BH4b	BH4b	BH4b
Depth from (m)	98.00	64.19	200.00
Depth to (m)	99.00	66.00	200.85
Sievers J-Value (SJ)	**9 ± 1.2**	**18 ± 2.9**	**7 ± 0.2**
Classification of rock surface hardness, or resistance to indentation (Dahl et. al. 2012)	*Medium*	*Medium*	*Medium*
Sievers Wear Number	*17.0*	*13.2*	*16.1*
Sievers (J-Value)/(Wear Number)	*0.5*	*1.4*	*0.4*

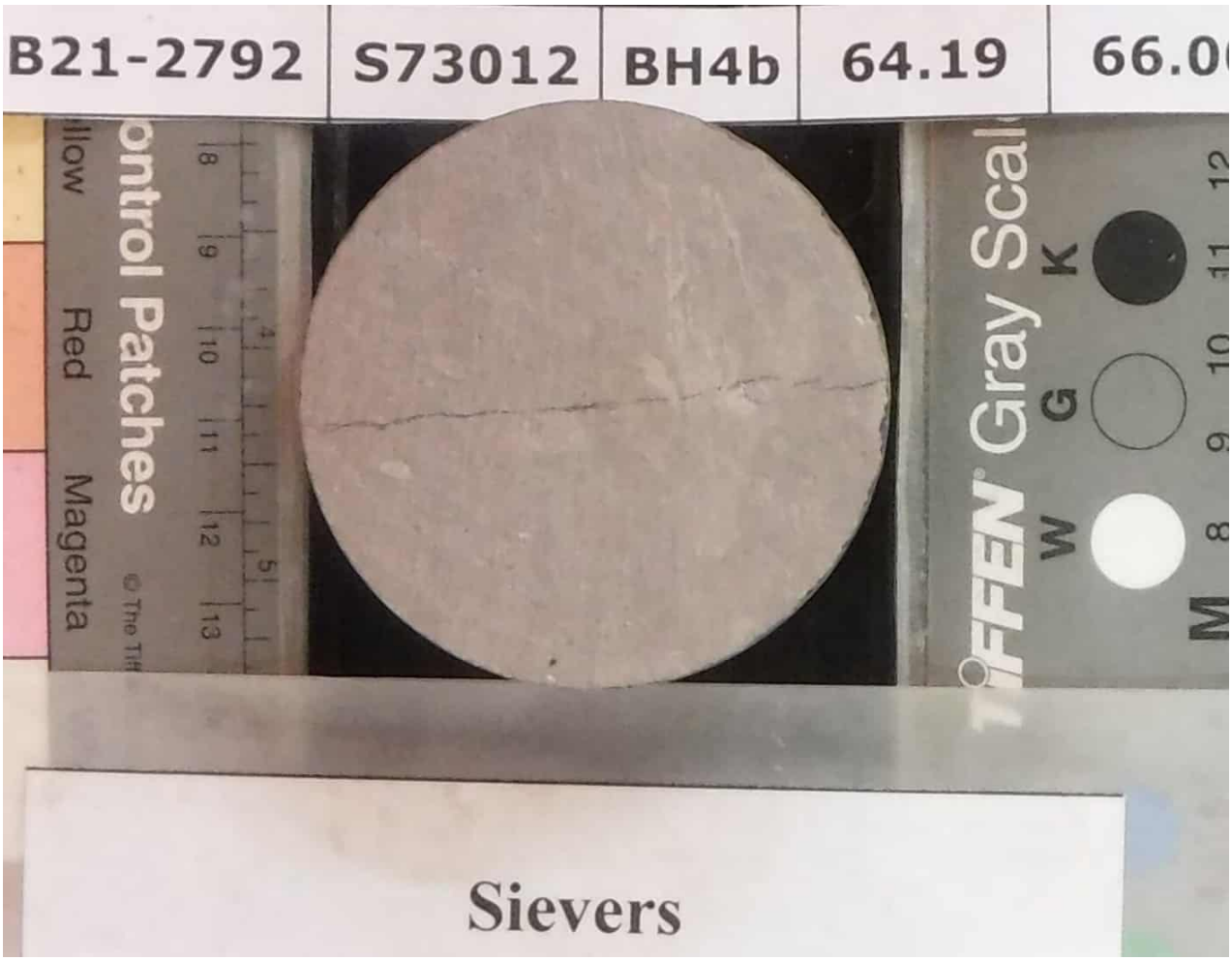
Date tested: 13/01/2022

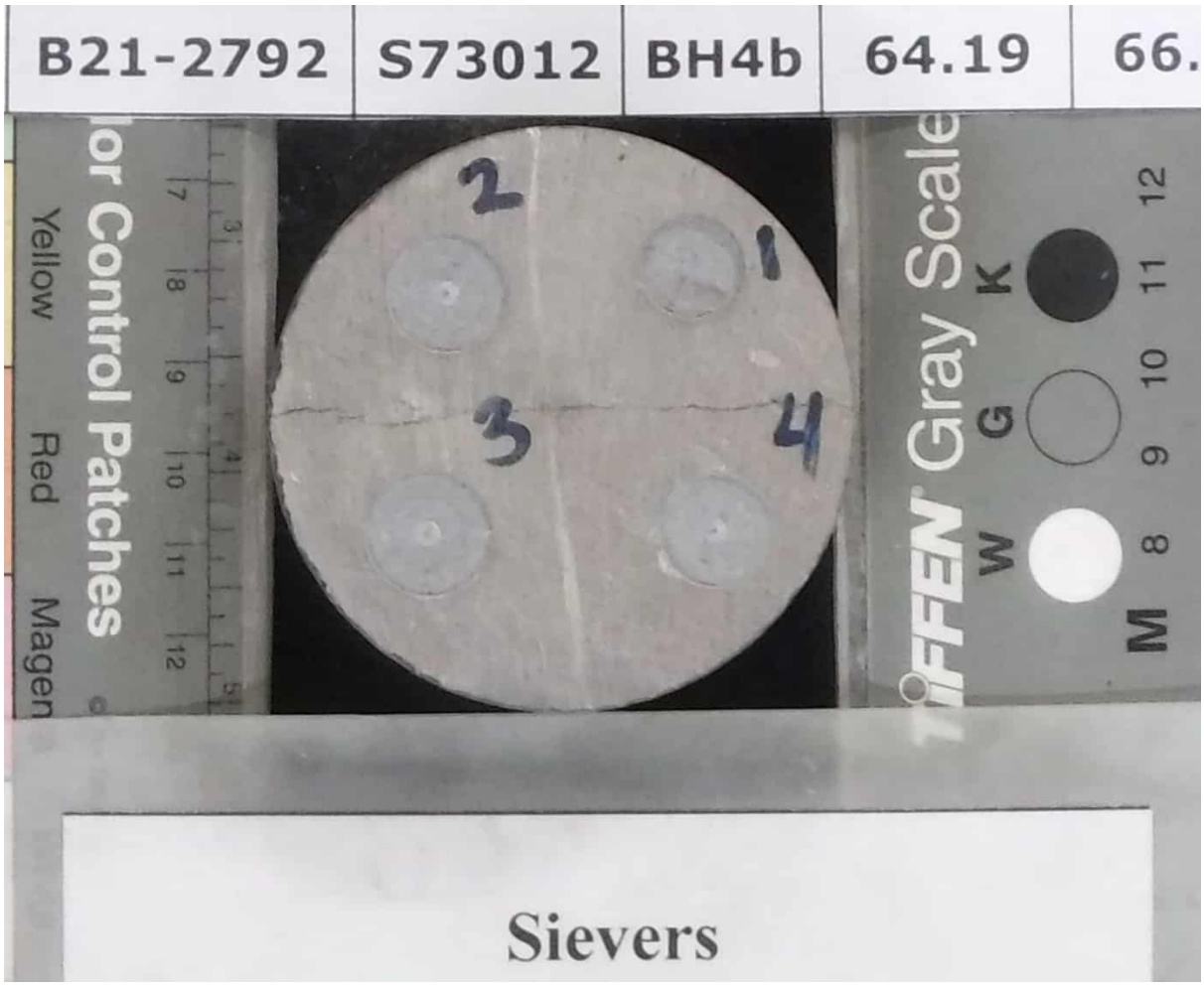
X
Dr W.E. Bamford
Director

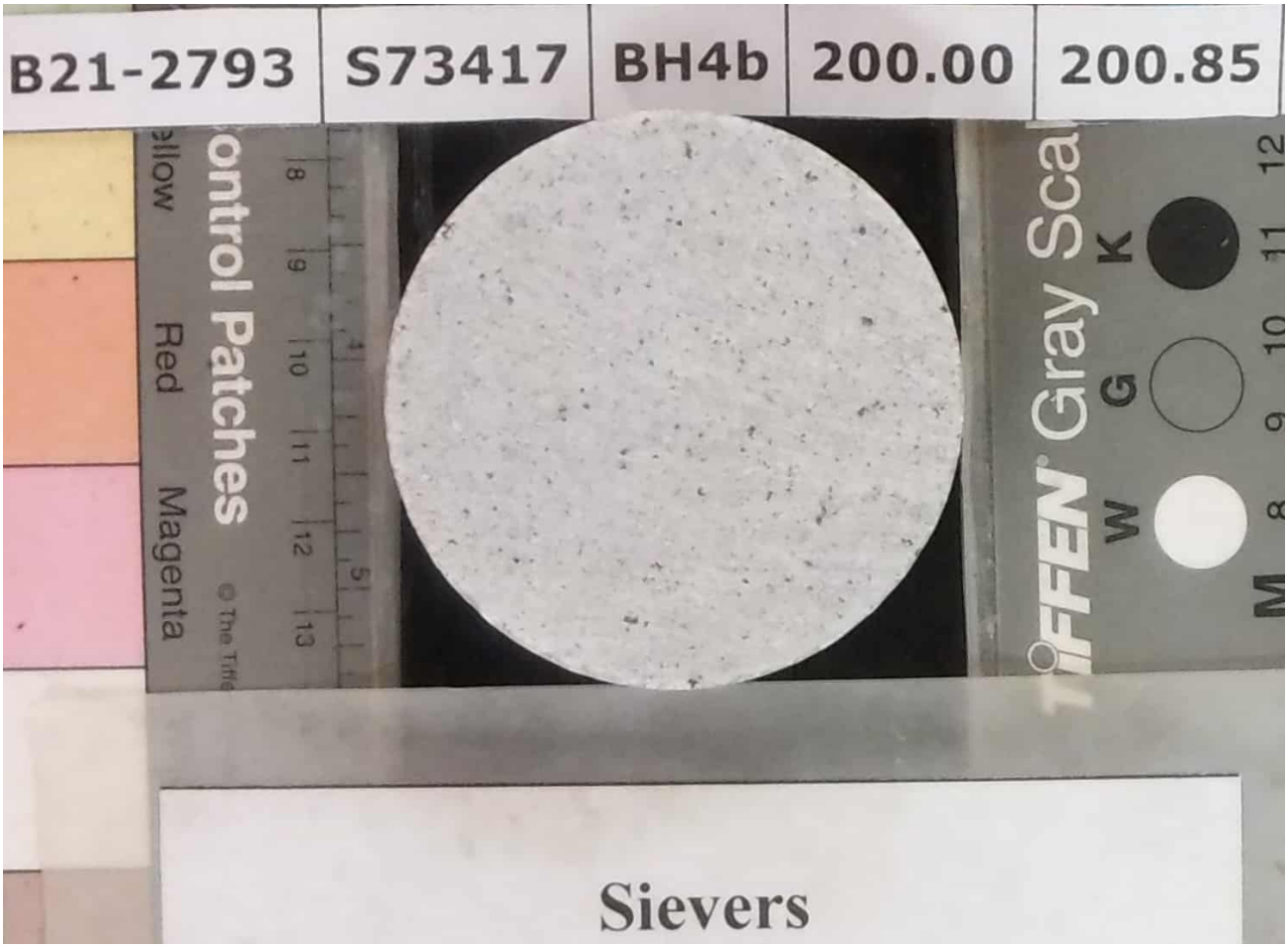
X
Dr D. Palamakumbure
Lab Manager

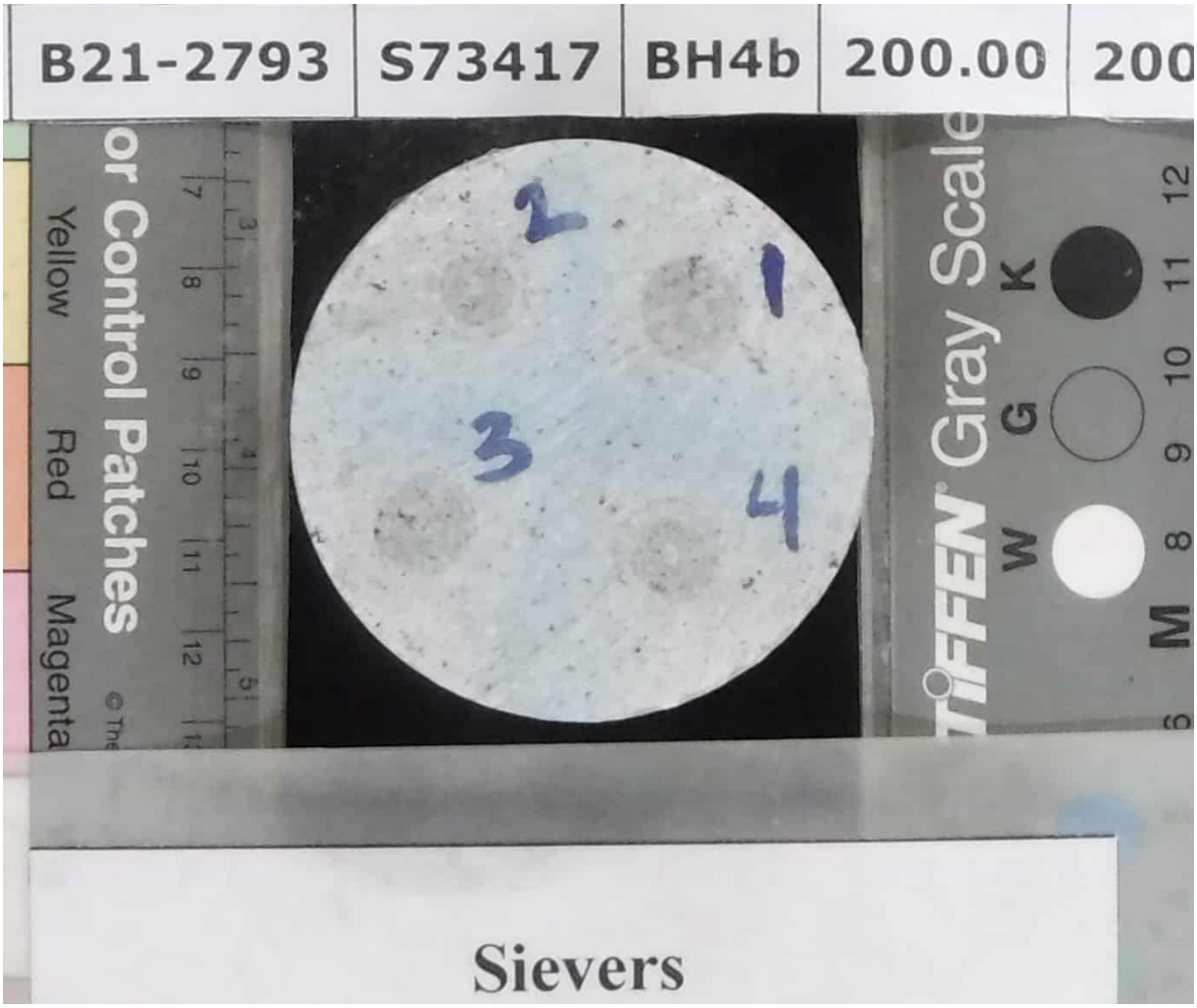

B21-2791
S73007
BH4b
98.00
99.00
Control Patches
Yellow
Red
Magenta
Gray Scale
K
G
W
M
Sievers


B21-2791
S73007
BH4b
98.00
Color Control Patches
Yellow
Red
Gray Scale
K
G
W
M
1
2
3
4
Sievers


B21-2792
S73012
BH4b
64.19
Yellow
Red
Magenta
Gray Scale
Sievers


B21-2792
S73012
BH4b
64.19
Yellow
Red
Gray Scale
1
2
3
4
Sievers


B21-2793
S73417
BH4b
200.00
200.85
Control Patches
Yellow
Red
Magenta
TIFFEN Gray Scale
K
G
W
M
Sievers


B21-2793
S73417
BH4b
200.00
200
Control Patches
Yellow
Red
Magenta
TIFFEN Gray Scale
K
G
W
M
1
2
3
4
Sievers

BRTS
Bamford Rock Testing Services

239 ARDEN STREET, NORTH MELBOURNE, 3051 AUSTRALIA
NATA Accredited Facility No. 19523

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Test Request No. : 1606
Date Received: 21 December 2021
Client: Macquarie Geotechnical
Project: Oven Mountain
Location: 30018018
Reference: S21430

ABRASION VALUE STEEL (AVS TESTS)

BRTS Test Method The NTNU Tests – AVS

BRTS Sample Number	B21-2791	B21-2792	B21-2793
Client's Sample Number	S73007	S73012	S73417
Lithology	Granite	Granite	Granite
Borehole	BH4b	BH4b	BH4b
Depth from (m)	98.00	64.19	200.00
Depth to (m)	99.00	66.00	200.85
TEST 1 : Mass before test	135.6672	135.4225	136.1776
Mass after test	135.6595	135.4205	136.1694
TEST 2 : Mass before test	133.3552	134.2765	135.3934
Mass after test	133.3426	134.2744	135.3856
Average Mass Loss (milligrams)	**10.15**	**2.05**	**8.00**
Test Deviation : *(Shall Not be >5)*	*4.9*	*0.1*	*0.4*
Classification of rock abrasion or the ability to induce wear on cutter steel (Dahl, Bruland, Jakobsen, Nilsen, Grøv 2012)	*Low*	*Very Low*	*Low*

Date tested: 14/01/2022

X
Dr W.E. Bamford
Director

X
Dr D. Palamakumbure
Lab Manager


B21-2791 S73007 BH4b 98.00 99.00
TIFFEN Color Control Patches
TIFFEN Gray Scale
AVS
Before test


#1606 B21-2791 S73007 BH4b 98.00 99.00
TIFFEN Color Control Patches
TIFFEN Gray Scale
AVS
After test


606 B21-2792 S73012 BH4b 64.19 66.00
TIFFEN Color Control Patches
TIFFEN Gray Scale
AVS
Before test


1606 B21-2792 S73012 BH4b 64.19 66.00
TIFFEN Color Control Patches
TIFFEN Gray Scale
AVS
After test


506 B21-2793 S73417 BH4b 200.00 200.85
Batch
TIFFEN Color Control Patches
Blue
Cyan
Green
Yellow
Red
Magenta
White
TIFFEN Gray Scale
AVS
Before test


506 B21-2793 S73417 BH4b 200.00 200.85
Batch
TIFFEN Color Control Patches
Blue
Cyan
Green
Yellow
Red
Magenta
White
3/Color
Black
TIFFEN Gray Scale
AVS
After test

BRTS
Bamford Rock Testing Services

239 ARDEN STREET, NORTH MELBOURNE, 3051 AUSTRALIA
NATA Accredited Facility No. 19523

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Test Request No. : 1606
Date Received: 21 December 2021
Client: Macquarie Geotechnical
Project: Oven Mountain
Location: 30018018
Reference: S21430

GOODRICH DRILLABILITY TEST

(BRTS In House Test Method GOODRICH)

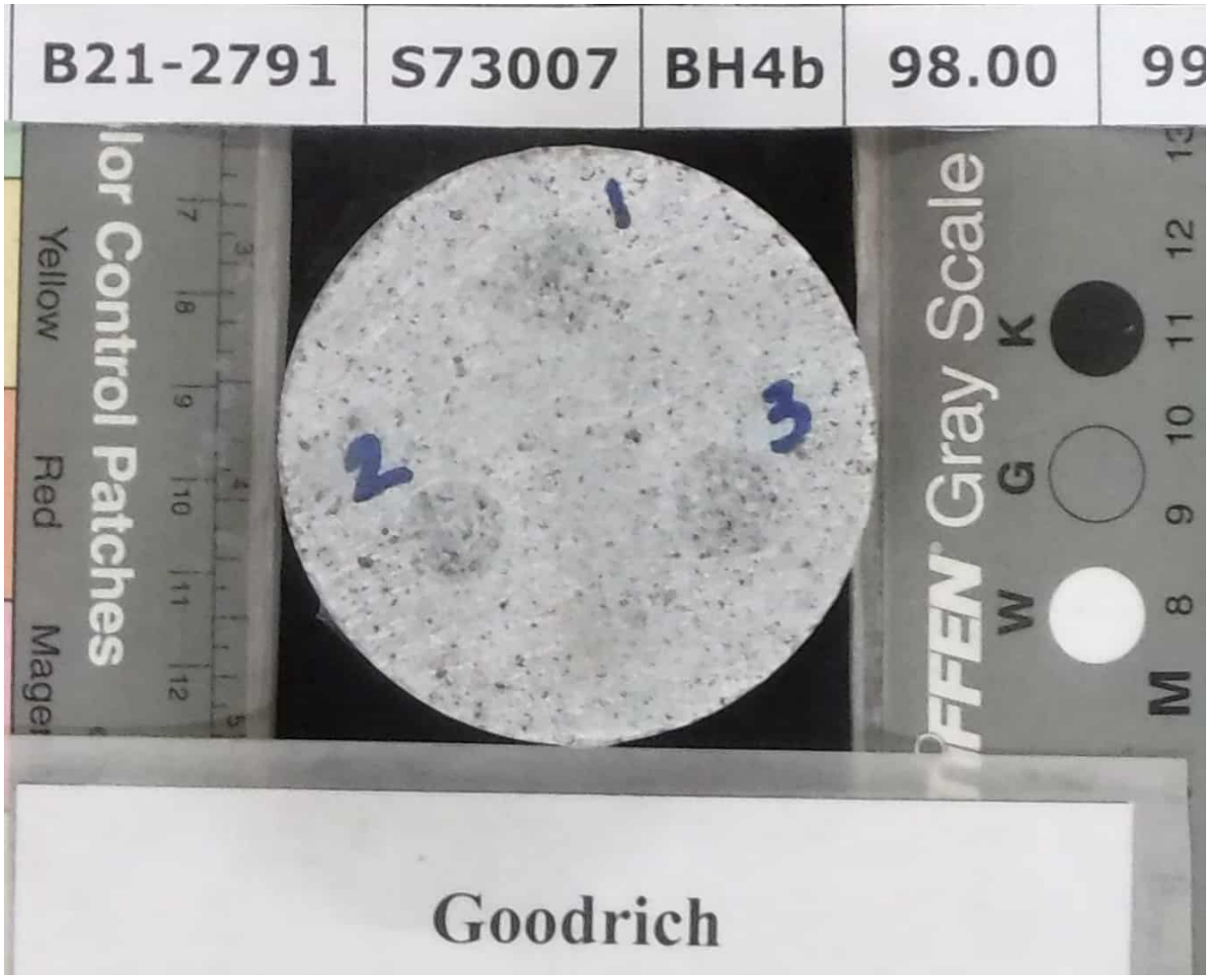
BRTS Sample Number	B21-2791	B21-2792	B21-2793
Client's Sample Number	S73007	S73012	S73417
Lithology	Granite	Granite	Granite
Borehole	BH4b	BH4b	BH4b
Depth from (m)	98.00	64.19	200.00
Depth to (m)	99.00	66.00	200.85
Goodrich Drillability	**2±0**	**21±12**	**2±0**
Classification	*Extremely Low*	*Low*	*Extremely Low*
Goodrich Wear Number	**14.4±0.3**	**9.6±2.6**	**16.4±0.8**
Classification	*High*	*Medium*	*High*
Goodrich (Drillability)/(Wear Number)	**0.1±0**	**3.5±2.8**	**0.1±0**
Classification	*Extremely Low*	*Medium*	*Extremely Low*

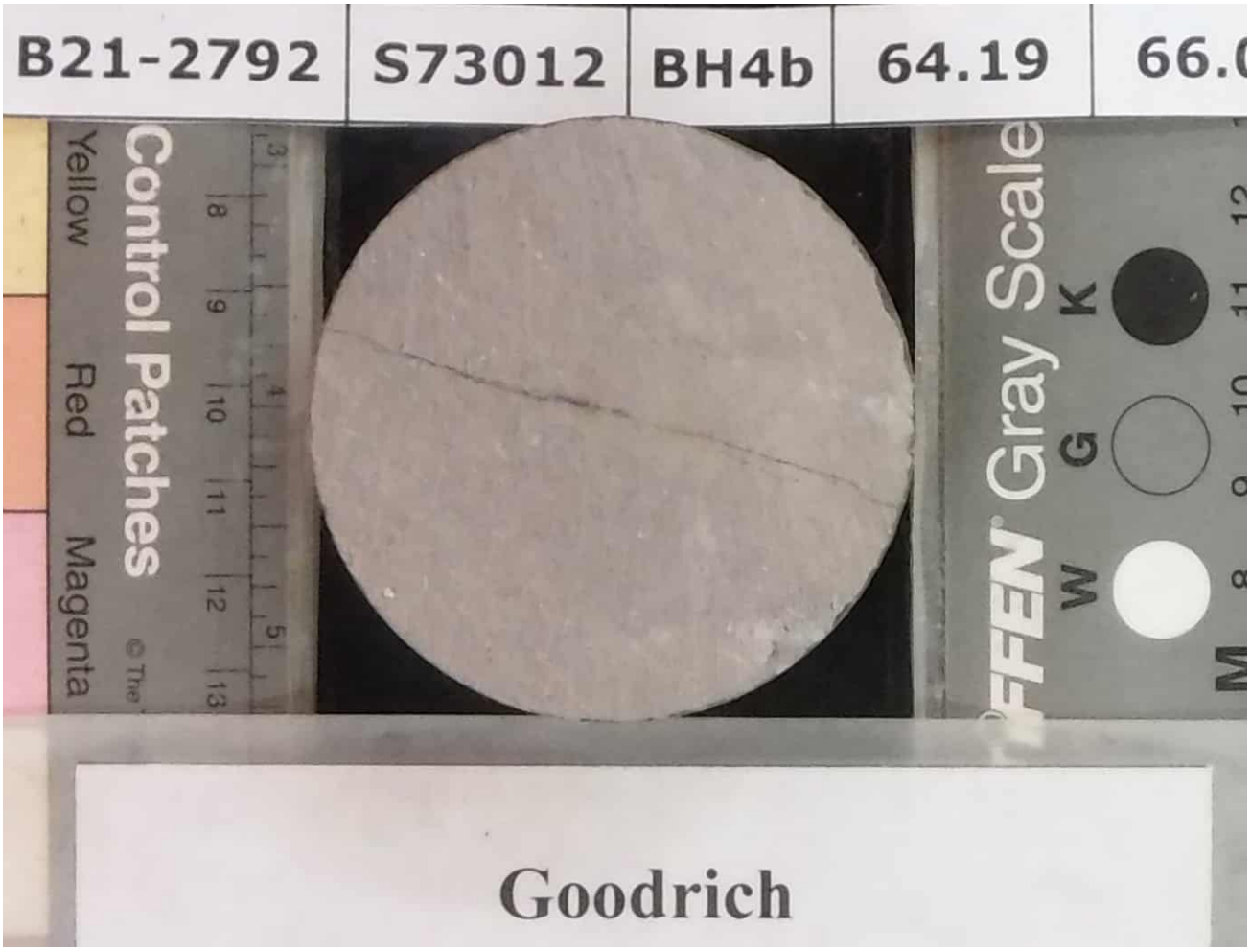
Date tested: 13/01/2022

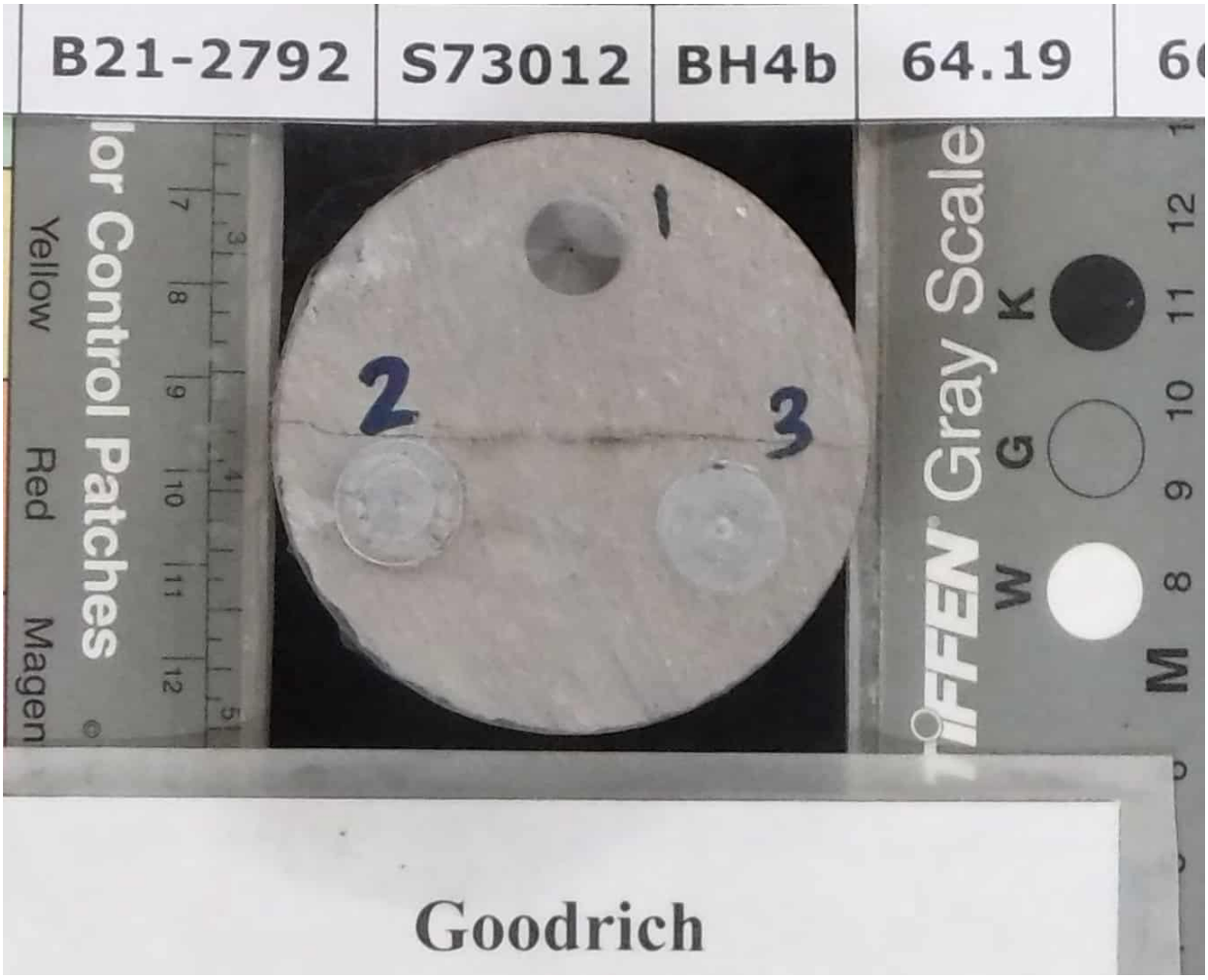
X
Dr W.E. Bamford
Director

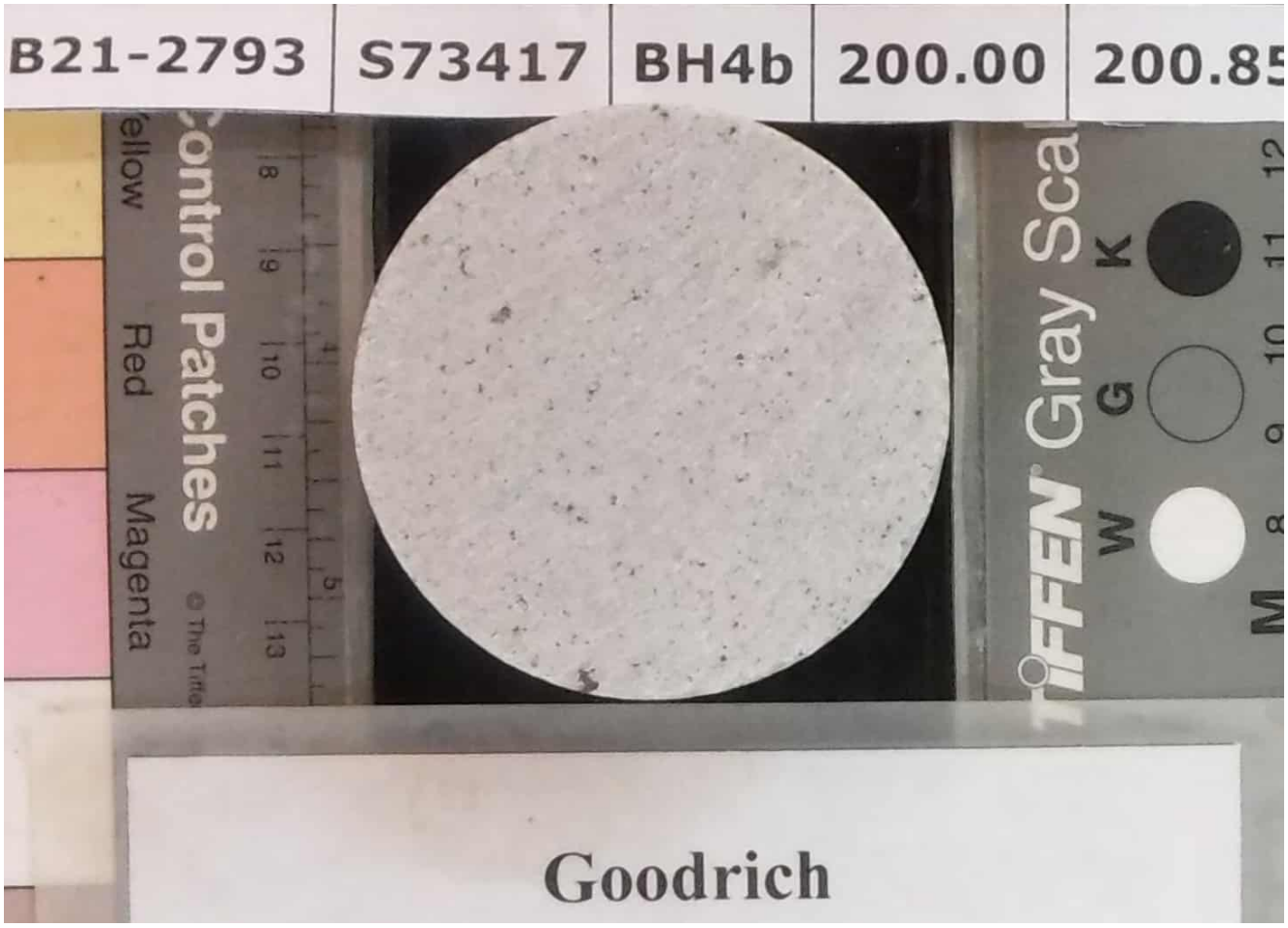
X
Dr D. Palamakumbure
Lab Manager

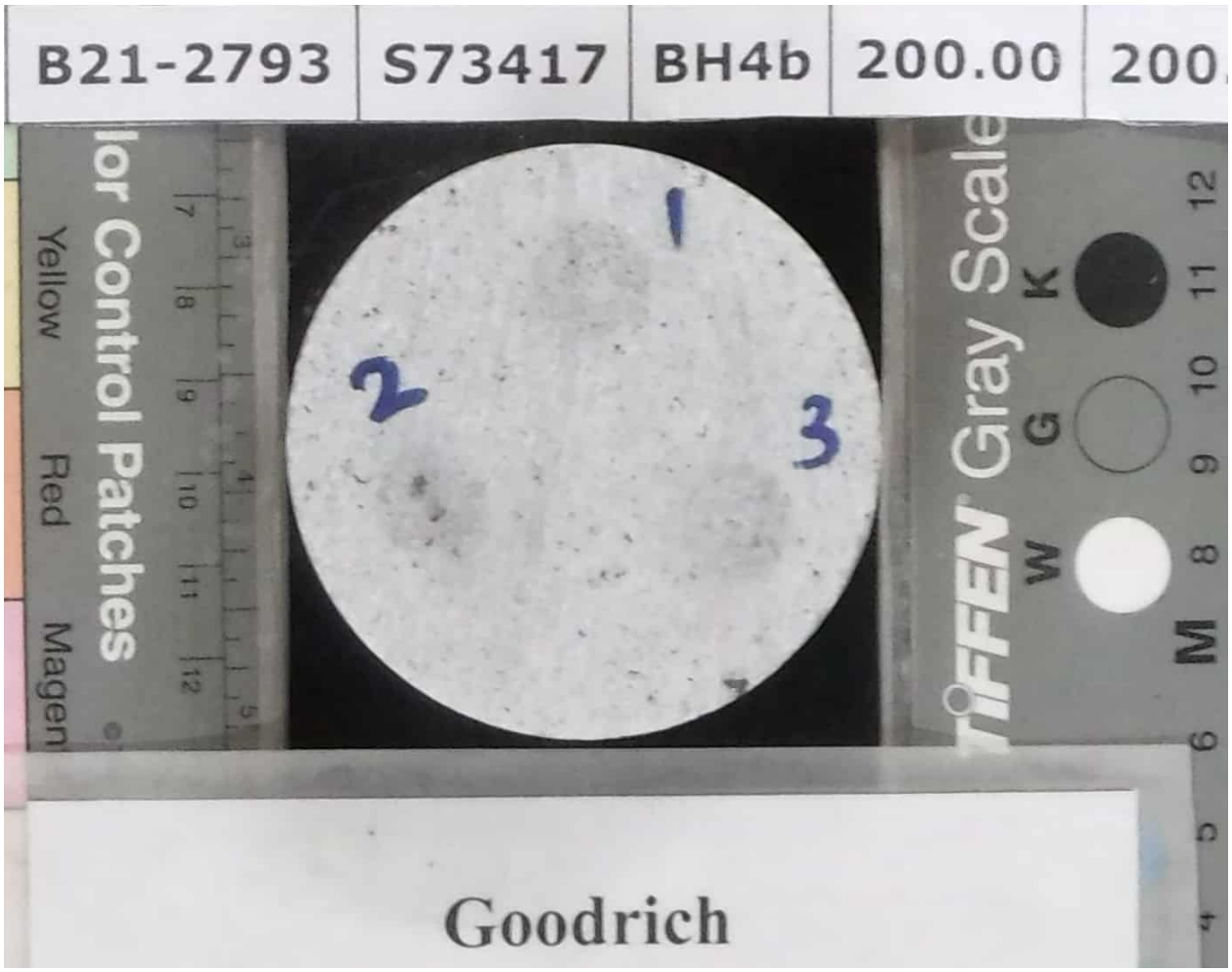

B21-2791
S73007
BH4b
98.00
99.00
Control Patches
Yellow
Red
Magenta
Gray Scale
K
G
W
M
Goodrich


B21-2791
S73007
BH4b
98.00
99
Control Patches
Yellow
Red
Gray Scale
K
G
W
M
1
2
3
Goodrich


B21-2792
S73012
BH4b
64.19
Control Patches
Yellow
Red
Magenta
Gray Scale
K
G
W
M
Goodrich


B21-2792
S73012
BH4b
64.19
Control Patches
Yellow
Red
Gray Scale
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1
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Goodrich


B21-2793
S73417
BH4b
200.00
200.85
Control Patches
Yellow
Red
Magenta
Gray Sca
K
G
W
M
Goodrich


B21-2793
S73417
BH4b
200.00
200
lor Control Patches
Yellow
Red
Magen
Gray Scale
K
G
W
M
1
2
3
Goodrich

Bamford Rock Testing Services

239 Arden Street, North Melbourne, Vic 3051 Australia
Telephone : (03) 9329 2818 email : tests@bamfordrocks.com.au
ABN : 78 167 341 693

REPORT 1606
ON
ROCK TESTING

(BRTS JOB NUMBER 1606)

Client : Macquarie Geotechnical

Project : Oven Mountain - 30018018

Reference : S21430

17th January, 2022

BRTS
Bamford Rock Testing Services
239 ARDEN STREET, NORTH MELBOURNE, 3051 AUSTRALIA

Test Request No. : 1606
Date Received: 21 December 2021
Client: Macquarie Geotechnical
Project: Oven Mountain
Location: 30018018
Reference: S21430

Cutter Life Index (CLI)

Ref : Filip Dahl SINTEF DRI, BWI, CLI Standard Jan 2003

BRTS Sample Number	B21-2791	B21-2792	B21-2793
Client's Sample Number	S73007	S73012	S73417
Lithology	Granite	Granite	Granite
Borehole	BH4b	BH4b	BH4b
Depth from (m)	98.00	64.19	200.00
Depth to (m)	99.00	66.00	200.85
Sievers J-Value	9 ± 1.2	18 ± 2.9	7 ± 0.2
AVS (Abrasion Value Steel)	10.15	2.05	8.00
Cutter Life Index (CLI)	**13.2**	**32.2**	**13.2**
Classification : (SINTEF/NTNU 2015)	*Medium*	*High*	*Medium*

X
Dr W.E. Bamford
Director

X
Dr D. Palamakumbure
Lab Manager

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 285813

Client Details

Client	Macquarie Geotech
Attention	Jasper Haines
Address	3 Watt Dr, Bathurst, NSW, 2795

Sample Details

Your Reference	**S21430, Oven Mountain (30018018)**
Number of Samples	7 Core
Date samples received	20/12/2021
Date completed instructions received	20/12/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

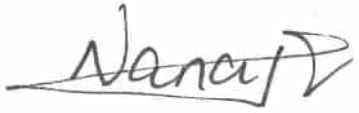
Date results requested by	14/01/2022
Date of Issue	14/01/2022

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Giovanni Agosti, Group Technical Manager
Greta Petzold, Senior Report Coordinator
Manju Dewendrage, Prep Team Leader
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil					
Our Reference		285813-1	285813-3	285813-6	285813-7
Your Reference	UNITS	S73001	S73011	S73422	S73423
Sample ID		BH4b 4.85-5.0m	BH4b 97.86-98.0m	BH4b 327.0-327-11m	BH4b 300.0-300.16m
Type of sample		Core	Core	Core	Core
Date prepared	-	22/12/2021	22/12/2021	22/12/2021	22/12/2021
Date analysed	-	22/12/2021	22/12/2021	22/12/2021	22/12/2021
pH 1:5 soil:water	pH Units	6.2	7.3	8.6	8.3
Sulphate, SO4 1:5 soil:water	mg/kg	84	<10	<10	<10
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10
Electrical Conductivity 1:5 soil:water	µS/cm	64	13	13	12

NAG/NAPP				
Our Reference		285813-2	285813-3	285813-5
Your Reference	UNITS	S73002	S73011	S73417
Sample ID		BH4b 14.29-14.57m	BH4b 97.86-98.0m	BH4b 200.0-200.85m
Type of sample		Core	Core	Core
Date prepared	-	22/12/2022	22/12/2022	22/12/2022
Date analysed	-	11/01/2022	11/01/2022	11/01/2022

Acid Extractable metals in soil						
Our Reference		285813-1	285813-3	285813-4	285813-6	285813-7
Your Reference	UNITS	S73001	S73011	S73012	S73422	S73423
Sample ID		BH4b 4.85-5.0m	BH4b 97.86-98.0m	BH4b 54.19-66.0m	BH4b 327.0-327-11m	BH4b 300.0-300.16m
Type of sample		Core	Core	Core	Core	Core
Date prepared	-	21/12/2021	21/12/2021	21/12/2021	21/12/2021	21/12/2021
Date analysed	-	21/12/2021	21/12/2021	21/12/2021	21/12/2021	21/12/2021
Arsenic	mg/kg	15	<4	12	<4	<4
Antimony	mg/kg	<7	<7	<7	<7	<7

Moisture						
Our Reference		285813-1	285813-3	285813-4	285813-6	285813-7
Your Reference	UNITS	S73001	S73011	S73012	S73422	S73423
Sample ID		BH4b 4.85-5.0m	BH4b 97.86-98.0m	BH4b 54.19-66.0m	BH4b 327.0-327-11m	BH4b 300.0-300.16m
Type of sample		Core	Core	Core	Core	Core
Date prepared	-	21/12/2021	21/12/2021	21/12/2021	21/12/2021	21/12/2021
Date analysed	-	21/12/2021	21/12/2021	21/12/2021	21/12/2021	21/12/2021
Moisture	%	<0.1	0.2	<0.1	0.3	0.4

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			22/12/2021	[NT]	[NT]	[NT]	[NT]	22/12/2021	[NT]
Date analysed	-			22/12/2021	[NT]	[NT]	[NT]	[NT]	22/12/2021	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	94	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	94	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			21/12/2021	[NT]	[NT]	[NT]	[NT]	21/12/2021	[NT]
Date analysed	-			21/12/2021	[NT]	[NT]	[NT]	[NT]	21/12/2021	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	106	[NT]
Antimony	mg/kg	7	Metals-020	<7	[NT]	[NT]	[NT]	[NT]	104	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

NAG & NAPP analysed by MPL Laboratories. Report No. 274460
- View attached report

Material Test Report

Macquarie Geotechnical Pty Ltd
Bathurst Laboratory
3 Watt Drive Bathurst NSW 2795
Phone: (02) 6332 2011
Email: macgeo@macgeo.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Barry Froebel
Laboratory Manager
NATA Accredited Laboratory Number: 14874

Report Number: **S21430-1**
Issue Number: 1
Date Issued: 09/03/2022
Client: SMEC Australia Pty Ltd
Level 5, 20 Berry Street, North Sydney NSW 2060
Contact: Nick Poriters
Project Number: S21430
Project Name: Oven Mountain (30018018)
Work Request: 248
Sample Number: BTH-248A
Client Sample #: S73424
Date Sampled: 01/03/2022
Dates Tested: 01/03/2022 - 08/03/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH4b 268.00-270.00m**

Wet / Dry Strength Variation (AS 1141.22)		Min	Max
Dry Strength (kN)	185		
Wet Strength (kN)	169		
Variation (%)	**9**		
Nominal Size of Aggregate (mm)	'-		
Fraction Tested (mm)	-19mm +9.5mm		
Test Cylinder Size (mm)	150		
Breakdown	NO BREAKDOWN		
Nature of Bulk Sample	Drill Core		
Duplicate Testing Performed ?	No		

This document shall not be reproduced except in full without approval of the laboratory. Results relate only to the items tested/sampled. Macquarie Geotechnical is not responsible for the accuracy of information provided by the client; nor how that information may affect the validity of results.

Appendix E Verticality Survey

ROBERTSON GEOLOGGING TECHNOLOGY
VERTICALITY vsn 6.2 04 Nov 2021

FINAL COPY

BDVS VERTICALITY SURVEY

COMPANY	M&EC
WELL	BH4b
FIELD	Carrai
COUNTRY	AUSTRALIA
LATITUDE	6591280
LONGITUDE	421495
PROJECT	OMPH

OTHER SERVICES
SON
DEN
DEV

PERM. DATUM	
LOG DATUM	
DRILL DATUM	
ELEVATION	980

KELLY BUSHING	0.000000m
DRILL FLOOR	0.000000m
GROUND LEVEL	0.000000m

	RunNo1	RunNo2	RunNo3
DATE	03 Nov 21, 10:06:40	27 Aug 20, 09:52:09	27 Aug 20, 09:52:09
RUN#	0	0	0
TYPE OF LOG			
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DEPTH LOGGER	0.000000	0.000000	0.000000
LOG DEEPEST	0.000000	0.000000	0.000000
LOG SHALLOW	0.000000	0.000000	0.000000
FLUID IN HOLE			
SALINITY			
DENSITY			
LEVEL			
MAX TEMP (C)	0.000000	0.000000	0.000000
RIG TIME			
RECORDED BY			
WITNESSED BY			

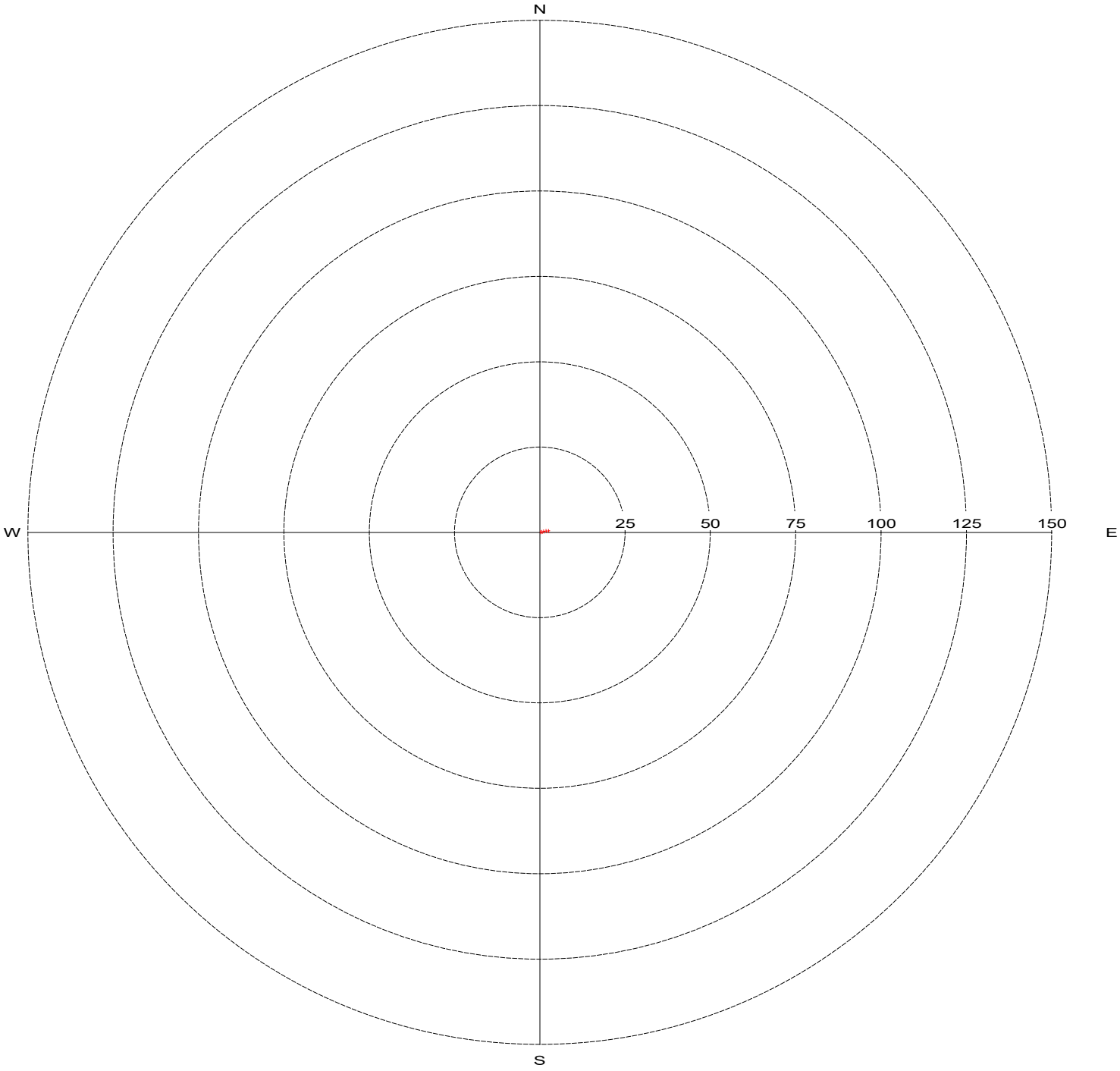
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0	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000	0.000000
0	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000	0.000000

REMARKS

LOG FILE: C:\Winlogger\Data\VErtB_UP_BH04.LOG
0.000 to 135.990m

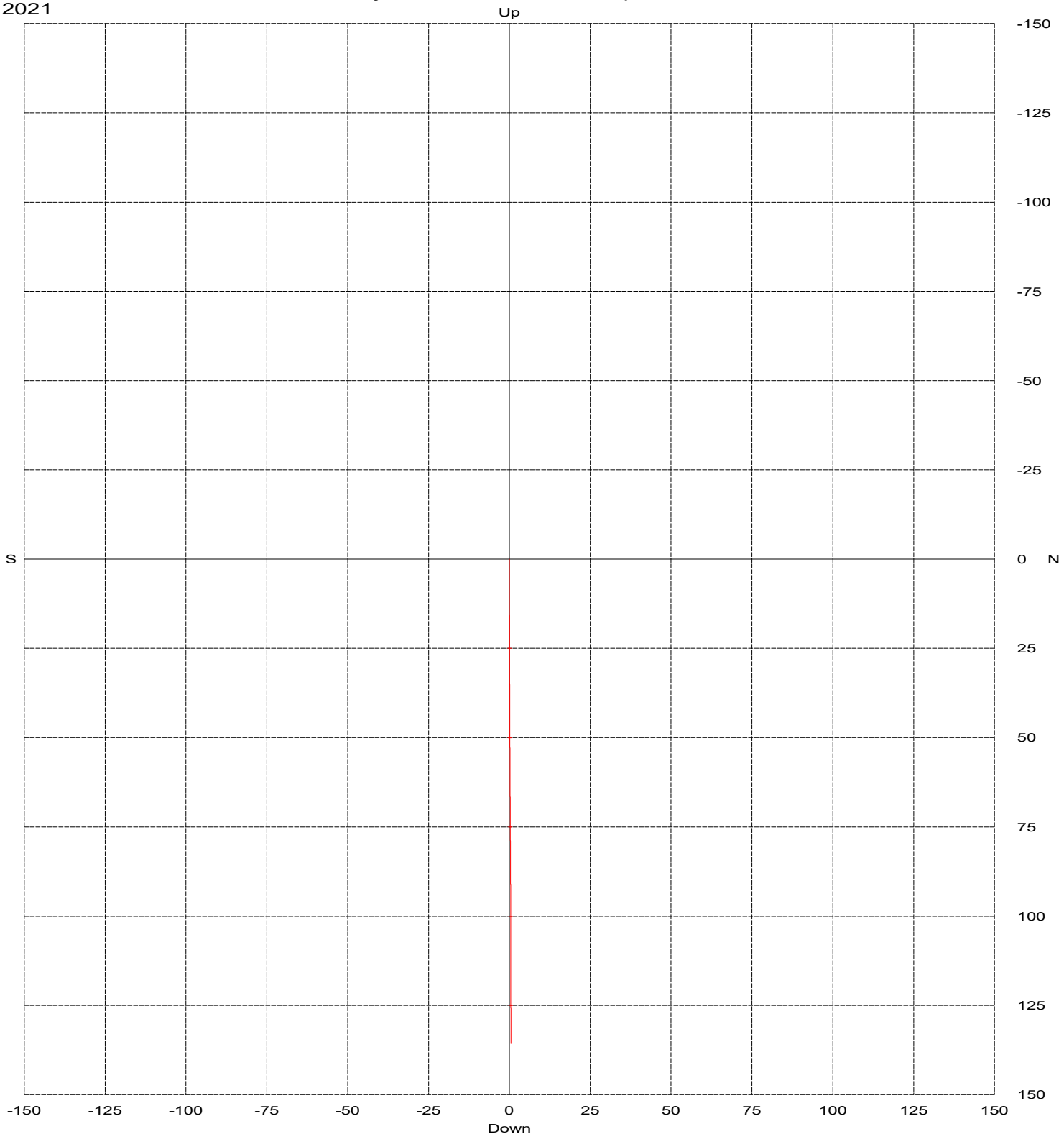
Borehole: BH4b
Zone from: 0.000 - 135.990m
North ref is Magnetic
Mean deviation: 1.24 to N80.45
End coordinates .....
North: 0.487
East : 2.895
Down : 135.904
Azimuth of end: N80.44
Distance start-end: 2.936m
Distance marks every 25m
04 Nov 2021

Projection onto horizontal plane



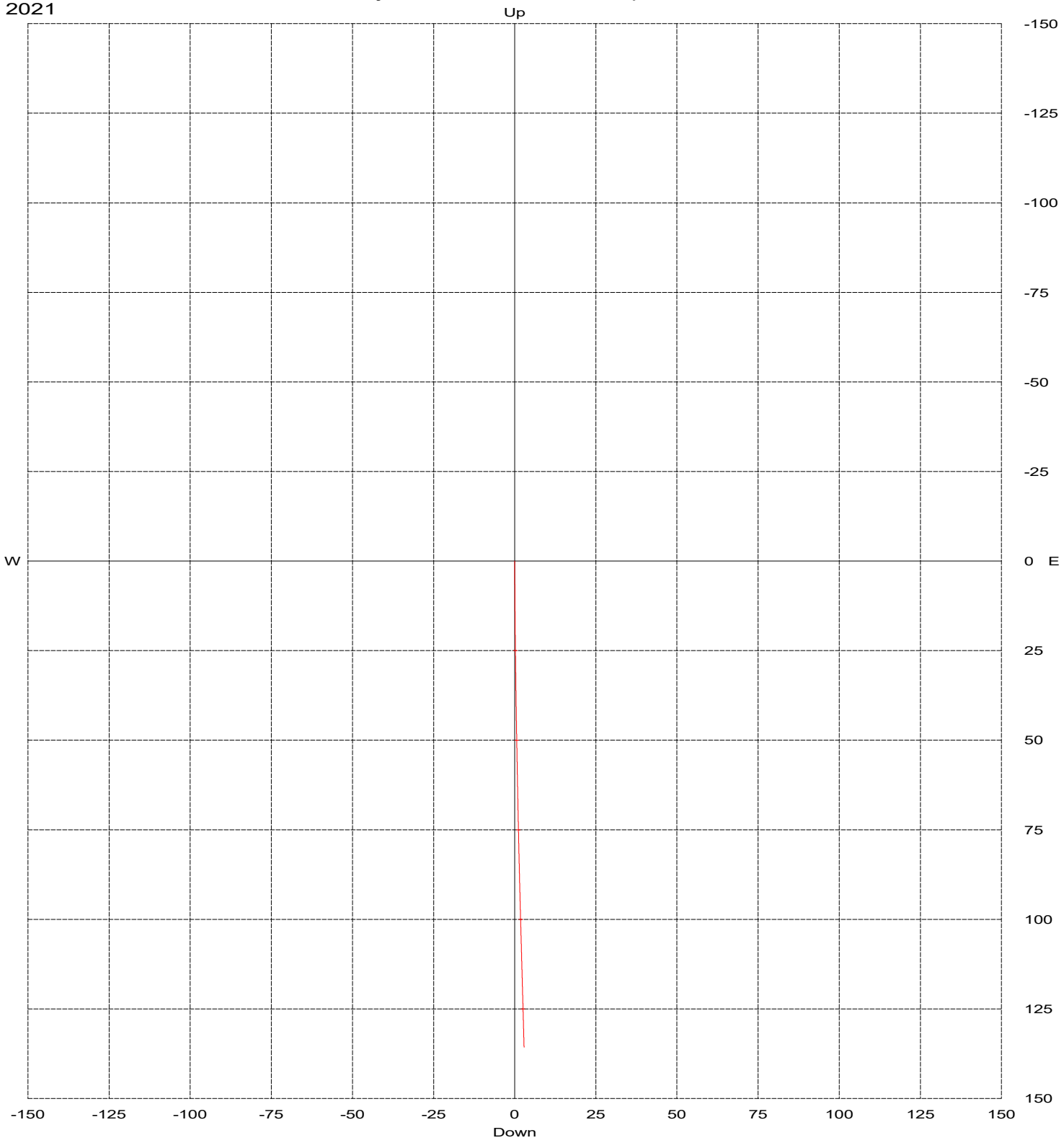
Borehole: BH4b
Zone from: 0.000 - 135.990m
North ref is Magnetic
Mean deviation: 1.24 to N80.45
End coordinates .....
North: 0.487
East : 2.895
Down : 135.904
Azimuth of end: N80.44
Distance start-end: 2.936m
Distance marks every 25m
04 Nov 2021

Projection onto vertical N-S plane



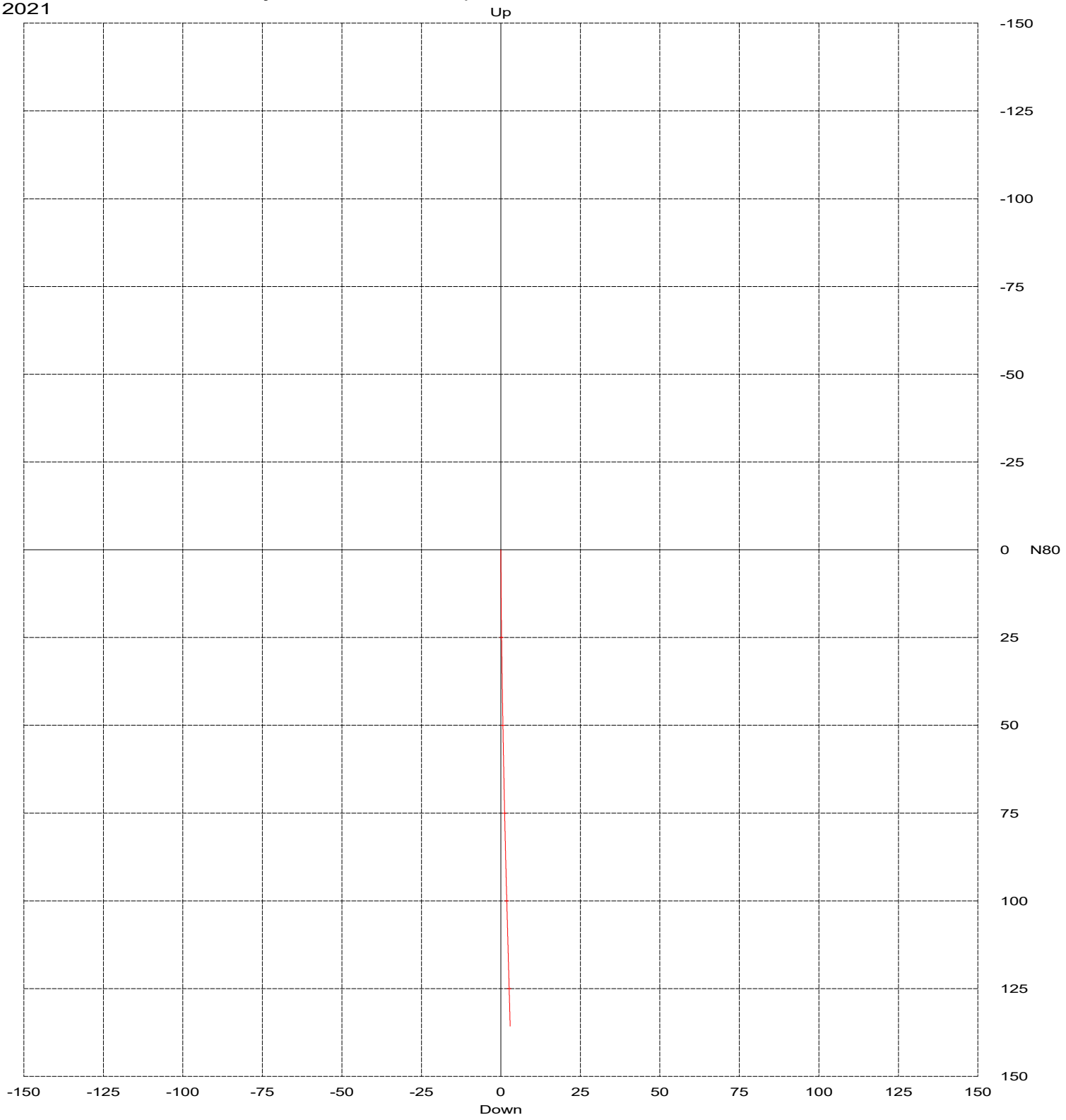
Borehole: BH4b
Zone from: 0.000 - 135.990m
North ref is Magnetic
Mean deviation: 1.24 to N80.45
End coordinates .....
North: 0.487
East : 2.895
Down : 135.904
Azimuth of end: N80.44
Distance start-end: 2.936m
Distance marks every 25m
04 Nov 2021

Projection onto vertical E-W plane

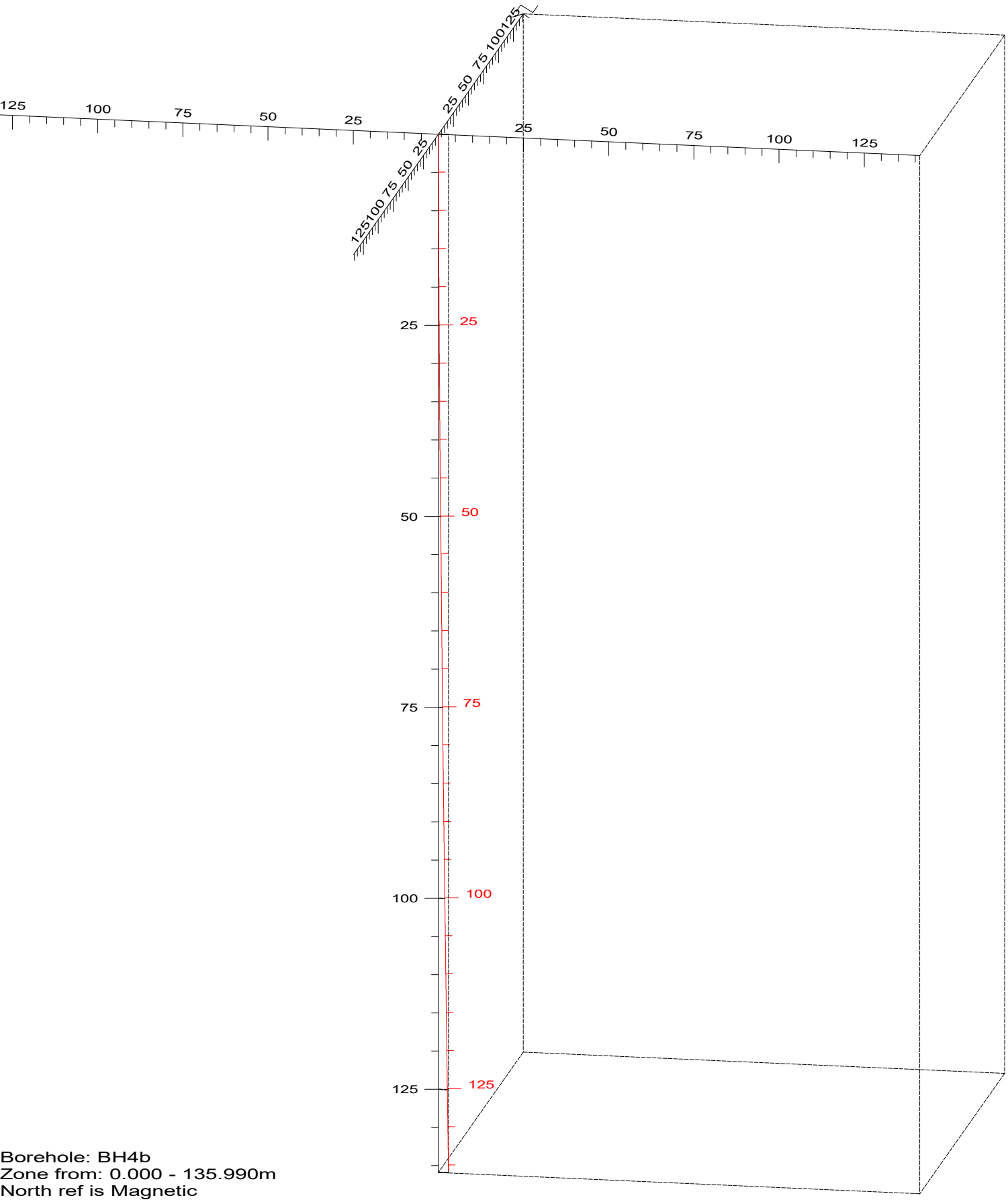


Borehole: BH4b
Zone from: 0.000 - 135.990m
North ref is Magnetic
Mean deviation: 1.24 to N80.45
End coordinates .....
North: 0.487
East : 2.895
Down : 135.904
Azimuth of end: N80.44
Distance start-end: 2.936m
Distance marks every 25m
04 Nov 2021

Projection onto vertical plane in end-borehole direction



Deviated borehole in orthographic projection, viewed from N170



Borehole: BH4b
Zone from: 0.000 - 135.990m
North ref is Magnetic
Mean deviation: 1.24 to N80.45
End coordinates .....
North: 0.487
East : 2.895
Down : 135.904
Azimuth of end: N80.44
Distance start-end: 2.936m
Viewpoint: N170
04 Nov 2021

ROBERTSON GEOLOGGING TECHNOLOGY
VERTICALITY vsn 6.2 03 Dec 2021

FINAL COPY

BDVS VERTICALITY SURVEY

COMPANY	M&EC
WELL	BH04b
FIELD	Carrai
COUNTRY	AUSTRALIA
LATITUDE	6591280
LONGITUDE	421495
PROJECT	OMPH

OTHER SERVICES
SON
DEN
DEV

PERM. DATUM	
LOG DATUM	
DRILL DATUM	
ELEVATION	899

KELLY BUSHING	0.000000m
DRILL FLOOR	0.000000m
GROUND LEVEL	0.000000m

	RunNo1	RunNo2	RunNo3
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DEPTH LOGGER	0.000000	0.000000	0.000000
LOG DEEPEST	0.000000	0.000000	0.000000
LOG SHALLOW	0.000000	0.000000	0.000000
FLUID IN HOLE			
SALINITY			
DENSITY			
LEVEL			
MAX TEMP (C)	0.000000	0.000000	0.000000
RIG TIME			
RECORDED BY			
WITNESSED BY			

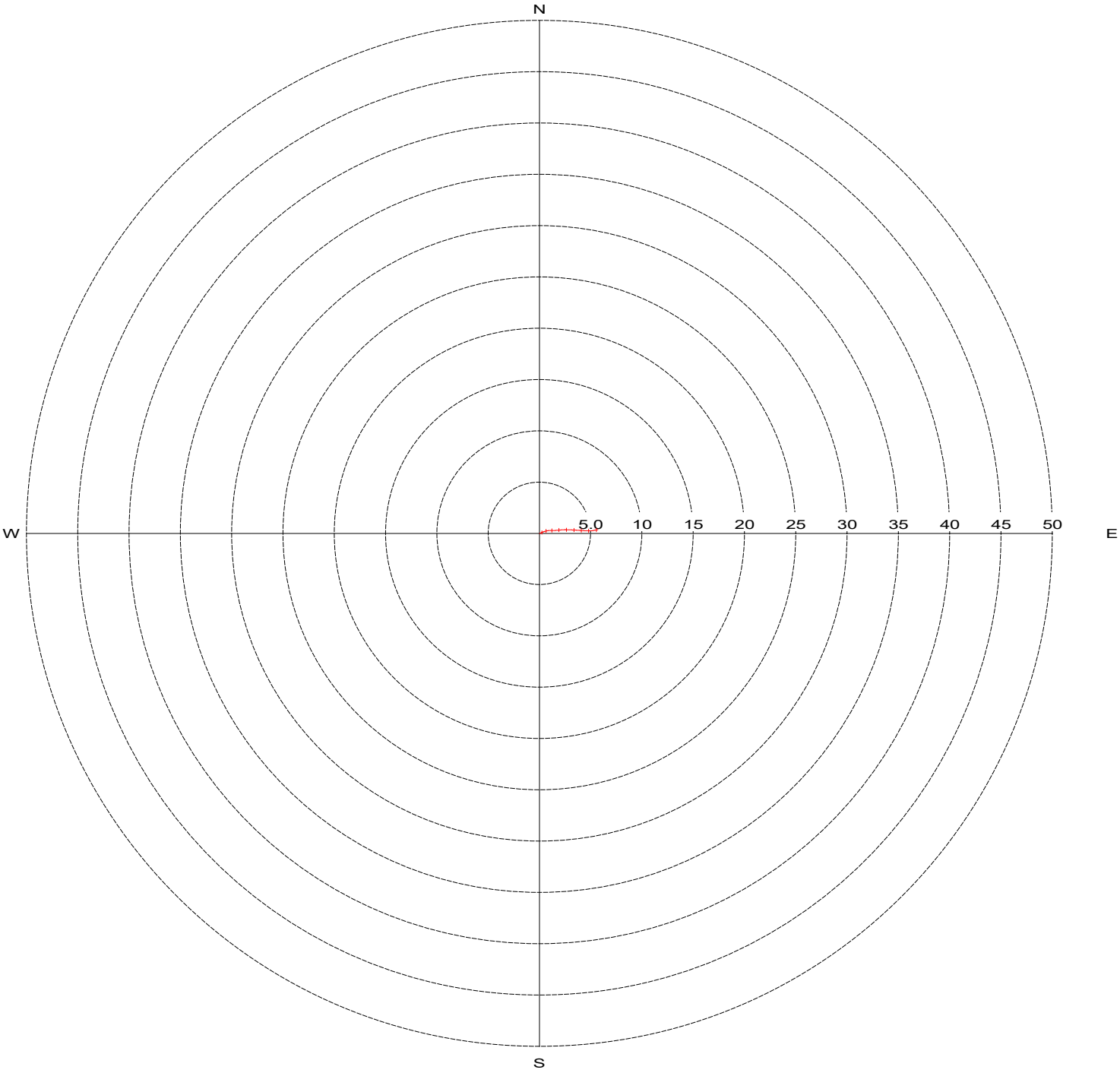
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	BIT	FROM	TO	SIZE	WEIGHT	FROM	TO
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0	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000	0.000000
0	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000	0.000000

REMARKS

LOG FILE: C:\Winlogger\Data\bh4brun2 up.LOG
0.000 to 229.990m

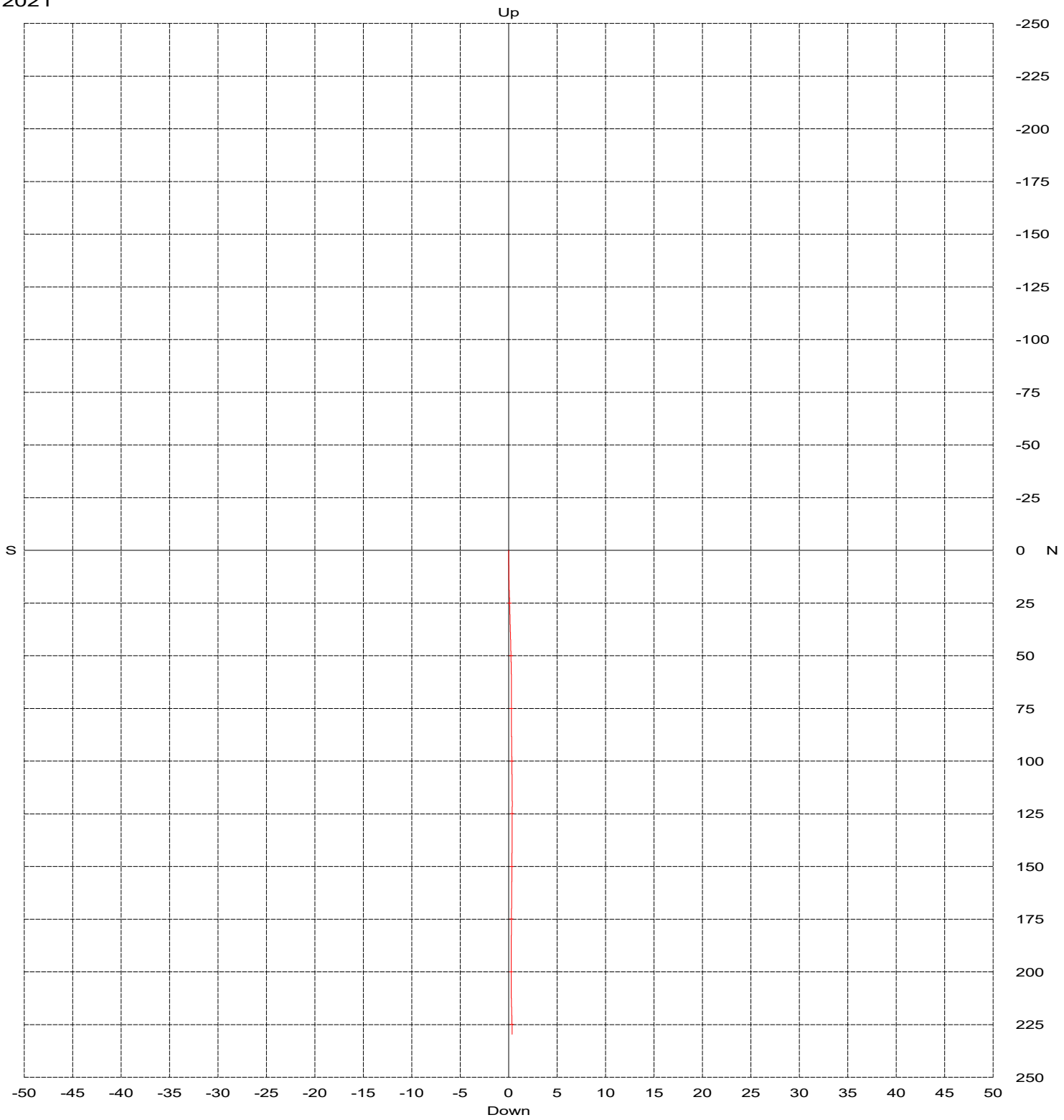
Borehole: BH04b
Zone from: 0.000 - 229.990m
North ref is Magnetic
Mean deviation: 1.42 to N86.31
End coordinates .....
North: 0.366
East : 5.684
Down : 229.863
Azimuth of end: N86.31
Distance start-end: 5.696m
Distance marks every 25m
03 Dec 2021

Projection onto horizontal plane



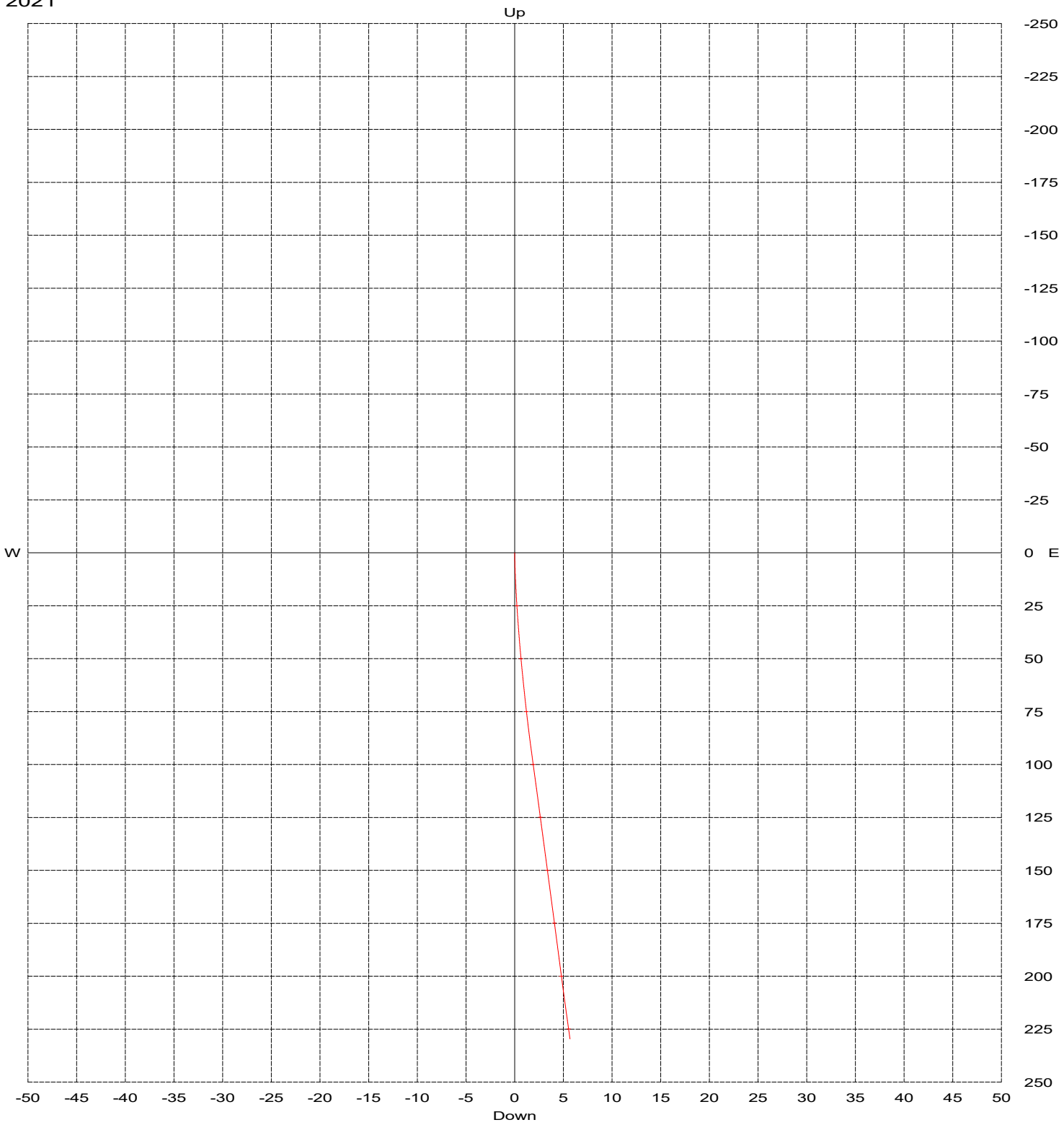
Borehole: BH04b
Zone from: 0.000 - 229.990m
North ref is Magnetic
Mean deviation: 1.42 to N86.31
End coordinates .....
North: 0.366
East : 5.684
Down : 229.863
Azimuth of end: N86.31
Distance start-end: 5.696m
Distance marks every 25m
03 Dec 2021

Projection onto vertical N-S plane



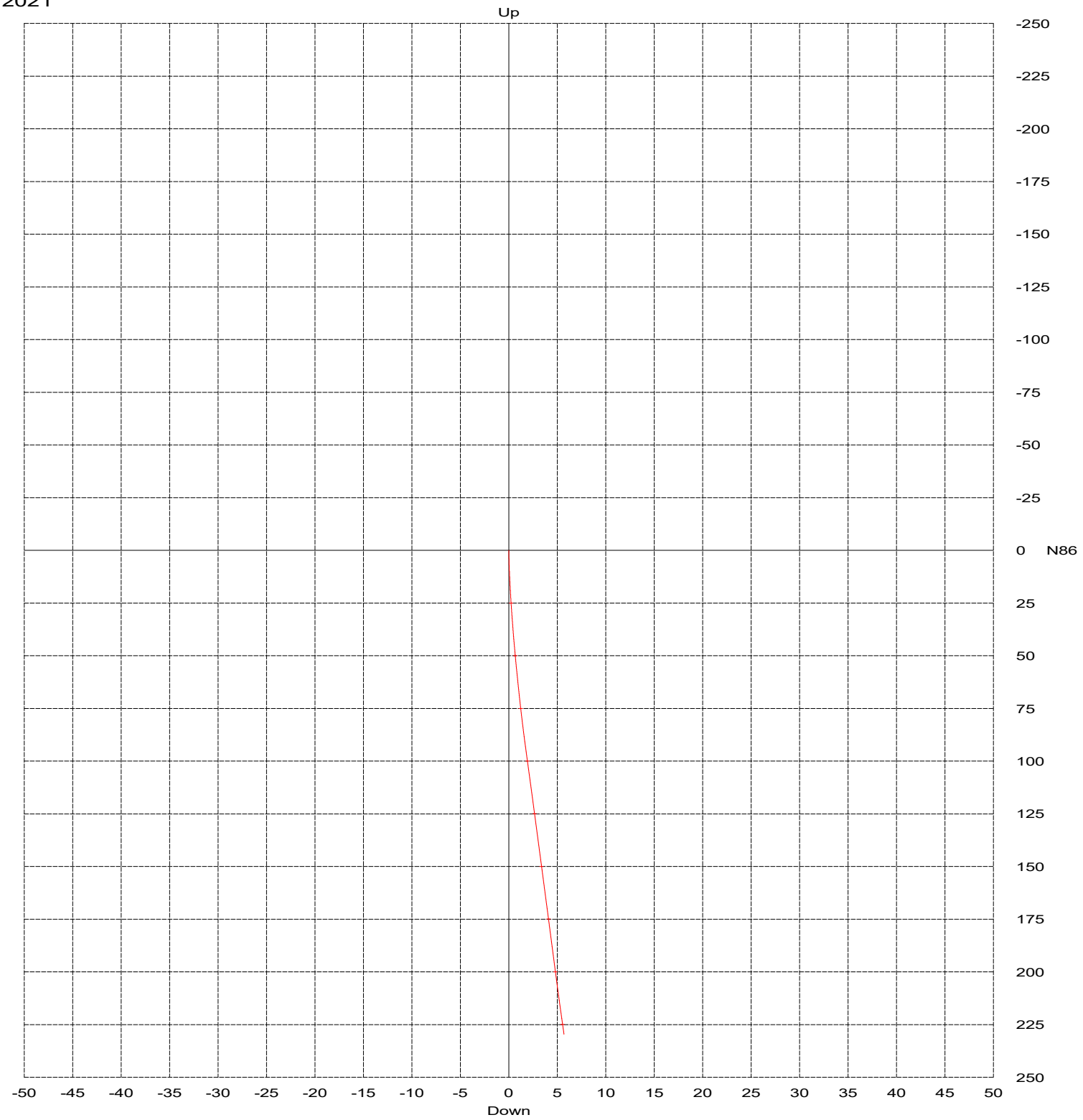
Borehole: BH04b
Zone from: 0.000 - 229.990m
North ref is Magnetic
Mean deviation: 1.42 to N86.31
End coordinates .....
North: 0.366
East : 5.684
Down : 229.863
Azimuth of end: N86.31
Distance start-end: 5.696m
Distance marks every 25m
03 Dec 2021

Projection onto vertical E-W plane

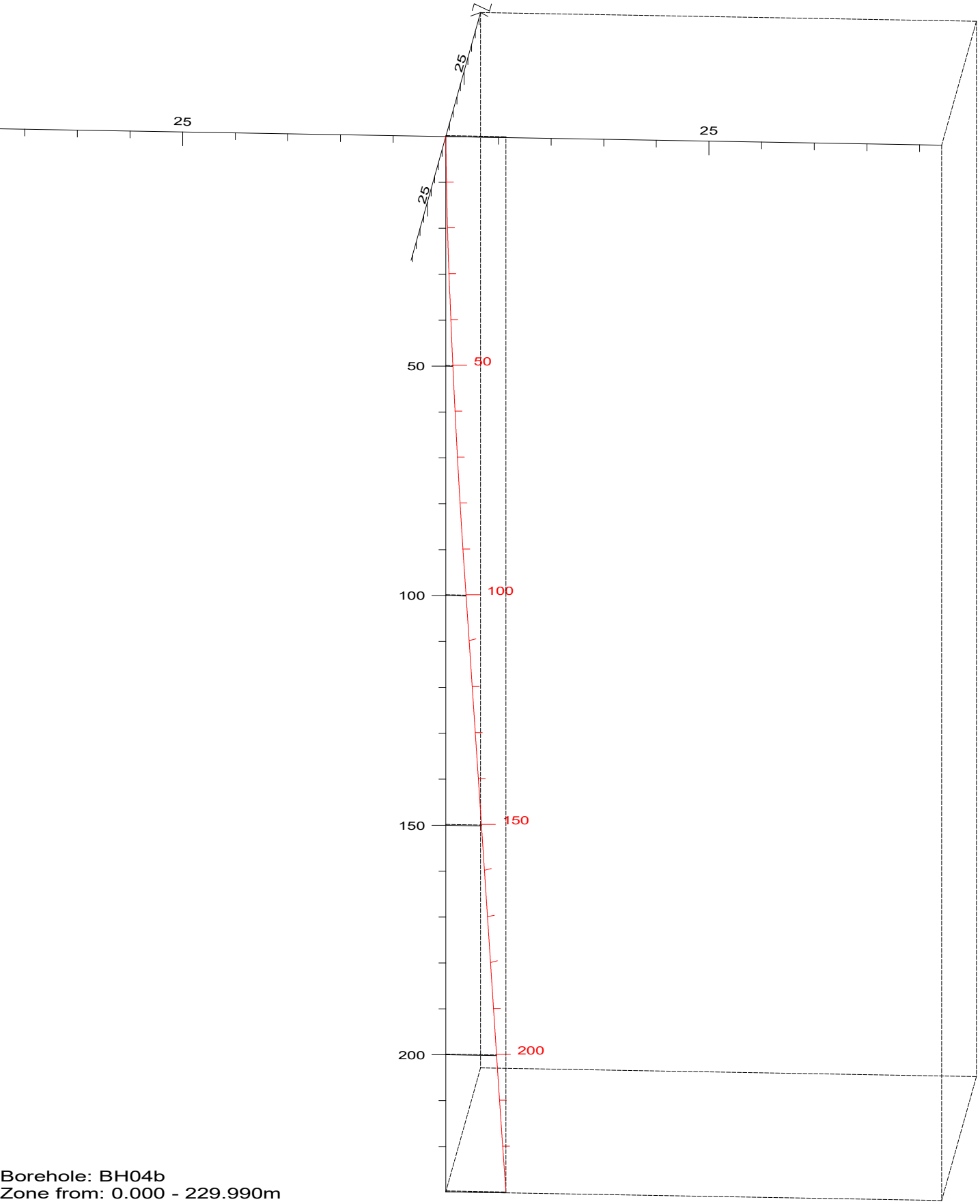


Borehole: BH04b
Zone from: 0.000 - 229.990m
North ref is Magnetic
Mean deviation: 1.42 to N86.31
End coordinates .....
North: 0.366
East : 5.684
Down : 229.863
Azimuth of end: N86.31
Distance start-end: 5.696m
Distance marks every 25m
03 Dec 2021

Projection onto vertical plane in end-borehole direction



Deviated borehole in orthographic projection, viewed from N176



Borehole: BH04b
Zone from: 0.000 - 229.990m
North ref is Magnetic
Mean deviation: 1.42 to N86.31
End coordinates .....
North: 0.366
East : 5.684
Down : 229.863
Azimuth of end: N86.31
Distance start-end: 5.696m
Viewpoint: N176
03 Dec 2021

Appendix F Geological Mapping

SMEC

Member of the Surbana Jurong Group



SMEC INTERNAL REF. 30018018

Technical Memorandum

Geological Mapping Memorandum

Client Reference No. 30018018
Prepared for: Oven Mountain Pumped Hydro
5 August 2022

Through our specialist expertise, we deliver advanced infrastructure solutions for our clients and partners.

Leveraging our 70-year history of delivering nation-building infrastructure, we provide technical expertise and advanced engineering services to resolve complex challenges.

Through our network of global specialists collaborating with local partners, we connect you with the best teams and capabilities to deliver innovative and sustainable solutions.

We’re redefining exceptional

Document Control

Document Type	Technical Memorandum
Project Title	Geological Mapping Memorandum
Project Number	30018018
File Location	X:\Projects\300180\30018018 - Oven Mountain PSP\110 Site Investigations\Geological Mapping\Report\Geological Mapping Reporting - Rev1 - Draft.docx
Revision Number	0

Revision History

Revision No.	Date	Prepared By	Reviewed By	Approved for Issue By
0	22/06/2022	Liam Johnston	Deryk Forster	Nick Poriters
1	05/08/2022	Matteo Villani / Liam Johnston	Nick Poriters	Nick Poriters

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Oven Mountain Pumped Hydro	05/08/2022	1 (electronic)

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Signature	

The information within this document is and shall remain the property of:
SMEC

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This report must be read as a whole. The executive summary is not a substitute for this. Any subsequent report must be read in conjunction with this report.

The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. This report has not and will not be updated for events or transactions occurring after the date of the report or any other matters which might have a material effect on its contents, or which come to light after the date of the report. SMEC is not obliged to inform you of any such event, transaction or matter nor to update the report for anything that occurs, or of which SMEC becomes aware, after the date of this report.

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1. Introduction

This report presents the results of the geological mapping carried out by SMEC Australia Pty Ltd (SMEC) for Oven Mountain Pumped Storage Pty Ltd (OMPS) at the proposed site location for the Oven Mountain Pumped Hydro Energy Storage Project (OMPHESP) (the Project). The Project is a 7,200 MWh 'off river' development located near the Macleay River, approximately 60 km southeast of Armidale and 70 km northwest of Kempsey in New South Wales.

The work was undertaken pursuant to the Consultancy Agreement for Engineering Services for the Oven Mountain Pumped Hydro Energy Storage Project between OMPS and SMEC dated 05 July 2021. SMEC was engaged by OMPS to complete a 15% Design for the Project.

This work forms part of a larger investigation, including seismic refraction survey and geotechnical drilling, that forms part of the 15% design package engagement.

1.1 General Arrangement

The proposed General Arrangement of the site is provided in Figure 1-1. The Upper Reservoir provides water through the vertical pressure shaft, then westward to the generation cavern, with the water then passing along the tail race to the Lower Reservoir, located immediately adjacent to and east of the Macleay River.

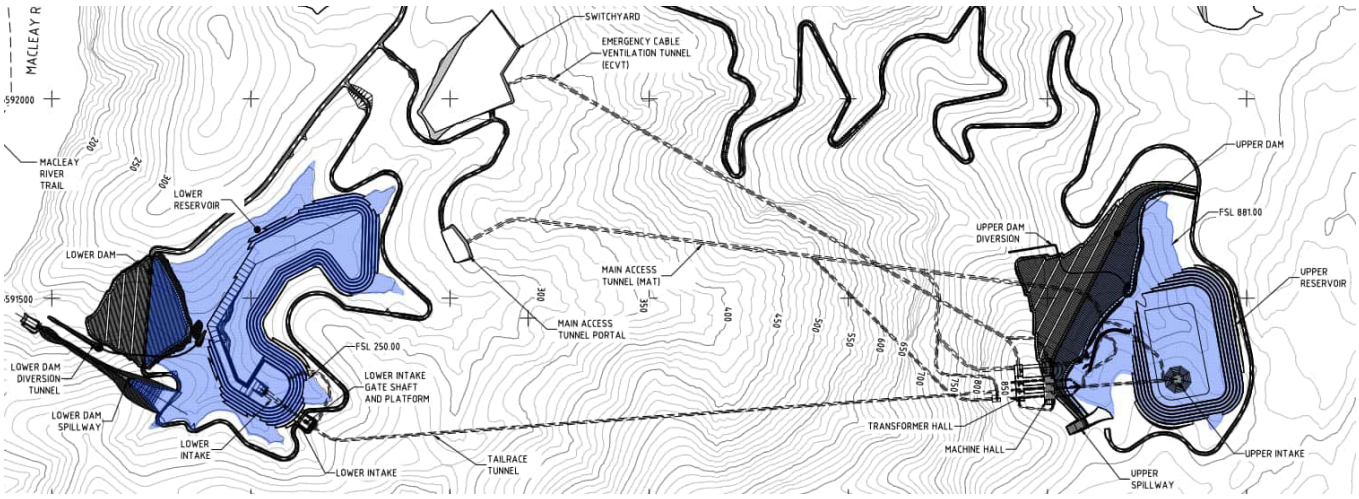


Figure 1-1 Proposed General Arrangement of the Project (Drawing 002 issued with the 15% Design report Revision 3).

2. Previous Studies

Between November and December 1996, SMEC carried out geological and geotechnical investigations at the Project site focussing about a project arrangement that has since been superseded. That field program comprised:

- Aerial photo interpretation;
- Geological mapping of the upper and lower reservoirs;
- Seven (7) boreholes across the proposed site;
- In situ hydrogeological testing; and
- Laboratory testing.

Three (3) different geological units were identified in the 1996 geotechnical investigation:

- Carrai Granodiorite;
- Horndfelsed Nambucca Beds sediments; and
- Metamorphosed sedimentary units of Nambucca Beds.

The rock was generally of very good quality in terms of strength, weathering, and defect prevalence and characteristics. Localised zones of deformation and alteration exist but are isolated and have little impact on the surrounding rockmass quality.

Full details of the geotechnical investigation, borehole logs, photos, and test results can be found in*: Report on Geological Investigations* of the main Oven Mountain Pumped Storage Review report, dated January 1997, and previously issued to the client.

In February 2020, a site inspection was completed by SMEC personnel and memorandum was distributed to the client in a Geological Technical Note Memorandum. The intention was to gain an appreciation of the geology in the proposed project site, and provide advice on different upper reservoir options, and the proposed lower reservoir location.

Observed geological conditions on site differ to those mapped by GSNSW. For the purposes of this assessment, the nomenclature adopted in the SMEC geotechnical investigation of 1996, and the 2020 inspection report, has been retained. The information gained in previous studies was reviewed and utilised to expedite the 2022 geological mapping exercise.

Information gained from the 2021 borehole drilled by SMEC was also used in preparation for and of the field mapping. Further information regarding the results of the 2021 campaign are provided in the Geotechnical Factual Report previously issued to OMPS.

3. Methodology

A SMEC Engineering Geologist and a Geophysicist visited the site in two (2) separate mobilisations, targeting the Upper Reservoir (02 – 05 May 2022), and the Lower Reservoir (31 May – 04 June 2022). The purpose of the site visits was to undertake geological mapping of the two areas to acquire sufficient data to form an understanding of the geological conditions at the sites, review the previous geological mapping undertaken by others, and to make additional observations to inform the 15% design.

Attention was paid to the determination of the distribution of lithological units, their strength, weathering, and structure, geomorphology and topography, and hydrogeological expressions across the site. The tunnel alignment was not mapped as a result of inclement weather, resulting in unsafe field conditions, preventing access to areas of steep terrain.

3.1 Location and Access

3.1.1 Upper Reservoir

The site mapping for the Upper Reservoir was concentrated around the current proposed layout of the embankment, abutments, reservoir, quarry, intake structure, and access road.

For the duration of works, SMEC personnel were accommodated at the campsite in caravans, and accessed the mapping areas by car or buggy, then by foot.

3.1.2 Lower Reservoir

Geological mapping of the Lower Reservoir was concentrated around the proposed arrangement of the embankment, abutments, reservoir, and quarry. Due to inclement weather and inaccessible terrain, the lower intake and tunnel portal were not mapped.

This section of the site was accessed by air, with a machine provided by Fleet Helicopters (ex Armidale). The team were based in Armidale, and were transported to Site 3 each morning, from where mapping was progressed along creek beds to access different locations within the Project.

3.2 Weather Conditions

Inclement weather delayed the geological mapping on several occasions, with the wet conditions creating high risk conditions, particularly in the smooth based creek beds, and densely vegetated colluvial slopes, often with waist high grass. The aforementioned surfaces become very slippery when wet. These weather related delays impacted both the Upper and Lower Reservoirs.

Similarly, access to the Lower Reservoir was limited as a result of cloud and wind gusts, which restricted helicopter operations.

Daily rainfall and maximum wind gust speed [at Armidale Airport] have been captured in Figure 3-1 below. Armidale lies approximately 60 km northwest of Oven Mountain and the topography changes considerably between the two locations, with Oven Mountain often experiencing additional rainfall and fog compared to Armidale.

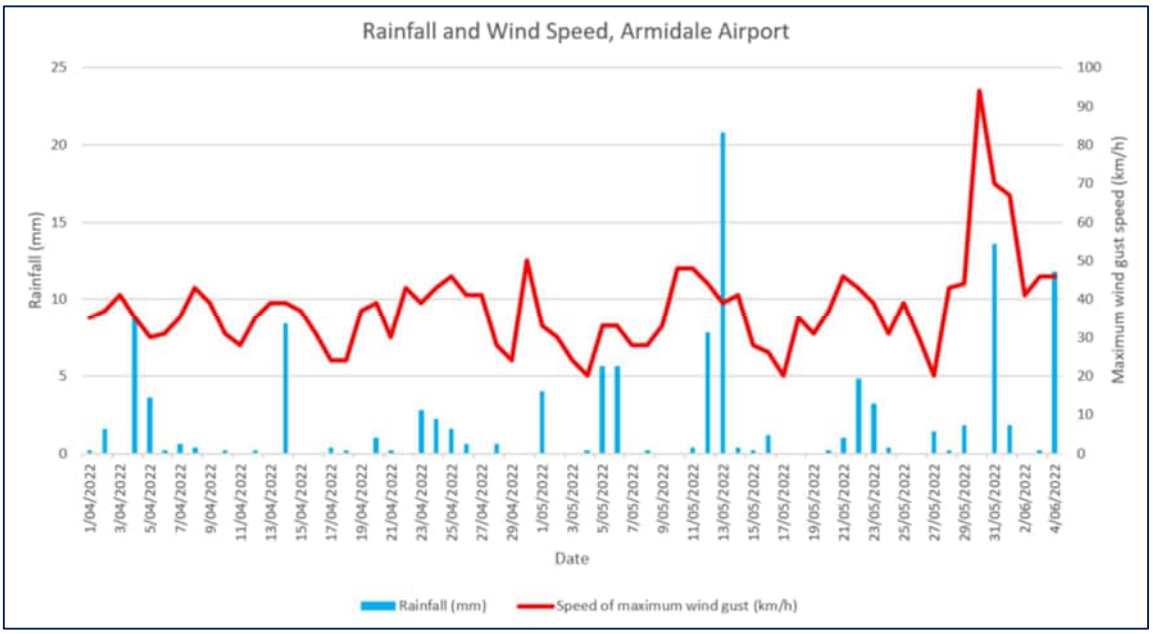


Figure 3-1: Daily rainfall and wind gust speed for Armidale Airport from 01 April to 04 June 2022.

4. Site Description and Geomorphology

The Site is located on a slope of western aspect to the east of the Macleay River. Two off river storage reservoirs are proposed within: a) Lower Reservoir: the gully on the side of Oven Mountain, and b) Upper Reservoir: on the western plateau of the mountain. Tunnels and caverns will connect the reservoirs below ground, with a surface access road to allow movement of personnel and plant between the reservoirs.

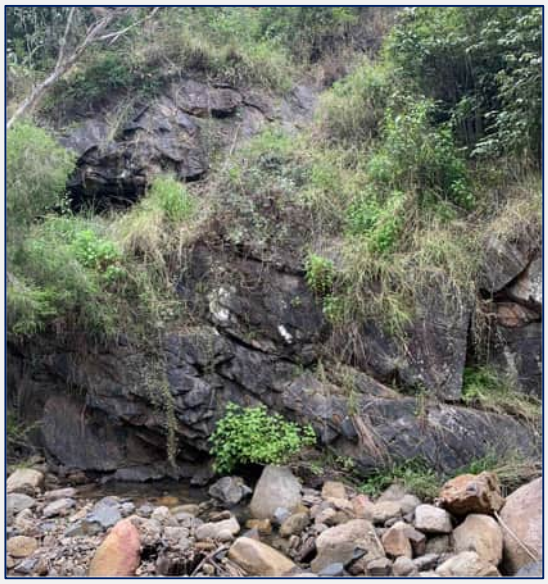
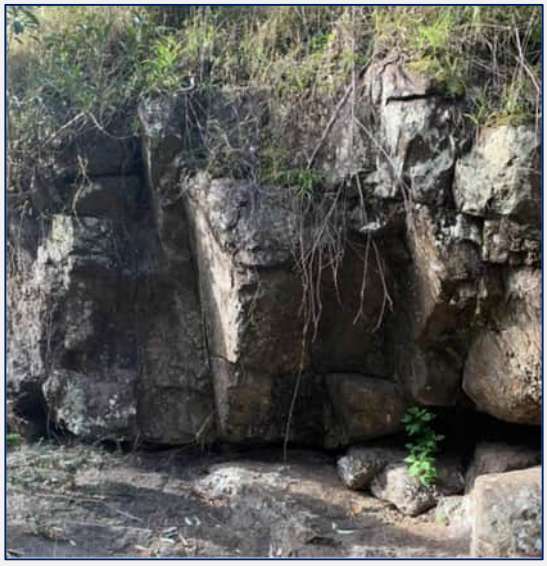
Various observations made at each of the proposed dam and reservoir areas are presented in Table 4-1 and can be viewed in Appendix 1 – Geological Map.

Table 4-1 Geomorphological Observations across the site.

Zone	Notes / Observations / Representative Photos
Upper Reservoir: Abutments	• Slope generally dips to the north at 15 – 20 degrees; • Each abutment slopes north and south-west to west at 30 and 35 degrees respectively; • Organic matter rich colluvial soils, with cobbles and occasional boulders; • Little to no outcrop observed; and • Trees are generally upright; inconsistent and very infrequent bowing of tree bases.

Zone	Notes / Observations / Representative Photos
	 *Creek running through proposed left abutment.*  *Organic matter rich colluvial soils.*
Upper Reservoir: Dam and Quarry	• Slope generally dips to the north and east at 10 – 15 degrees, with topography dominated by gulleys cut by streams; • Proposed eastern wall of possible quarry is comprised steep granodioritic slopes up to 50 degrees; • Colluvial soils, with cobbles and occasional boulders, within dam reservoir; • Little to no outcrop observed west of the rock slope; outcrop exposed in eastern boundary of the full supply level; and • Trees are generally upright.  *Topography at the intake structure.*  *Proposed eastern wall of possible quarry.*
Upper Reservoir: Access Road	• Slope generally dips southwest to northwest at 25 – 30 degrees; • Vegetation comprises dense bush (three metres tall) when facing south, and less dense bush (to two metres), with mature trees 15 m in height toward the north; and • Organic matter rich colluvial soils with cobbles and boulders are present on less steep areas, and granodiorite slopes are exposed in river beds and on steeper sections. • Refer to Appendix 1 – Geologic Map for proposed access road locations.

Zone	Notes / Observations / Representative Photos
	 *Dense bush & rock outcrop on moderate slope.*  *Terrain looking southwest.*
Lower Reservoir: Abutments	• Two slope profiles were observed: – Steep cliffs [up to 80 degrees] along short (< 20 m) sections of the right abutment; and – Surrounding slopes of 20 – 25 degrees. • Slopes dip to the north and south; • Organic matter rich colluvial soils with cobbles and boulders; • Talus deposits at the base of cliffs and in riverbeds; • Outcrops observed in streambeds; very few outcrops on abutment slopes; • Trees are generally upright, though some have minor bowing at the base; and • Point bars have formed where the valley floor is wider, and the slope is less steep. These deposits contain colluvial and alluvial soils, gravel, cobbles, and boulders. • Refer to Appendix 2 – Cross Sections (CSSR03).

<table>
<tr><th>Zone</th><th>Notes / Observations / Representative Photos</th></tr>
<tr><td></td><td> 
Densely vegetated northern slope.
 
Steep cliff (< 20 m long) on the southern slope.</td></tr>
<tr><td>Lower Reservoir: Dam and Quarry</td><td>• Slope has a large aspect range of approximately 270 degrees from northeast to southeast, through west;
• Vegetation comprises dense scrub, one to two metres in height, and mature trees up to 15 metres tall; and
• Organic matter rich colluvial soils with cobbles and boulders are present on less steep areas and granodiorite slopes are exposed in river beds and on steeper sections.
 
Densely vegetated northern section of dam and possible quarry site.
 
Outcrop at the base of the dam.</td></tr>
</table>

5. Site Geology

The following subsections summarise the geological investigations and the subsequent conceptual geological model that has been developed for the site. This model builds upon with work completed by SMEC in 1997, with further resolution provided through additional drilling and geophysical surveys at the site.

The engineering characteristics of these materials are discussed in the following section.

5.1 Regional Geology

The Project is located within the Nambucca Block of the New England Orogenic Province. The Nambucca Block is a three to four kilometre thick sequence of Early Permian to Late Carboniferous sedimentary rocks, with minor felsic and mafic volcanic, and rare calcareous horizons (Gilligan et al. 1992). The Nambucca Block has undergone multiple phases of deformation, and thermal metamorphism. Regional Departmental mapping, by the Geological Survey of New South Wales (GSNSW) indicates predominantly orthogonal regional faults striking north-northwest to south-southeast, and west-southwest to east-northeast. There are, however, no major faults mapped within the project area (GSNSW, 2019). Limited detailed geophysical information is available for the area. Additionally, lithological contacts are not evident in regional geophysical surveys.

The project site is located on the western slope of the Carrai Plateau, which is underlain by a middle Triassic aged granodiorite intrusion. This intrusion was emplaced within the surrounding Late Permian metasedimentary strata and country rock of the Nambucca Beds Group. The top of the intrusion forms a relatively flat tableland, surrounded by deeply incised creeks and tributaries associated with the Macleay River. The Carrai Plateau is part of a chain of northwest- southeast trending belt of intrusive I-type granitoid bodies, located between Wauchope and Round Mountain (Gilligan et al. 1992).

5.2 Local Geology

This section describes the geological conditions at the site, as determined by the investigations completed as part of both this, and the 1997, geotechnical study.

5.2.1 Soils

SMEC (1997 and 2022) reported a shallow soil profile of less than 1.25 metre depth across seven (7) of the eight (8) boreholes that have been drilled in the upper and lower reservoir areas. Observations made during the geological mapping phase were consistent with the results of the intrusive works. Soils within the project area are generally described as:

- Alluvium: Typically 0.10 – 0.30 metres thick and comprises organic matter rich dark brown to black silty clay, with gravel. Generally located in lower energy stream systems within and near to the lower reservoir, on river banks, and in point bars.
- Colluvium: Generally developed on valley side slopes, ranging from approximately 0.1 – 1.0 metres deep and typically comprising brown to dark brown gravelly/cobbly sand, and clay, with boulders, on steeper terrain. An example of colluvial soils exposed on the valley slope is presented in Figure 5-1 below.



Figure 5-1: Colluvial soils exposed in the Upper Reservoir valley slope.

- Scree: Boulder fields developed in very steep terrain typically greater than 38 – 40 degrees (angle of repose), and generally at the base of cliffs and steep slopes.
- Residual Soil: Formed as thin mantles over weathered rock profiles. Residual soil from hornfels generally comprised an orange-brown silty clay, with gravel, and granodiorite residual soils comprised pale grey to orange gravelly sand, with cobbles. Both rock types displayed a resistance to weathering. Thin soils are likely due to a combination of weathering rate, and loss of material through erosion from the steep slopes.

5.3 Rock

Observations of the site geology [made by SMEC in 1997 and 2020] are generally consistent with those made in the recent 2022 geological mapping. Updates made to previous geological mapping include:

- a more accurate delineation of the contact between the hornfels and granodiorite in the upper reservoir;
- the observation of persistent defect sets; and
- the delineation at the hornfels and meta-siltstone gradational boundary at the Lower Reservoir.

As discussed in Section 2, there is some conjecture as to which rocks belong to which geological unit. SMEC (1997) and SMEC (2020) assigned the hornfels and metasiltstone to the Nambucca Beds as it more closely represented rocks of this origin and composition. With reference to maps compiled by the Geological Survey of New South Wales (GSNSW), the unit that appears to be overlying the Carrai Granodiorite is the Parrallel Beds. Whilst the published mapping suggests otherwise, the observations made across three SMEC site visits (1997, 2020, 2022) suggest the metamorphosed hornfels unit is closer in composition to the that of the nearby Nambucca Beds. Petrographic results undertaken on a sample from BH4B at 18m depth identifies the rock unit as being Hornfels. Further petrographic analysis should be undertaken on the rock chip samples from the hydrogeological investigation program.

5.3.1 Granodiorite

The granodiorite is generally pale grey to grey and fine to medium grained. In outcrop, it is medium to high strength and moderately to slightly weathered. Variation in hornblende and biotite content across the outcrops was observed, with greater concentrations of these minerals resulting in a notably darker coloured rock in hand specimen. Around the hornfels contact, finer grained granodiorite and aplite was observed, though displayed no change in strength or

weathering. The change in grain size is likely the result of an intrusion scale chilled margin, where the magma has cooled rapidly against the cold country rock.

The contact between the granodiorite and hornfels is remarkably distinct and slightly weathered to fresh in all observed locations. Granitic and syenogranitic dykes were also observed within the hornfels and meta-siltstone across site that were assumed to be related to the same major intrusion event, though at a later stage.

Localised areas of moderately to highly weathered granodiorite were identified within creek beds, and are associated with a slight colour change to pale pink and orange. It is possible that the more weathered material has allowed erosion to progress more rapidly, thus capturing the drainage system.

5.3.2 Hornfels

The hornfels is dark brown to dark grey and generally high strength in outcrops. Bedding was difficult to determine as it is now indistinct, however a single outcrop in the upper reservoir demonstrated bedding in the hornfels dipping at 30 degrees toward the west. Field observations were unable to determine bed thicknesses. The hornfels outcrops observed were generally slightly weathered and high to very high strength, indicating a very shallow weathering profile. Some possible faulting was observed in this unit but less in comparison to the meta-siltstone.

The consistency seen in the hornfels reflects a 'relatively' homogenous parent lithology and is also characteristic of large-scale contact metamorphism.

5.3.3 Meta-siltstone

The meta-siltstone ranges from dark brown to dark grey and blue in some locations. Bedding markers were not observed so it could not be determined. Like the hornfels, the meta-siltstone is resistant to weathering with outcrops generally slightly weathered and of high strength. More defects were observed in the meta-siltstone compared to the hornfels; most notably the increase in possible faults. These features could be interpreted as faults, indicated by zones of closely spaced joints and accessory joints that could imply shear movement or strain accommodation structures. Offset of structures within the rock was not observed. The homogeneity seen in the hornfels is also reflected in the meta-siltstone, indicating a similar fine-grained protolith of the [likely] Nambucca Beds.

Hornfels forms by high-temperature and low-pressure metamorphism, characteristic of rock surrounding an igneous intrusion, such as the Carrai Granodiorite. The Nambucca Beds meta-siltstone is a pressure related metamorphism unit that has experienced at least lower greenschist metamorphism associated with subduction.

These differences in metamorphic grade are rarely apparent in hand samples and require detailed petrographic assessment to understand the differences in rock type. Despite the boundary being indistinct, an effort was made to distinguish it from the hornfels.

5.4 Rock Mass Defects

As part of the geological mapping program, the geometries and characteristics of representative defects were measured and recorded. Defects recorded by SMEC (1997) near the proposed site were combined with the defects by SMEC (2022), providing a total population of 197 defects.

It is noted that the Australian Standard, relating to the description of defects, has been updated, thus the description of the 1997 defects and those observed in 2020 and 2022, are not directly comparable.

Stereonets for different defect types have been compiled are attached as Appendix 4.

5.4.1 Defect Sets

Dip direction measurements were recorded during the geological mapping with two (2) different systems listed below. Both tools were used and found to be typically within 5 degrees variation of recording.

- Geological compass: Freiberg 360 degree structural compass; and
- Cellular phone: Samsung galaxy note 20 ultra 5G, using Fieldmove version 1.5.2 on Android version 12 OS.

Dip direction measurements taken with the geological compass were recorded during the mapping with respect to magnetic north. In order to present the data with respect to grid north for geotechnical assessment, a local

declination of + 12 degrees has been applied to all dip measurements taken with the Freiberg compass. The Australian Geomagnetism Reference Field Values were requested for site, with the results shown in The cellular phone reported bearings relative to true north.

Requested

Latitude	Longitude	Elevation	Date
-30° 48 59.99	152° 10 19.53	0.5 km	2022/04/01

Calculated

Latitude	Longitude	Elevation	Epoch
-30.8167°	+152.1721°	0.50 km	2022.2466

Magnetic Field Components
D = 11.848 deg

Figure 5-2: Geomagnetic declination for the mapping area from Geoscience Australia Geomagnetism department.

The orientation of the defects has been plotted for the Upper and Lower Reservoir sites on stereographic projection using DIPS 8.013 software developed by RocScience. The software allows discontinuity data to be presented and contoured in order to identify the main defect sets within the rockmass.

The data was plotted onto two (2) sets of stereonets, representing different defect types at the upper and lower reservoir areas separately, and are presented in Appendix 4.

5.4.1.1 Possible Faulting

Possible strike-slip faulting was observed in the Upper Reservoir left abutment and access road. These defects are sub-vertical, dipping to the east and appear to have up to 30 mm movement in the sinistral (left-lateral) direction. Movement in the vertical direction (i.e. throw) was not observed. There is a possibility that these defects are in fact stress relief joints, which are of different origin and have different implications to tectonic faults.

Over geological time, the Macleay River has incised the valley and as a result, stress has been released from within the rockmass. Loads applied to the slopes by the rock mass have been reduced, and defects parallel to the valley then form as stress is redistributed. This is referred to as valley closure. The implication of these defects being caused by valley closure is that they are relatively superficial and are unlikely to penetrate deep into the rock where the cavern and much of tunnels are to be built. The defects are also more likely to form in the upper slopes of the valley where the rock has been under greater stress for longer periods of time.

Defects interpreted as faults in the lower reservoir hornfels and meta-siltstone were more common with two sets being identified dipping sub-vertically toward the northeast and east. Movement was not observed in these defects but inferred by zones of tightly spaced accessory joints. Like the upper reservoir, these defects could be strain accommodation features associated with erosion and stress release within the surrounding rockmass, implying a different cause of stress to the geological environment.

Further detailed local and regional geological mapping and structural interpretation is required to further classify these defects.

5.4.1.2 Joint sets

Jointing in the Upper Reservoir was categorised into two (2) sets: sheet joints dipping sub-horizontally to the west, and sub-vertical joints dipping to the east. Sheet joints are characteristic of intrusions and form as a result of erosional stress release after emplacement and crystallisation of the magma. These defects are sub-horizontal and dip to the west, paralleling the topography, and can range in dip to ~ 30 degrees.

The lower reservoir jointing was categorised into two (2) sets: both sub-vertical and dipping to the northeast and east respectively.

5.4.1.3 Foliation

Hornfels and meta-siltstone exhibit signs of foliation while the granodiorite does not. Foliation is not always visible in the outcrops observed and was much more prevalent in the Lower Reservoir. It was categorised in the upper reservoir based on 3 data points to dip sub-vertically to the northwest. Where foliation was present in the lower reservoir, it was strongly developed. Two sets were observed they dip sub-vertically to the west and northwest.

5.4.1.4 Bedding

The hornfels exhibits very indistinct bedding planes, and only several outcrops at the upper reservoir gave indicators of bedding. The bedding orientates downhill toward the Macleay River at generally sub-vertical toward the west.

Few bedding indicators were observed at the lower reservoir, with one (1) possible set being identified. This set dips sub-horizontally to the northwest.

5.4.2 Defect Characteristics

For each of the different rock types the defect characteristics, as observed during the field program, have been summarised in Table 5-1 to Table 5-3.

Generally, the observed defects did not contain any soft coatings (clay, rushed rock etc.), however this does not mean that they are not present. Faults in the Lower Reservoir were infilled, which is a secondary process that occurs as surficial soil falls into the open fault.

FAULTS	Shape	Roughness	Coating	Aperture (mm)	Persistence (m)	Spacing (m)
Granodiorite	Planar to undulating	Rough	Clean to 2 mm quartz coat	0 – 5	> 5	0.5 – 3.0
Hornfels	Undulating	Rough to slickensided	15 mm quartz coat to angular medium gravel	0 – 10	> 7	Not observed in sets
Meta-siltstone	Planar to undulating	Rough to smooth	Clean to iron coat to infill with organic clayey silt	0 – 10	> 7	Not observed in sets

Table 5-1: Observed defect conditions for faults during the geological mapping.

JOINTS	Shape	Roughness	Coating	Aperture (mm)	Persistence (m)	Spacing (m)
Granodiorite	Planar to curved	Rough	Clean to iron veneer	0.0 – 0.1	> 5	0.4 – 2.0
Hornfels	Planar to undulating	Rough to smooth	Clean to 1 mm quartz coat	0	> 4	0.3 – 1.5
Meta-siltstone	Planar	Rough	Clean to iron veneer	0	> 3	0.2 – 1.0

Table 5-2: Observed defect conditions for joints during the geological mapping.

BEDDING	Shape	Roughness	Coating	Aperture (mm)	Persistence (m)	Spacing (m)
Hornfels	Planar to undulating	Rough	Clean to calcite veneer	0	0.2 – 1.0	0.05 – 1.0
Meta-siltstone	Planar to undulating	Rough	Clean to quartz veneer	0	1.0 – 2.0	0.01 – 0.05

Table 5-3: Observed defect conditions for foliation during the geological mapping.

6. Hydrogeological Observations

Ephemeral creeks and streams collect surface runoff across the site and feed into Macleay River. These streams were flowing during both field mapping exercises. Other focus points, such as natural springs, hanging swamps or distinctive small areas of vegetation change, were not identified. Hanging swamps and patches of dense vegetation can infer a spring and cause issues related to ground stability.

Some key hydrogeological observations were made in the main stream that collects surface runoff around the project area. The creek the flows from the upper reservoir, beneath the proposed lower reservoir abutment and connects to the Macleay River. Water flows observed within this drainage feature flowed consistently until a location west of the lower reservoir abutments, and the flow subsided for 10m, then resumed flow 10m downstream. The gradient of the creek within the gulley was approximately 5 degrees. A flow rate of approximately 2 L / minute was observed at both locations. This observation took place following wet weather.

This would be an area to investigate in subsequent phases of the project as it could represent interconnectivity of defects below the lower reservoir abutments. Aquifer connectivity could then translate into reservoir leakage beneath the abutment foundations.

7. Geological Hazards

The area of the proposed dam site and the surrounding areas were observed with respect to potential geological hazards that need to be considered during the design and construction.

Evidence of rock falls were observed with cobbles and boulders in loose uncemented colluvium talus / scree across the site. On the slope of the proposed Upper Reservoir access road, cobbles and boulders were typically larger than 200 mm in diameter and this size increased as slope steepness increased. Loose cobbles and boulders on the slope, and in the cut face of the slope, could mobilise creating a rock fall hazard. Additionally, prior to work on the slopes, it is recommended that the slope be assessed regarding the attenuation of vibrations and the likelihood of boulder mobilisation.

Colluvial slopes at the Upper Reservoir site are generally stable, with little bowing of tree bases and no hummocky ground observed. Sheet joints within the granodiorite are stable in dry conditions, however an increase in hydrostatic pressure could reduce the friction angle and landslides could mobilise along these joints.

Signs of unstable ground were more apparent at the Lower Reservoir dam and abutments, with evidence of minor landslide scarps and some active slides. One observed slide (refer to Photo R in Appendix 3 – Photo Board) was identified by the distinctive scarp of the previous failure and bowing at the base of the only semi-mature tree within the failed area. The second slope failure at the Lower Reservoir was a small (one (1) square metre) slip that occurred on residual soil. Both failed slopes have a southerly aspect and are on slopes with an inclination of 25 – 30 degrees.

Large boulders (up 40 m^3) in riverbeds of the Lower Reservoir are present at the proposed dam site, indicating that significant rock fall does occur in the area.

1 Geological Map

LEGEND

- Foliation
- Potential Faults (Dip Angle and Dip Direction)
- Inferred Boundary
- Boundary
- Seismic Lines
- Macleay River
- Streams
- Granodiorite
- Hornfels
- MetaSiltstone

Design

- Tunnel
- Surface Works
- Dam Reservoirs
- Access Roads

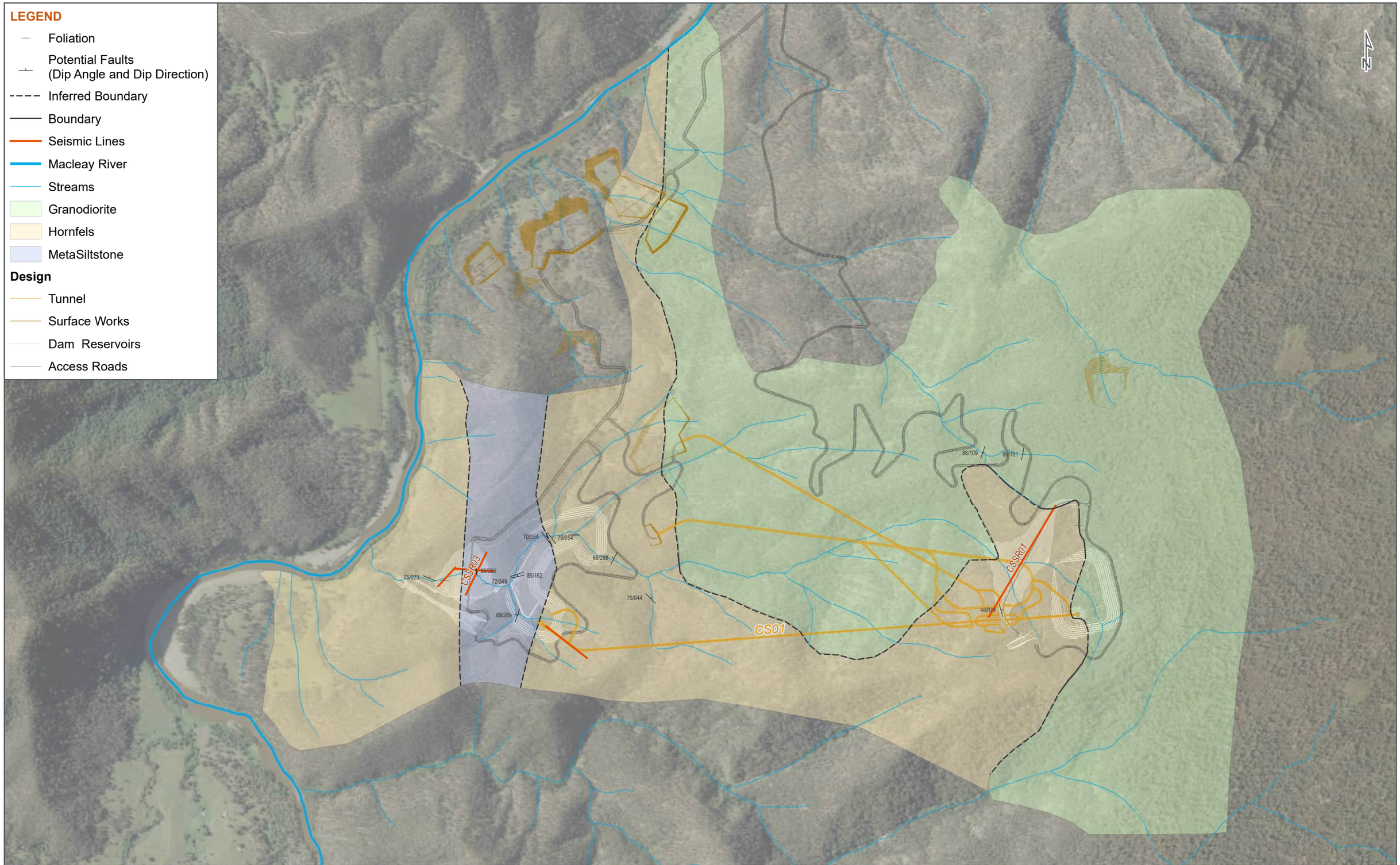


FIG NO. Appendix 1	**FIGURE TITLE** GM01	**DATE** 05/08/2022	0 75 150 300 450 600 750 Meters 1:15,000	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 56
PROJECT NO. 30018018	**PROJECT TITLE**: Oven Mountain Pumped Hydro Storage	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2020 Imagery: © Department of Customer Service 2020		

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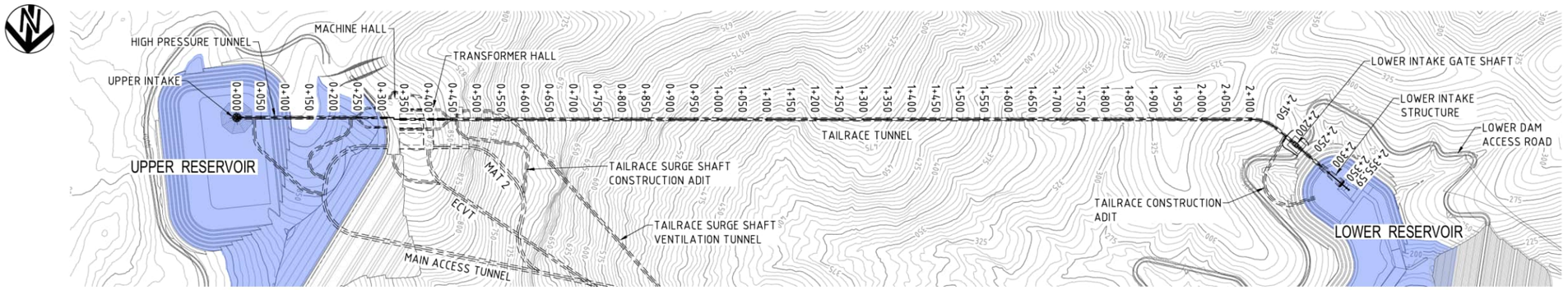
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.

SMEC
Member of the Surbana Jurong Group

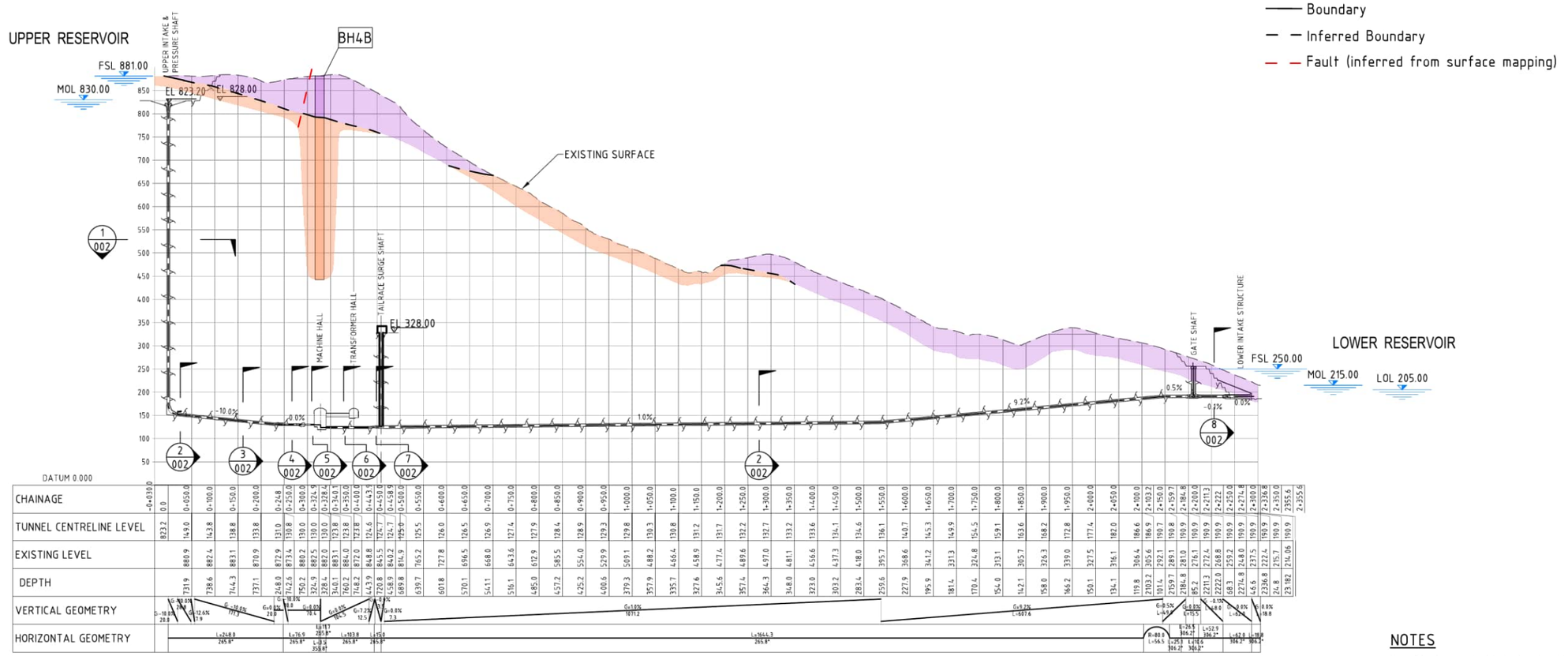
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Last updated by: FA13847 on 5/08/2022 at 11:54

2 Cross Sections



PLAN
SCALE 1:5000 (A1)



PROFILE
SCALE 1:5000 (A1)
(VERTICAL EXAGGERATION: 1 x)

- Hornfels
- Granodiorite
- Boundary
- Inferred Boundary
- Fault (inferred from surface mapping)

NOTES

1. ALL DIMENSIONS ARE IN METRES, UNLESS OTHERWISE STATED.
2. VERTICAL DATUM IS AHD.
3. SURVEY PROJECTION USED IS MGA ZONE 56, USING GDA94 DATUM.
4. CONTOUR INTERVAL 5m MINOR, 25m MAJOR.
5. ROCK SUPPORT NOT SHOWN FOR CLARITY.

DRAWING FILE LOCATION / NAME

PLOT DATE 13 Apr 2022 TIME 08:17:27

EXTERNAL REFERENCE FILES
X_SMEC_A1
X_DES_TUNNEL_PL
X_DES_TUNNEL_LS
X_EXIST_CONTOURS
X_DES_SURGE_SHAFT_LSWS
X_DES_DAM_PL
X_DES_ROADS

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
A	11.03.22	ISSUED FOR 15% DESIGN	001	L.D.
B	20.03.22	ISSUED FOR GEOLOGICAL MAPPING MEMORANDUM	002	

TITLE	NAME
DRAFTER	T. CORFIAS/L. JOHNSTON
DESIGNER	F. TAKHTEMINA
DESIGN CHECK	F. TAKHTEMINA
DESIGN MANAGER	J. KENT-JOHNSTON
PROJECT MANAGER	H. SALEM
PROJECT DIRECTOR	L. DROWLEY

SCALES AT A1 SIZE DRAWING
SCALE 1:5000 50 0 100 200

PRELIMINARY

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NORTH SYDNEY NSW 2060
SMEC PROJECT No 30018018

CLIENT
OVEN MOUNTAIN PUMPED HYDRO STORAGE

PROJECT TITLE
Oven Mountain Phase 1 – 15% Concept
(Geological Mapping)

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
AS NOTED	15% DESIGN	30018018/CS01	A

150 mm ON ORIGINAL
A1

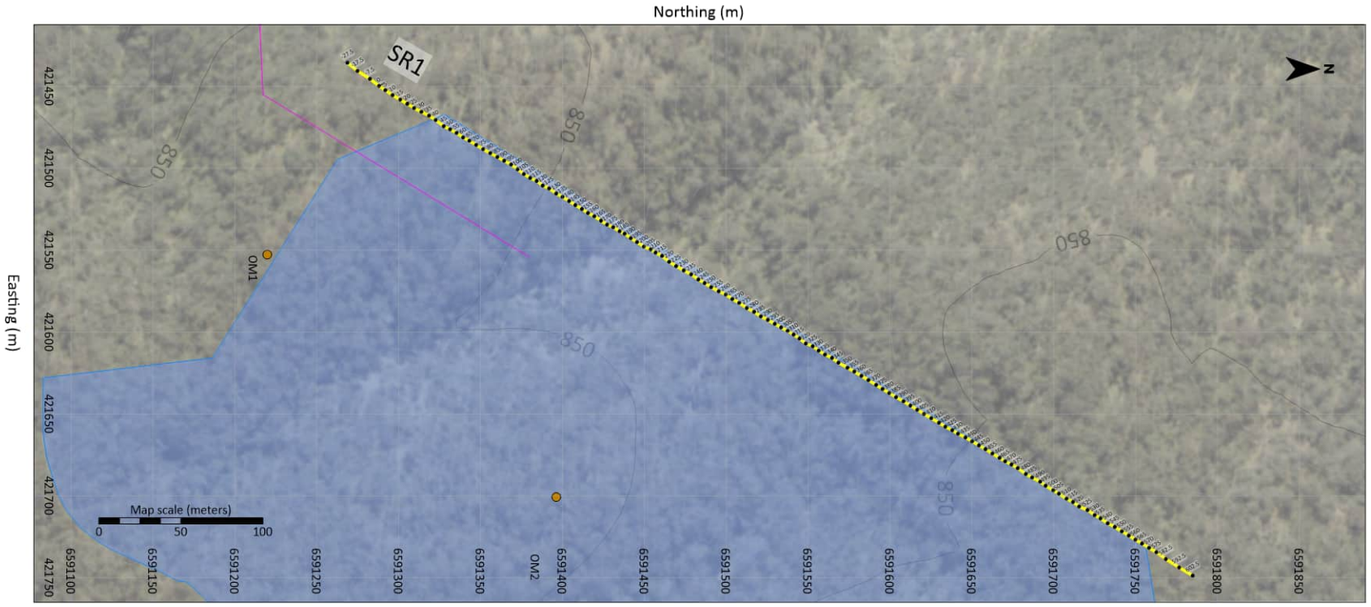
Disclaimer:

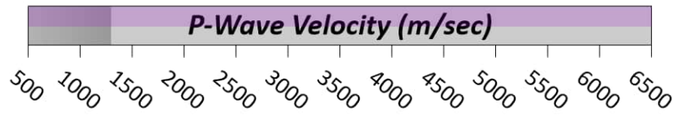
Interpreted seismic profiles are subject to uncertainties due to seismic signal to noise ratio and due to the normal limitations of seismic refraction interpretation where a simple 2/3 layered model is imposed on complex site with highly variable (laterally and vertically) anisotropic weathering and rock conditions.

The seismic and geological interpretation derived by SMEC and presented inthis figure has been prepared for the client only as a guide to likely subsurface conditions to aid the geotechnical interpretation and planning purposes.

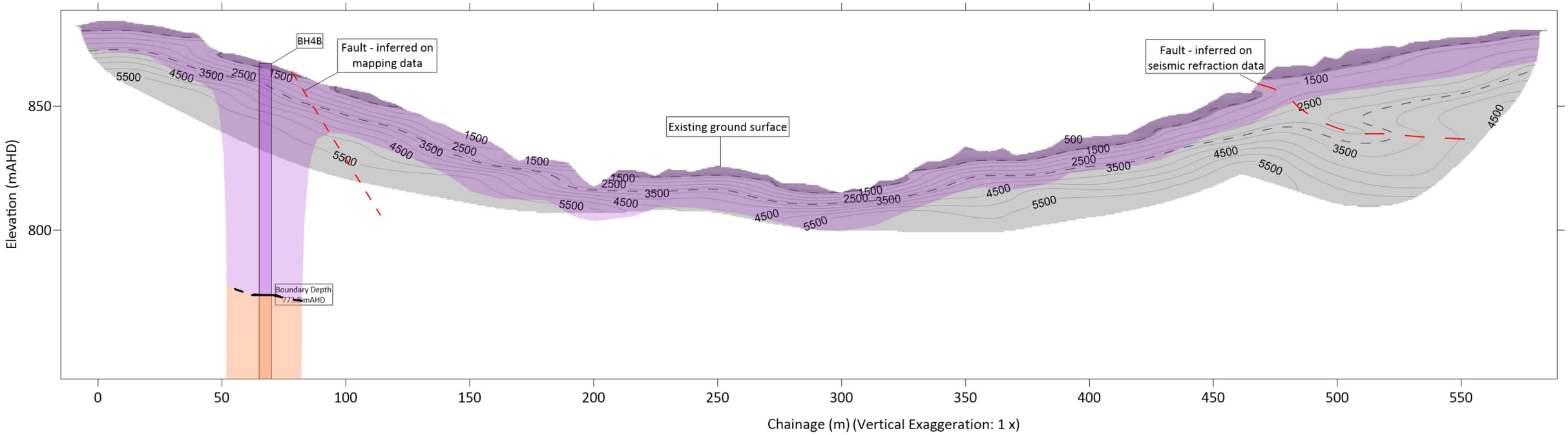
REFERENCE:

- *Hornfels*
- *Granodiorite*
- *Fault*
- *Inferred boundary*
- *Observed boundary*
- *Displayed SRT Line Location (Plan view)*





SR01 RMS error 4.5%=2.01ms 40 WET itr. 50Hz Width 4.0% initial GRADIENT.GRD v. 4.01



NOT FOR CONSTRUCTION

SMEC
Member of the Surbana Jurong Group

OVEN MOUNTAIN PUMPED HYDRO STORAGE

Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia - T +61 2 9925 5555

Additional Data provided by: Australian Government Geoscience Australia

revision	description	drawn	approved	date
	SMEC_CSSR01_Rev0	MV/LJ		20/06/2022

INTELLIGENT RESOURCES INC. SOFTWARE

drawn	MV/LJ
approved	
date	20/06/2022
scale	AS SHOWN
original size	A3

Survey Parameters:
- Geometrics Geode Seismograph
- 48 Channel 5m spaced cables
- 10Hz spiked geophones @5m
- Sledgehammer/metal plate Source

Sample Interval:31.25micro sec
Record Length: 1sec

*Lidar data provided by OMPH

client: Ovens Mountain Pumped Hydro Storage

project: Ovens Mountain Phase 1 - 15% Concept (Geological Mapping)

title: Site Investigation (Geological mapping)

project no: 30018018

figure: CSSR01

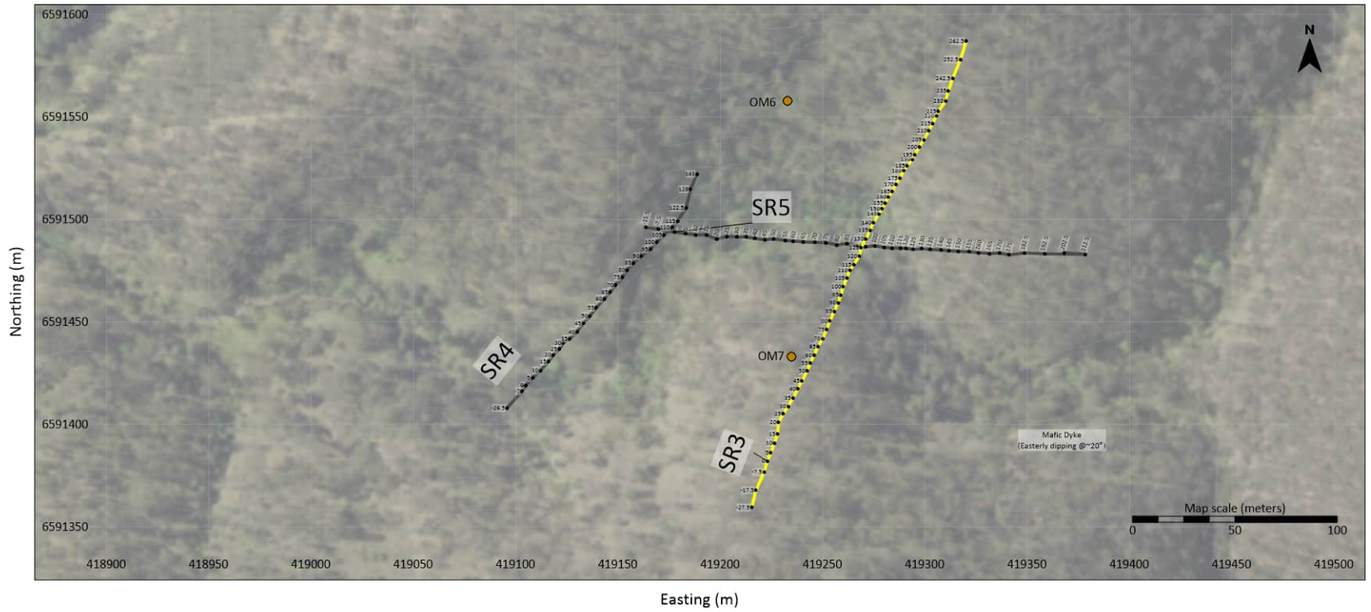
Disclaimer:

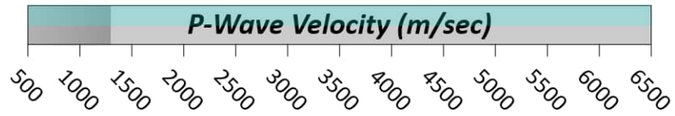
Interpreted seismic profiles are subject to uncertainties due to seismic signal to noise ratio and due to the normal limitations of seismic refraction interpretation where a simple 2/3 layered model is imposed on complex site with highly variable (laterally and vertically) anisotropic weathering and rock conditions.

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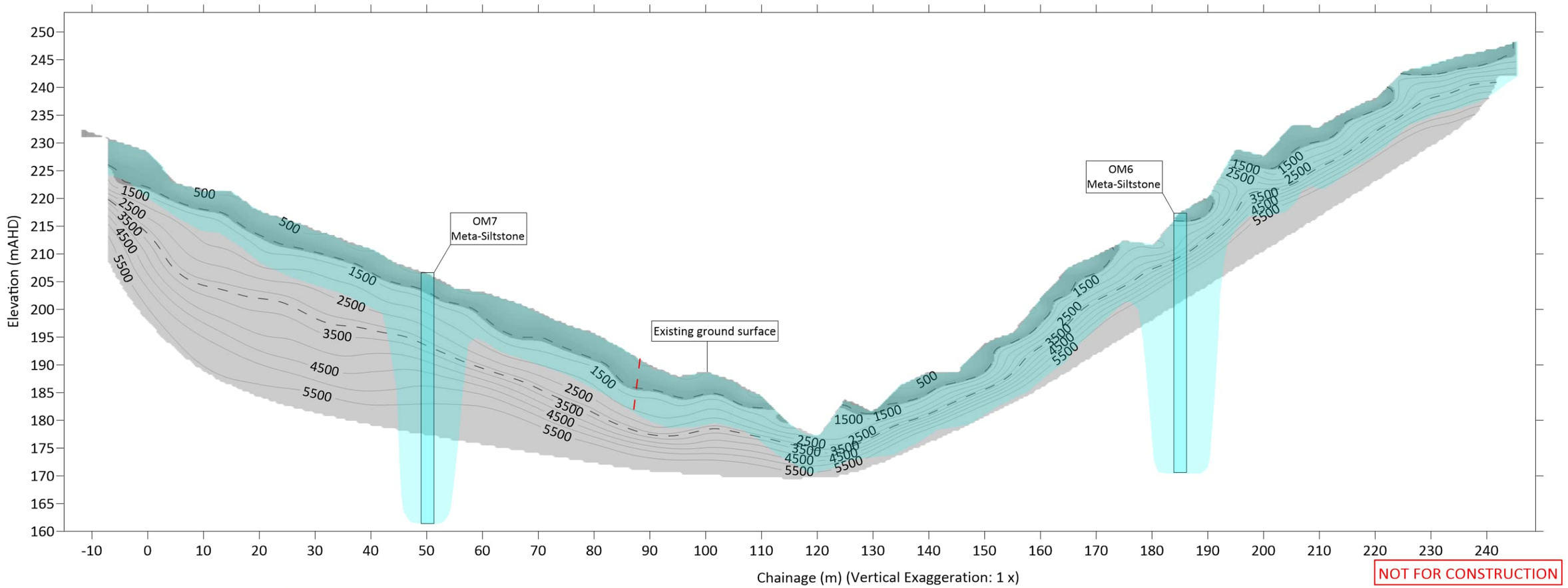
REFERENCE:

- *Meta-siltstone*
- *Fault (inferred from field mapping)*
- *Displayed SRT Line Location (Plan view)*
- *Surveyed SRT Line Location (Plan view)*





SR03 RMS error 4.4%=1.24ms 40 WET itr. 50Hz Width 3.5% initial GRADIENT.GRD v. 4.01



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OVEN MOUNTAIN PUMPED HYDRO STORAGE

Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia - T +61 2 9925 5555

Additional Data provided by: Australian Government Geoscience Australia; SIMEC Mojo

revision	description	drawn	approved	date
	SMEC_CSSR03_Rev0	MV/LJ		20/06/2022

INTELLIGENT RESOURCES INC. SOFTWARE

Geodetic Parameters
Coordinate System: GDA94 Zone 56

drawn	MV/LJ
approved	
date	20/06/2022
scale	AS SHOWN
original size	A3

Survey Parameters:
- Geometrics Geode Seismograph
- 48 Channel 5m spaced cables
- 10Hz spiked geophones @5m
- Sledgehammer/metal plate Source

Sample Interval:31.25micro sec
Record Length: 1sec

*Lidar data provided by OMPH

client: Ovens Mountain Pumped Hydro Storage
project: Ovens Mountain Phase 1 - 15% Concept (Geological Mapping)
title: Site Investigation (Geological mapping)
project no: 30018018
figure: CSSR03

3 Photo Board

418000E 419000E 420000E 421000E 422000E 423000E

6593000N

6592000N

6591000N

Legend

- Inferred Boundary
- Boundary
- Photo Locations
- Seismic Lines
- Streams
- Macleay River
- Granodiorite
- Hornfels
- Meta-siltstone

Design

- Tunnels
- Surface Works
- Dam Reservoirs
- Access Roads

N

C D H F J I B G L M N O P Q T S R

FIGURE TITLE	GM02	DATE	17-06-2022
DRAWING NO.	30018018_GM02	PROJECT TITLE	Oven Mountain Pumped Hydro Storage
PROJECT NO.	30018018	COORDINATE SYSTEM	GDA 1994 Zone 56

0 1 2 km

PAGE SIZE A3

CREATED BY LL16284 SOURCES Basemap: Google Satellite

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Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.

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SMEC AUSTRALIA PTY LTD
ABN 47 065 475 149

Filepath: C:\GIS\NSW\Outgoing\30018018 - Oven Mountain PSP\03_Incoming\20220617_LJ_QGISData\QGIS data\GIS Field mapping\Field mapping.qgz



Photo A: Contact of Hornfels and Granodiorite at the Upper Reservoir access track.



Photo B: Rolling vegetated hills of the Upper Reservoir intake structure looking toward SW quarry wall.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 1/11

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Photo C: Strike-slip fault with 30mm of sinistral movement near the Upper access track.

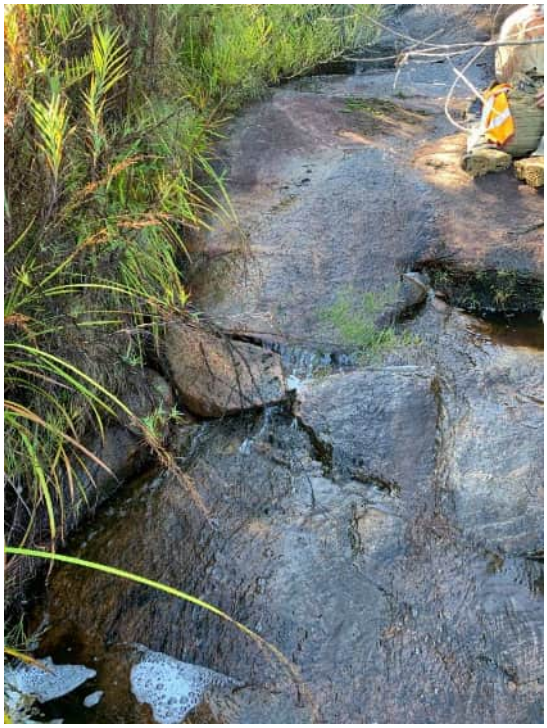


Photo D: Sub-horizontal sheet joints near the Upper Reservoir access track, looking East up a river bed.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 2/11

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Photo E: Quartz veins in the Upper Reservoir left abutment.



Photo F: Pegmatite dyke outcrop in the Upper Reservoir quarry.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 3/11

SMEC 2.10.13 LIB:GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE A4P LJ.GPJ <<DrawingFile>> 14/06/2022 18:57 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



Photo G: Sheet joints and Slightly Weathered to Fresh granodiorite in SE quarry wall, photo looking North.



Photo H: Slightly Weathered contact of Hornfels and Granodiorite in the Upper Reservoir quarry.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 4/11

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Photo I: Moderately Weathered hornfels in the Upper Reservoir left abutment.



Photo J: A Granitic to Leucogranitc dyke in the footprint of the Upper Reservoir left abutment.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 5/11

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Photo K: Hornfels cliff within the Lower Reservoir left abutment.



Photo L: Organic-rich alluvial soil profile of a point bar within the Lower Reservoir right abutment.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 6/11

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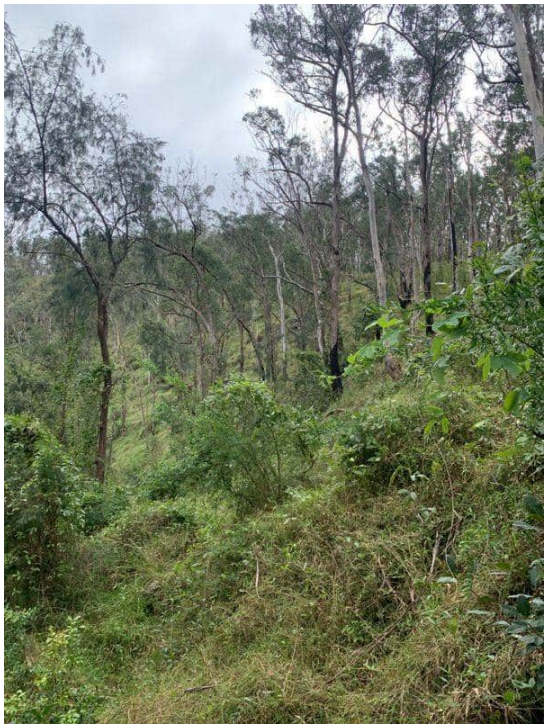


Photo M: Densely vegetated eastern abutment of the Lower Reservoir.

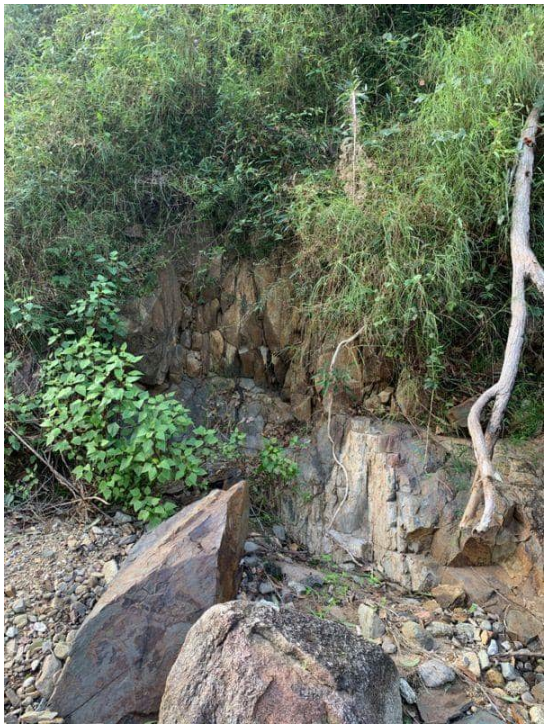


Photo N: Fault in the Lower Reservoir dam.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 7/11

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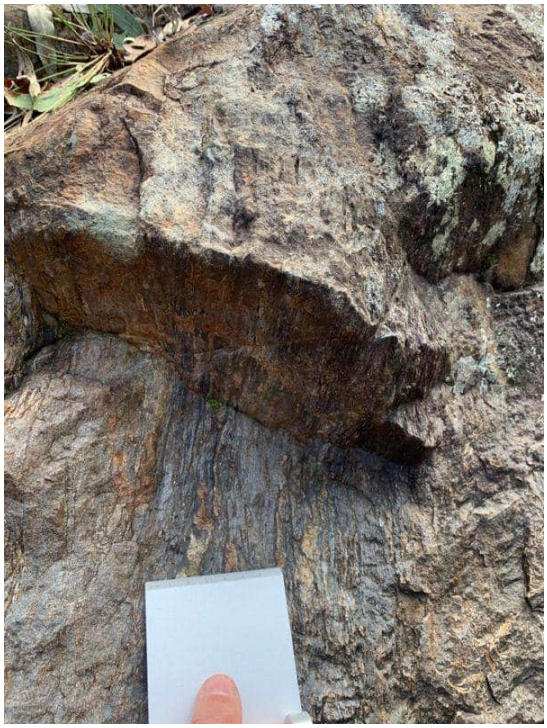


Photo O: Foliation in meta-siltstone in the Lower Reservoir quarry.



Photo P: Accessory joints between planes of a fault in the Lower Reservoir quarry.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 8/11

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Photo Q: Large boulders of granodiorite in the creekbed within the dam of the Lower Reservoir.



Photo R: Tree bowing on an active landslide east of the Lower Reservoir dam FSL.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 9/11

SMEC 2.10.13 LIB:GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE A4P LJ.GPJ <<DrawingFile>> 14/06/2022 18:57 10.02.00.04 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30



Photo S: En echelon quartz veins east of the Lower Reservoir dam FSL.



Photo T: Recent landslide near the northern quarry wall in the Lower Reservoir.

SMEC Member of the Surbana Jurong Group	TITLE: Oven Mountain PSP Photo - LJ	DRAWN: GDM	DATE: 14/06/2022
		CHECKED: LJ	DATE: 14/06/2022
		SCALE: Not To Scale	A4
		PROJECT No: 30018018	FIGURE No: 10/11

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Photo U: Possible fault (defect with shear movement) showing offset and grooves on the defect surface, located at the Upper Reservoir left abutment.

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TITLE

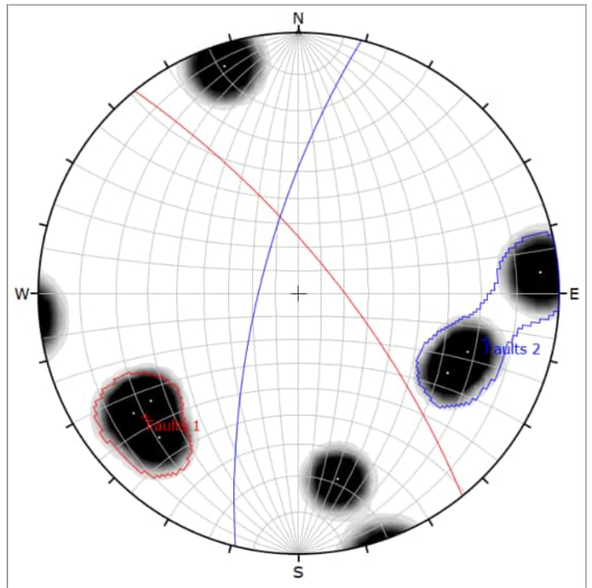
Oven Mountain PSP
Photo - LJ

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CHECKED	LJ	DATE	04/08/2022
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PROJECT No	30018018	FIGURE No	11/11

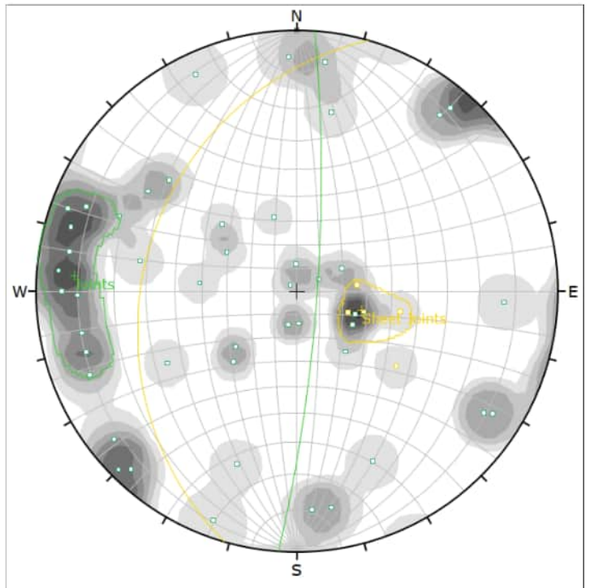
4 Stereonets

UPPER RESERVOIR

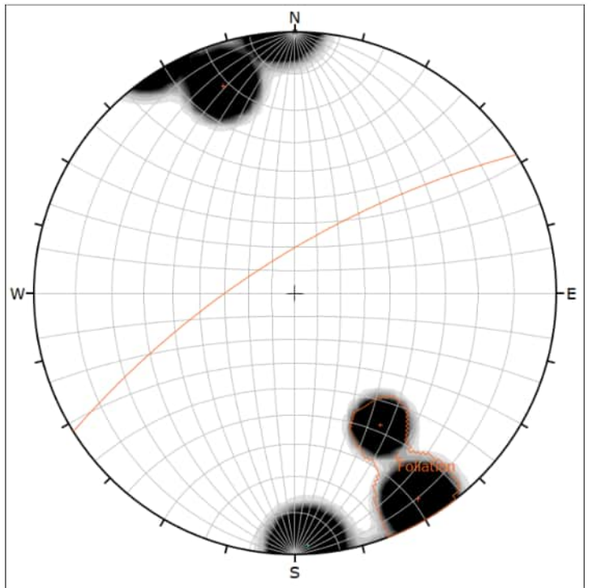
LOWER RESERVOIR



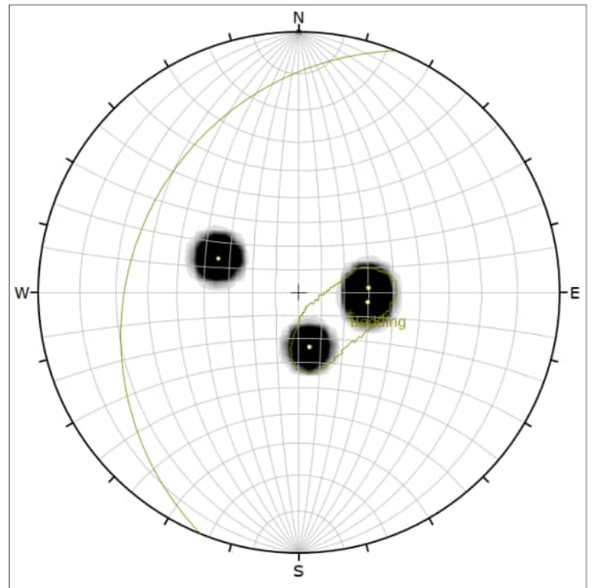
FAULTS



JOINTS



FOLIATION



BEDDING

LEGEND

○	Bedding	□	Joint (sheet)
△	Dyke	+	Lineation
◇	Fault	×	Vein
+	Foliation	×	Vein Plunge Azimuth
□	Joint		

DENSITY CONCENTRATIONS

0.00	-	1.00	5.00	-	6.00
1.00	-	2.00	6.00	-	7.00
2.00	-	3.00	7.00	-	8.00
3.00	-	4.00	8.00	-	9.00
4.00	-	5.00	9.00	<	

		Upper reservoir	Lower reservoir
Faults	F1	86/116	74/051
	F2		73/284
Joints	J1	29/286	82/039
	J2	81/094	77/109
Foliation	F1	73/328	70/284
	F2		74/342
Bedding	B1	24/292	65/343

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OVEN MOUNTAIN PUMPED HYDRO STORAGE

Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia - T +61 2 9925 5555

revision

description	drawn	approved	date
SMEC_Strutural summary_Rev0	LJ		21/06/2022

rocscience

drawn	LJ
approved	
date	21/06/2022
scale	AS SHOWN
original size	A3

client: Ovens Mountain Pumped Hydro Storage

project: Ovens Mountain Phase 1 - 15% Concept (Geological Mapping)

title: Geological Mapping Stereonet Data

project no: 30018018

figure: Structural Summary

Appendix G Seismic Refraction Tomography Survey

Member of the Surbana Jurong Group

Technical Memorandum

Memo No.	001	**Date of Issue**	12/04/2022
Subject	Geophysical survey results	**Discipline**	Geotechnical
Project Name	Ovens Mountain Pumped Storage	**Project No.**	30018018
Document No.	30018018-RPT-001-Geophysics	**Revision**	Rev1
Author	Rod Lawrence		
Reviewed by	Nick Poriters	**Approved by**	Hany Salem
Prepared for	OMPS Pty Ltd	**Attention to**	Anthony Melov
Attachments	Appendix A – Seismic figures and profiles		

1 Purpose

The purpose of this memo is to present the findings of the 2021 Seismic Refraction survey undertaken at the upper and lower reservoirs for the proposed Ovens Mountain Pumped Hydro site during September 2021.The geophysical survey was undertaken prior to any access track works for the planned geotechnical investigation were commenced to avoid potential impacts from machinery generated seismic noise.

This memo aims to provide preliminary information on the depth to bedrock along the proposed alignments and surveyed areas, in particular at the abutments and conceptual dam foundations. Where intersected, key features within the foundation that are relatable to existing Borehole information have been further characterised. The overall aim of this report is to provide a brief summary of information that will be useful in the subsequent concept design phase of the proposed scheme layout.

2 Seismic Refraction Survey

The geophysical investigation was undertaken by SMEC's subcontractor Scurbat Geophysics Projects Pty Ltd in the period from 14th to 28th September 2021. The purpose of this work was to constrain depth to bedrock and to investigate the location of geological features and adverse geological conditions in the vicinity of the proposed dam sites and tailrace tunnel portal. Details of the survey and results are provided herein and in Appendix A.

2.1 Seismic refraction tomography method

The seismic refraction method is based on the measurement of the travel time of seismic waves (typically p-waves) refracted at the interfaces between subsurface layers of different velocity. Seismic energy is provided by a source ('shot') located on the ground surface. For shallow applications this normally comprises a hammer and alloy plate, weight drop or small explosive charge (explosives in a borehole or a blank shotgun cartridge). Energy

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radiates out from the shot point, either travelling directly through the upper layer (direct arrivals) or travelling down to and then laterally along higher velocity layers (refracted arrivals) before returning to the surface.

The energy is detected on the surface using a linear array (or spread) of geophones spaced at regular intervals. Shots are deployed at and beyond both ends of the geophone spread in order to acquire refracted energy as first arrivals at each geophone position.

Data is recorded on a digital seismograph. Travel time versus distance graphs are then constructed and velocities calculated for the overburden and deeper refractor layers. Depth profiles for each refractor are produced by an analytical procedure, based on attention of shot and receiver geometry and the measured travel times and subsequent calculated velocities. The final output comprises a depth profile of the refractor layers and a velocity model of the subsurface.

2.2 Survey layout

The original scope specified the acquisition of 4 lines totalling 1500 m in length. SMEC's subcontractor conducted a site walk over prior to the survey where dense vegetation and extremely steep terrain was noted often requiring assisted access via an ARGO (ATV) and large distances on foot. Upon satellite phone discussions with SMEC's Associate Geophysicist, minor adjustments were made to the survey locations to ensure the best results for the survey were achieved. Five linear surveys were undertaken at the locations shown on

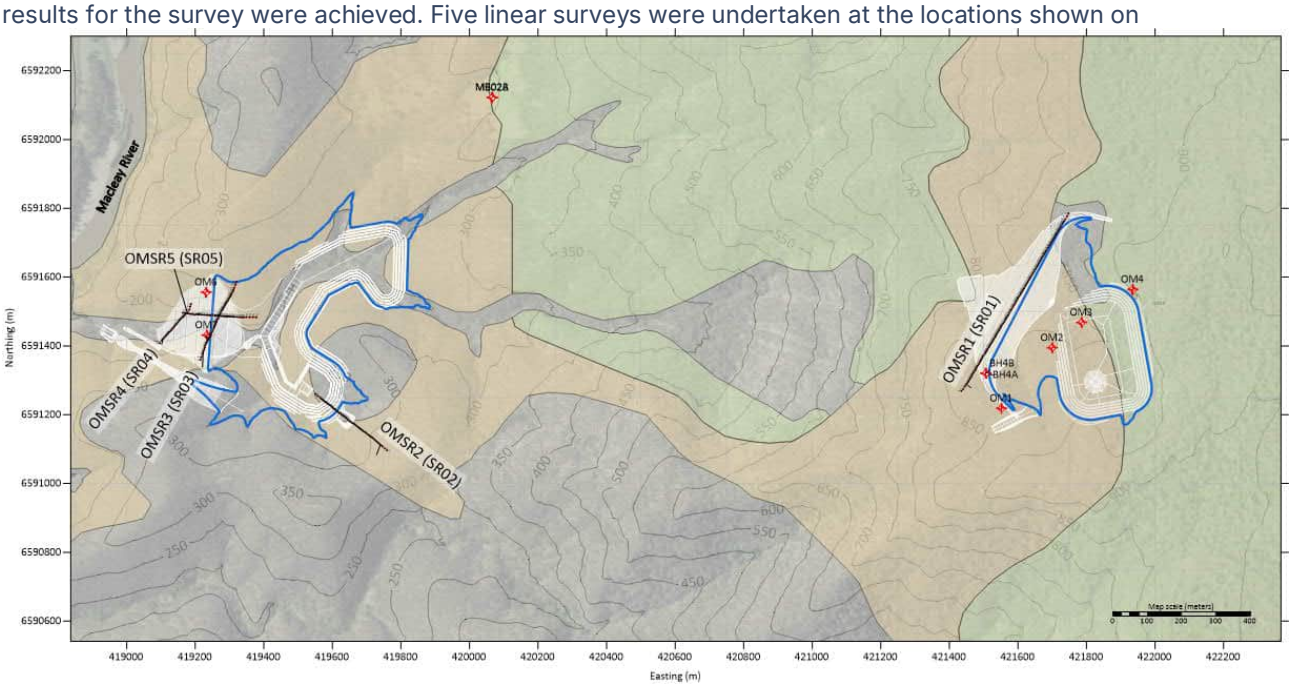


Figure 2-1, providing a total coverage of 1335 linear metres across the area of investigation.

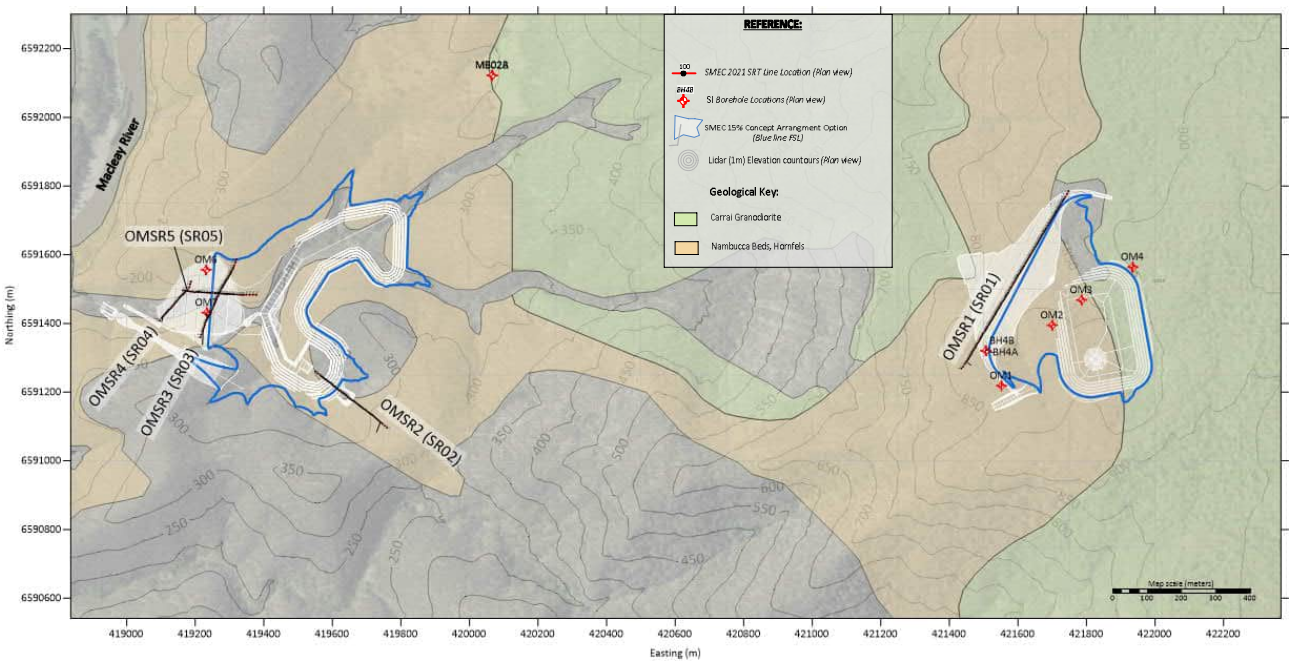


Figure 2-1 SRT line locations for the site investigation

2.3 Data acquisition

Data was collected by a Principal Geophysicist from Scurbat Geophysics and an experienced field crew who were responsible for survey organisation, data collection and ensuring compliance with the relevant SMEC safety and quality systems and industry standards (ASTM D5777-18).

A total of 1335 m of seismic refraction lines (7 spreads and 158 seismic shots) were acquired during the survey. Table 2-1 summarises the locations and statistics from the seismic refraction survey.

Table 2-1 Seismic refraction traverse locations and statistics

Line ID	Easting Start	Northing Start	Easting End	Northing End	No. Spreads	No. Shots	Line length (m)
SR01	421449.6	6591287.9	421734.3	6591762.7	3	62	575
SR02	419739.9	6591112.6	419564.3	6591249.0	1	22	235
SR03	419222.9	6591382.1	419311.4	6591562.7	1	31	235
SR04	419104.9	6591418.9	419179.0	6591499.1	1	18	115
SR05	419177.4	6591493.7	419341.1	6591482.6	1	25	175

*Coordinates in GDA94 Zone 56

Taking into account the targeted depth of the survey, target size and site obstacles, an optimal seismic survey spread geometry was selected for seismic data acquisition. This consisted of 48 geophones with seismic spread of 5-meter geophone spacing. Most of the seismic traverses were surveyed with average of 23 seismic shot locations.

Table 2-2 summarises the chainages of the shot points along the geophone spread. Shot locations 1 to 3 and 20 to 23 were "off" shots and 4 to 20 were "inside spread" shots. After acquiring the shots, if a roll-along was required the receiver spread was moved forward along the alignment by one spread length with a two geophone overlap until the desired line coverage was achieved.

Table 2-2 Location of seismic shot points for all survey lines.

Line ID	Outside spread shots (Negative chainage)	Inside spread shots	Outside spread shots (positive chainage)
SR01	-27.5,-17.5,-7.5	2.5,12.5,27.5,42.5,57.5,72.5,87.5,102.5,117.5, 132.5,147.5,162.5,177.5,192.5,207.5,222.5,232.5	242.5,252.5,262.5
SR02	-27.5,-17.5,-7.5	2.5,12.5,27.5,42.5,57.5,72.5,87.5,102.5,117.5, 132.5,147.5,162.5,177.5,192.5,207.5,222.5,232.5	242.5,252.5
SR03	-27.5,-17.5,-7.5	2.5,12.5,27.5,42.5,57.5,72.5,87.5,102.5,117.5, 132.5,147.5,162.5,177.5,192.5,207.5,222.5,232.5	242.5,252.5,262.5
SR04	-16.5, -6	2.5,7.5,17.5,27.5,37.5,47.5,57.5,67.5,77.5,87.5, 97.5,107.5,112.5	122.5,134,143
SR05	-15.5,-7.5	2.5,7.5,17.5,27.5,37.5,47.5,57.5,67.5,77.5,87.5, 97.5,107.5,117.5,127.5,137.5,147.5,157.5,167.5 172.5	182.5,192.5,202.5,212.5

*Chainage in meters.

2.4 Seismic survey equipment

The seismic acquisition was performed using a Geometrics Geode 48-channel, digitally enhanced seismograph connected to a Panasonic Tough Book laptop computer. The R.T.Clark (Co.Inc.) 48 (10 Hz) geophone array was connected by 2 x 24 channel (5m takeout) receiver cables for the survey. Seismic data acquired and field records inspected by the field Geophysicist on the laptop using Geometrics Seismodule Controller Software (SCS). The survey data was saved digitally in SEG-2 universal seismic digital data format.

A sledgehammer of 8 kg was used as an energy source for the survey. Line location and ground elevation for the seismic survey was obtained using an EOS Arrow 100 DGPS unit with satellite differential correction (claimed lateral accuracy: better than ±1 metre, vertical accuracy: ±3 metres). On average due to tree cover and steeply incised valleys the horizontal accuracy was ±0.4m. The vertical points were cross checked against the existing Lidar dataset and corrected where required.

2.5 Data quality

The overall data quality was good, even though the geophones in some cases were affected by strong wind gusts. When the hammer shot needed more energy, multiple repeated hammer hits were performed (stacked) at the same position to compensate for the background seismic noise.

2.6 Data processing software

The software used to process the seismic data included:

- Seismodule Controller Software (SCS) acquisition software was used to record the seismic data.
- Rayfract v4.02 seismic processing software was used to preliminary pick the first breaks of the seismic records, with signals filtered where needed using filtering frequency band-pass and Fast Fourier Transformation (FFT) band pass filtering.
- Rayfract v4.02 tomographic software was used for inversion of the seismic data.

- The final seismic tomogram and figures were generated using Golden Software Surfer 20 Gridding software.

3 General survey results

3.1 General notes

The results of the seismic refraction tomography inversion for the survey seismic lines are presented as coloured velocity models in Appendix A. The figures contain the P-wave seismic velocity tomography models with a location map also provided. In the tomography velocity models, different P-wave seismic velocity values are presented with the appropriate colour range starting from 'colder' or blue colour representing lower velocities to the more intense or warmer colour ranges (yellow, red, white) representing higher velocities. More intense (i.e. hotter) colours represent a corresponding increase in velocity and material density.

The seismic survey results are generally described in this report proceeding from upstream (left looking South) or looking downstream (South to North) across the subject site.

The interpretation in this section of the report is limited to drawing the reader's attention to the presence of major anomalies and correlating the modelled velocities with borehole logs (if present). Where appropriate, potential lithological or structural conditions are proposed as possible explanations for these anomalies. The interpretations in this section are not intended to be definitive. Further investigation and analysis by a suitably qualified geotechnical engineer in conjunction with a review of additional information (borehole logs, cores, etc.) should be completed to verify that any interpretations where given are reasonable.

3.2 General velocity profile trends

The typical P-wave velocity model is generally comprised of three horizontal layers. The depth to the boundary between the uppermost layer and the second layer, and the second and third layer is variable. Table 3-1 shows the range of P-wave velocities for each layer.

Table 3-1 P-wave velocity trends vs inferred site geology

Layer ID	P-wave Velocity (m/s)		Inferred Geology Comments
	Minimum	Maximum	
1	500	1200	Unconsolidated soils and colluvial. Zones of deeper weathered material.
2	1200	3200	Increasing weathering results in a decrease in velocity. This range is typical for weathered granite and hornfels.
3	>3200		Slightly weathered or fresh basement rock

Note: It is important to emphasize that the seismic velocity interpretation is site specific and may vary considerably. This will depend on several geological factors, such as density contrast, water saturation, changes in the degrees of weathering, etc. thus inferences made should be further assessed against logged geological conditions.

3.2.1 Layer 1 (< 1,200 m/s)

This layer has the lowest velocity range (500 to 1200 m/s). The velocity varies laterally and with depth. At the lower range of velocities, below 700 m/s, these velocities are generally inferred to be unconsolidated soils or colluvium. The velocity range is also within the range seen in stiff clays ranging from medium to very stiff material which is expected in the project area in the weathered granites. Higher velocity ranges 700 to 1200 m/s may relate to extremely or highly weathered rocks or increases in rock fraction (soil to rock ratio).

3.2.2 Layer 2 (1400 – 3200 m/s)

Layer 2 shows the greatest lateral and vertical variation. These velocities relate inversely to the degree of weathering.

3.2.3 Layer 3 (> 3200 m/s)

The depth to layer three is variable along the profiles. The material is likely associated with slightly weathered or fresh bedrock.

3.3 Seismic refraction SR01 line results

Seismic Line SR01 is along the proposed upper reservoir dam axis line and exhibits a topographic rise both to the west and to east of approximately 60 m.

The P-wave tomogram plots for line SR01 are displayed in Figure SR01 (Appendix A).

- Layer 1 velocity distributions show variation with depth and laterally across the section. This layer deepens slightly in the western section of the line. Velocity inversions are evident in several zones predominantly between chainage 25 to 50 m (depth 875 m), 150 to 175 m (depth 835 m) and 190 to 210 m (depth 820 m). This coincides with the recorded occurrence of rock outcrop at surface noted during the survey. Little correlation to the logged materials in BH4B is distinguishable however the featureless velocity profile is reflected in the high RQD (>90%) results within the Hornfels.
- Layer 2 velocity boundary is evidently deepening to the north with a velocity inversion feature near the end of the profile (500 to 530 m) which could be inferred as a fracture zone, dyke, or weathered zone/contact
- Layer 3 velocity models on this line shows a relatively consistent profile, with minor weathering associated with the base of the valley and the velocity inversion feature in the north mentioned above.

3.4 Seismic refraction SR02 line results

Seismic Line SR02 exhibits a topographic fall from west to east of approximately 80 m.

P-wave tomogram plots for SR02 are displayed on Figure SR02 (Appendix A).

- The thickness of the Layer 1 velocity model decreases slightly west to east and is generally less than 4-5m thick inferred to be colluvial materials.
- Layer 2 velocity model underlays Layer 1 and undulates along the profile increasing slightly in depth from the surface down slope from 110 to 210 m. The velocity characteristics for this profile differ greatly from that of the SR01 profile in the upper reservoir and could suggest that this area falls under a differing subsurface geological rock type or additional variable depth of colluvial materials with high rock fraction?
- A Layer 2 velocity high velocity anomaly is evident at depth 230 m RL chainage 225 m possibly a deviation in the bedrock profile.
- Modelled Layer 3 velocities are moderately variable under 5000m/s and then become relatively uniform.
- The velocity contrasts and velocity inversion on this line suggesting a potential change in geological rock types or degrees of alteration along the profile. No geotechnical information exists for correlation here.

3.5 Seismic refraction SR03 line results

Seismic Line SRT-03 is aligned South to North roughly along the lower reservoir dam axis and exhibits a large topographic rise of 70 m.

P-wave tomogram plots for line SR03 are displayed on Figure SR03 (Appendix A).

- Layer 1 velocity distributions show significant variation with depth and laterally across the section. The Layer 1 velocity in the southern part of the line is imaged to a thickness of >7 m while in the Northern side the depth is < 4 m with multiple rock outcrops at surface.
- Layer 2 velocity distribution is correlated with a basement high features (Layer 3) and is deeper in the south when compared to that of the northern section of the line (centred around the valley hinge).
- This seismic line is inferred to possibly cross a geological boundary as the velocity structures on either side of the valley are starkly different. No velocity dip is evident in the centre of the valley which could suggest a structural feature (e.g. fault/fractur zone).
- The historic Boreholes OM6 and OM7 which are offset from the seismic line provide little correlation however do confirm the presence of metasiltstone logged both sides of the valley which contradicts the geological contact theory. The velocities present are generally greater than what would be reflective of thicker accumulation of colluvial materials, therefore more suggestive of a simple differential weathering profile occurrence across the valley. This is supported by the differing rock strengths and weathering identified in the boreholes also.

3.6 Seismic refraction SR04 line results

Seismic Line SR04 is aligned NNE to SSEW and exhibits a topographic rise of approximately 10 m focused in the centre.

P-wave tomogram plots for line SR04 are displayed in Figure SR04 (Appendix A).

- Layer 1 velocity distribution is consistent across the line but pinches out at approximately at chainage 45 to 52 m (inferred to be outcrop at surface).
- Layer 2 velocity distribution thickens from approximately 5 m to approximately 10 m across the line.
- Layer 3 basement feature is evident on the SSW end of the line.
- Linear velocity anomalies dipping to North at chainage 15 m and 30 m could infer the presence of a fault or fracture and/or zone of increased weathering. No geotechnical information exists for correlation here.

3.7 Seismic refraction SR05 line results

Seismic Line SR05 runs roughly perpendicular to the proposed lower reservoir dam site parallel to creek line and a section which meanders to the north and south. Evident in the profile is the rise where the arm of the slope to the south (extending north) was surveyed over.

P-wave tomogram plots for this line SR05 are displayed in Figure SR05 (Appendix A).

- Layer 1 velocity distribution is constrained to the upper 5 m of lithology with multiple regions of surface outcrop truncating this interface. This layer is slightly deeper right at the start of the profile which is expected being in the valley floor/creek bed.
- Layer 2 velocity is complex across the line with velocity inversions evident in multiple zones due to surface outcrop. Velocity inversions to note are mainly in the centre of the line where the survey profile climbs out of the valley, over the hill and back down into the creek again at chainage 50 to 90 m (depth 175 m) and further east at chainage110 m (depth 180 m).
- Layer 3 velocity distribution is modelled and relatively consistent for most of the line at depth of roughly 6-9m below the surface, however appears to drop away towards the western end of the line (chainage >10 m). No geotechnical information exists for correlation here.

3.7.1 General velocity features of interest along the seismic refraction tomography profiles

Survey results were generally of a high quality, due to favourable ground conditions for SRT survey with minimal soil cover and generally shallow bedrock profile. The surveys indicated the site subsurface is generally dominated by a geology comprised of a variably moderate to high strength rock, and at places covered with a relatively thin veneer of a less competent (inferred to be colluvial soil) material. Zones where high velocities are

evident at the surface are inferred to coincide with medium to high strength rock (outcrop) at the ground surface. A number of subtle lower velocity bedrock zones have also been modelled. An example of this is Figure 3-1 which shows an excerpt of SR3 profile, showing a distinctly variable velocity gradient in one area that could indicate the presence of a more deeply weathered (softer) material, fractured zone or change in subsurface geological conditions. A geological boundary is mapped proximal to this location however this occurrence should be further investigated by geological surface mapping.

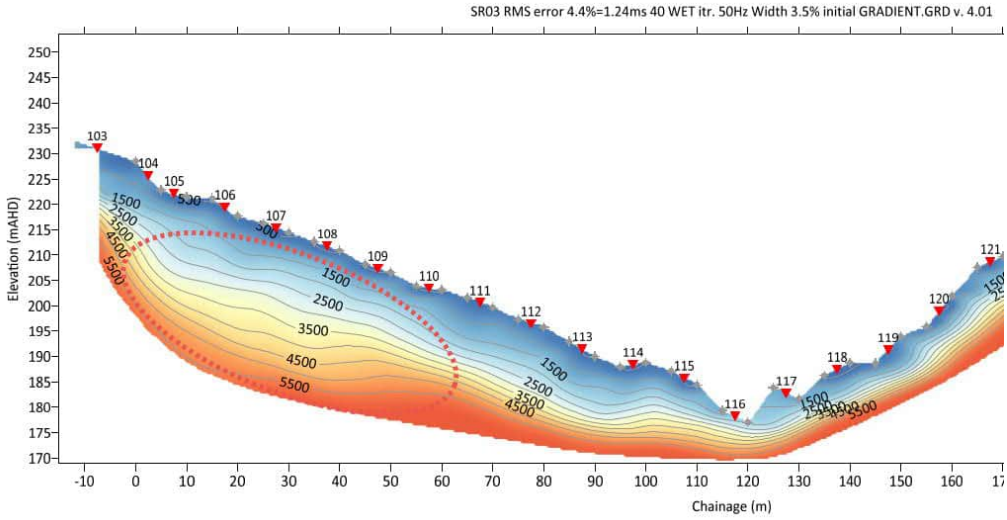


Figure 3-1 Excerpt from SRT line SR03 showing broadening velocity gradient zone.

This zone is shown to be roughly parallel east/west as it is also evident from the lower elevation SR04 profile (Figure 3-2) and has an apparent upstream to downstream alignment through the foundation of the proposed lower reservoir dam.

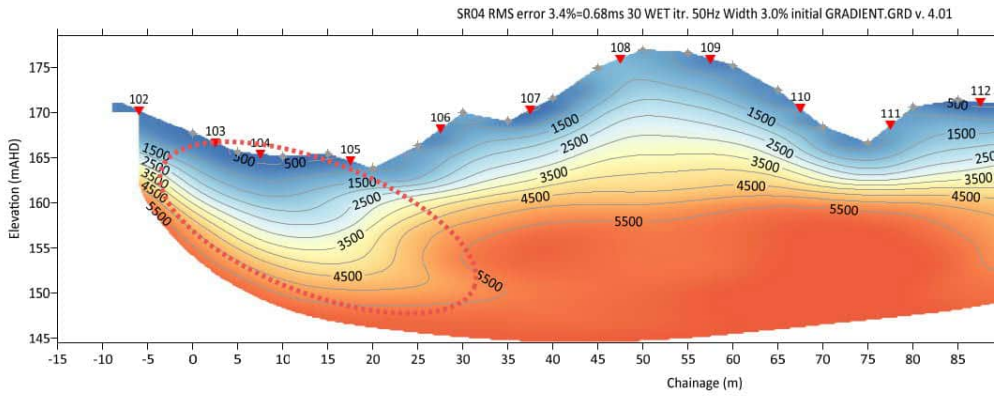


Figure 3-2 Excerpt from SR4 line; CH 0 to CH 35 showing a North dipping linear velocity feature.

A similarly north dipping velocity feature was identified in the upper reservoir right abutment (Figure 3-3). It is inferred that this area is underlaid by granite however as the feature coincides with a topographical surface feature is suggested that this feature could be structurally related and likely requires further assessment to define.

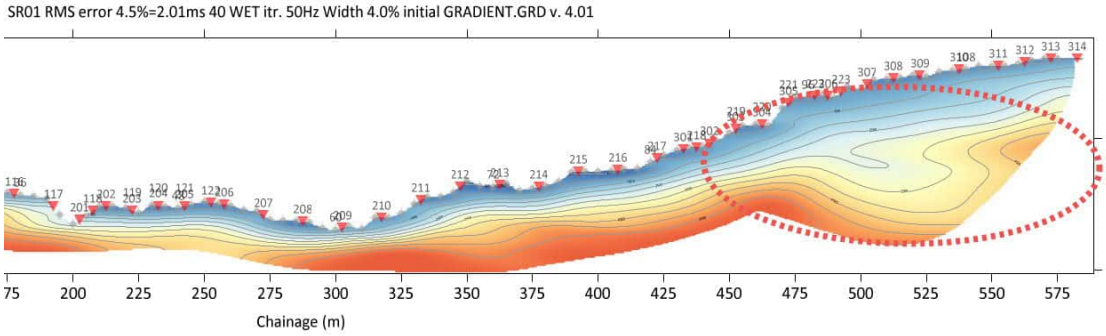


Figure 3-3 Excerpt from SR1 line; CH 75 to CH 560 showing a North dipping linear velocity feature in the right abutment

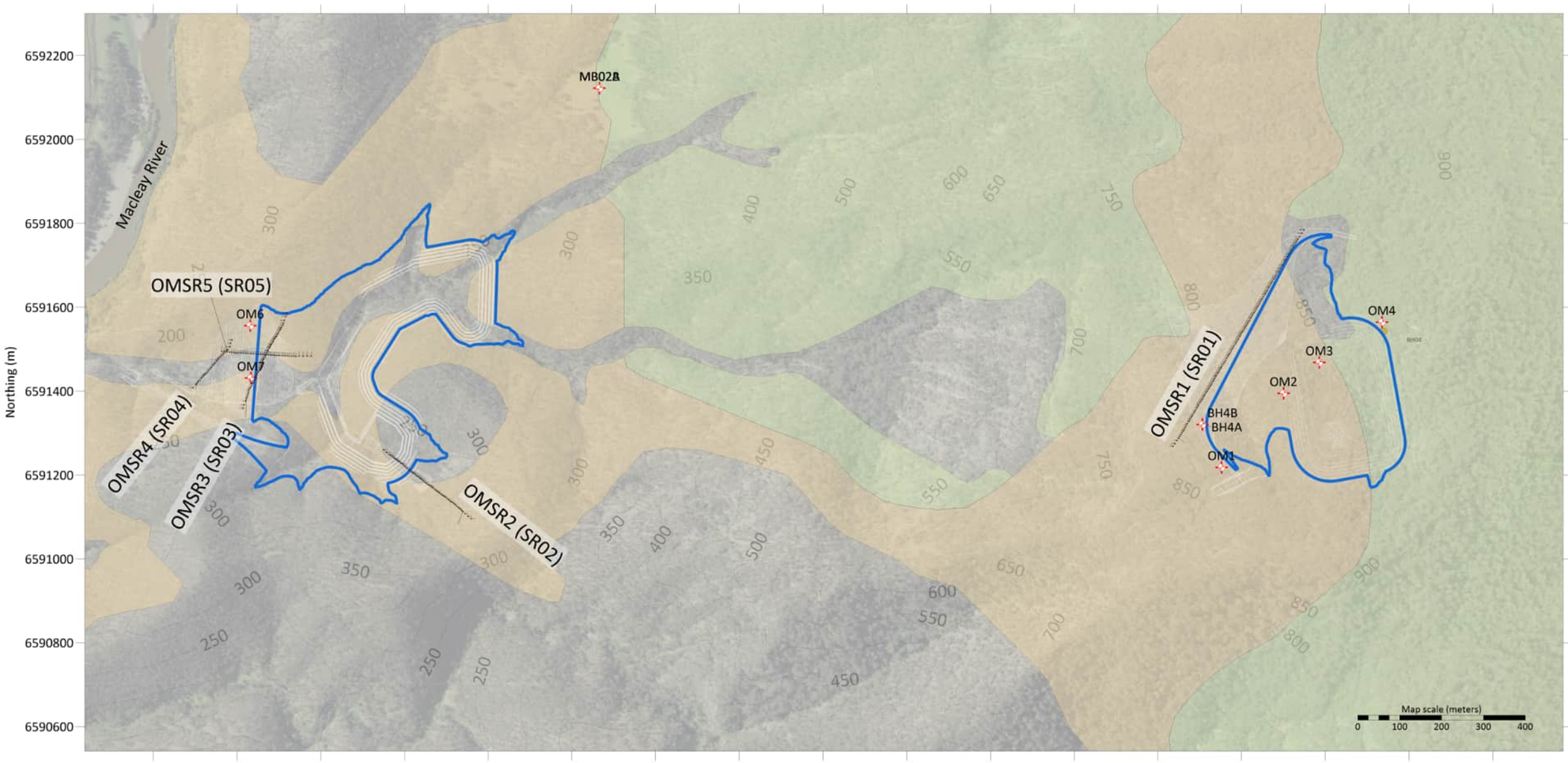
4 Conclusions

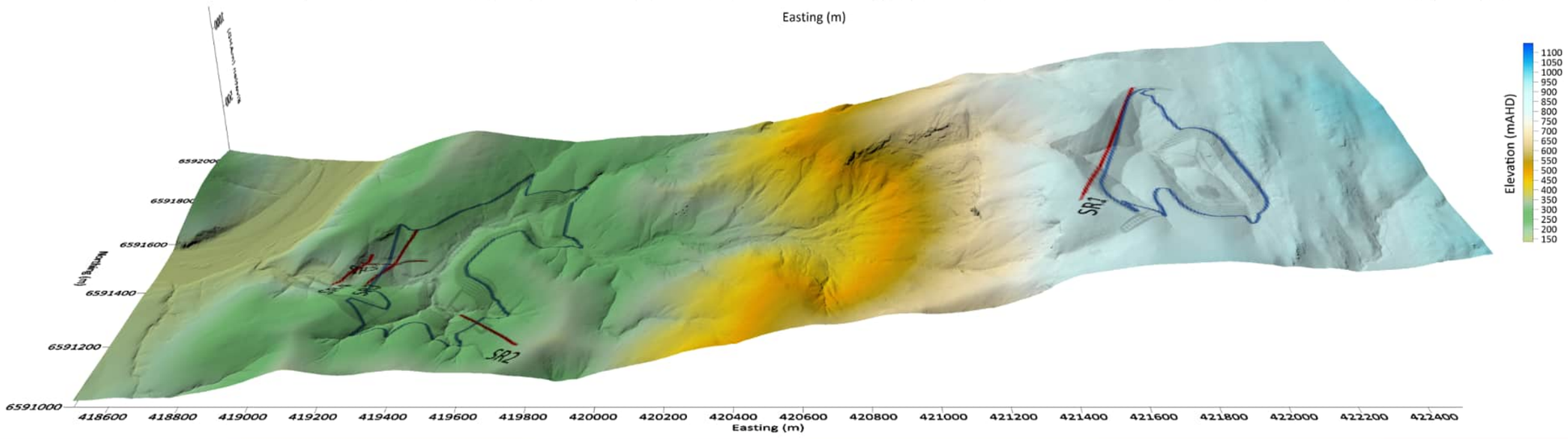
The major conclusions of this memo are:

1. This seismic survey has identified structures in the upper and lower reservoir which may require further assessment via intrusive investigations. These areas include:

    - **Upper Reservoir Dam** - The right abutment foundations of the proposed upper reservoir saddle dam as a deep zone of weathered rock was identified in SR01. This area will require further assessment and more careful attention to the proposed embankment design, as it may not be feasible to found the proposed dam entirely on high strength rock.
    - **Lower Reservoir Dam** -A more deeply weathered zone in the basement rock mass was detected in the left abutment of the lower reservoir from both SR03 and SR04. This feature should be investigated further to identify its origin and structure.
    - **Geological contacts** – Potential geological contacts were identified in SR03 and SR05 which require detailed surface mapping to confirm or discount.

Appendix A - **Seismic figures and profiles**







REFERENCE:

- *SMEC 2021 SRT Line Location (Plan view)*
- *SI Borehole Locations (Plan view)*
- SMEC 15% Concept Arrangment Option *(Blue line FSL)*
- Lidar (1m) Elevation countours *(Plan view)*

Geological Key:

- Carrai Granodiorite
- Nambucca Beds, Hornfels

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SMEC
Member of the Surbana Jurong Group

OVEN MOUNTAIN PUMPED HYDRO STORAGE

Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia - T +61 2 9925 5555

Additional Data provided by: Australian Government Geoscience Australia; SI Metpet

revision	description	drawn	approved	date
	SMEC_DRAFT_Rev0	RL		17/11/2021
	SMEC GIR_DRAFT_Rev1	RL		12/04/2022

Geodetic Parameters
Coordinate System: GDA94 Zone 56

drawn	RL
approved	
date	12/04/2022
scale	AS SHOWN
original size	A3

*Lidar data provided by OMPH

client: Ovens Mountain Pumped Hydro Storage
project: Ovens Mountain Phase 1 - 15% Concept (Geophysical Investigation)
title: GEOPHYSICAL INVESTIGATION (SEISMIC REFRACTION PROFILES)
project no: 30018018
figure: OM-SRT-Plan

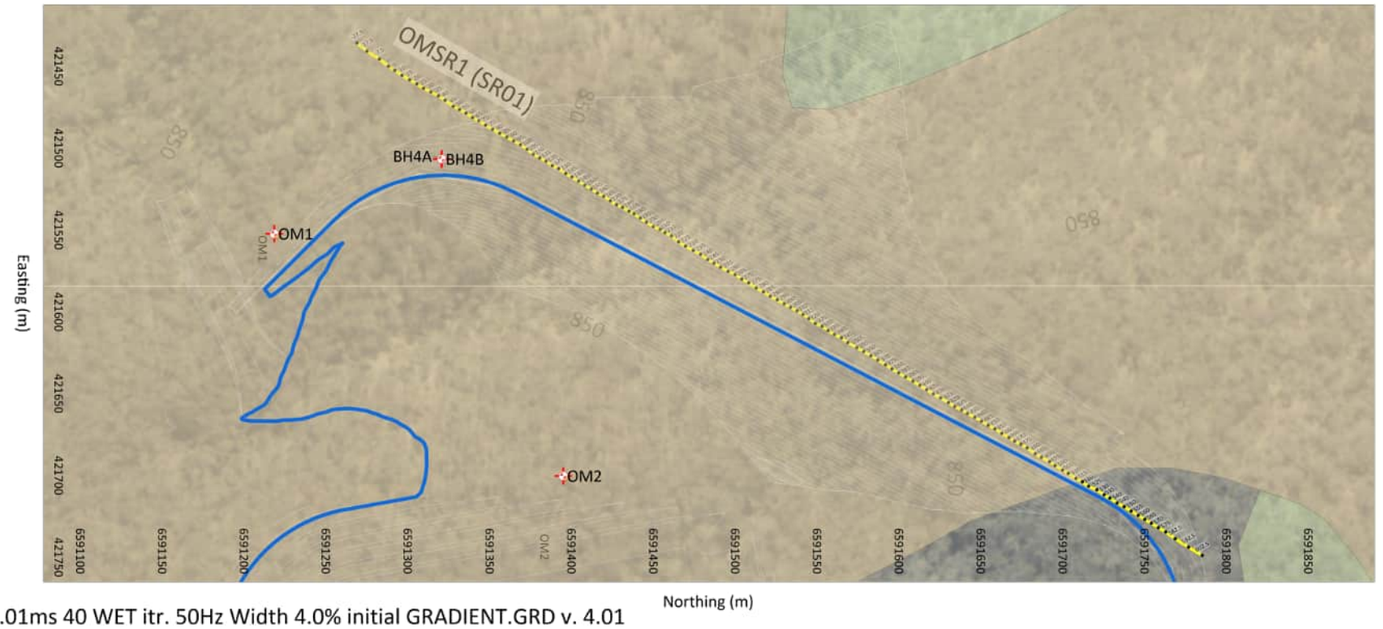
Disclaimer:

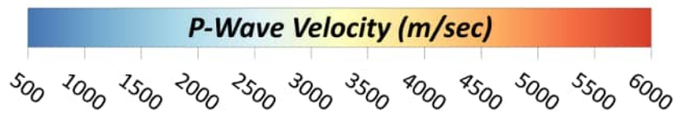
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The seismic and geological interpretation derived by SMEC and presented inthis figure has been prepared for the client only as a guide to likely subsurface conditions to aid the geotechnical interpretation and planning purposes.

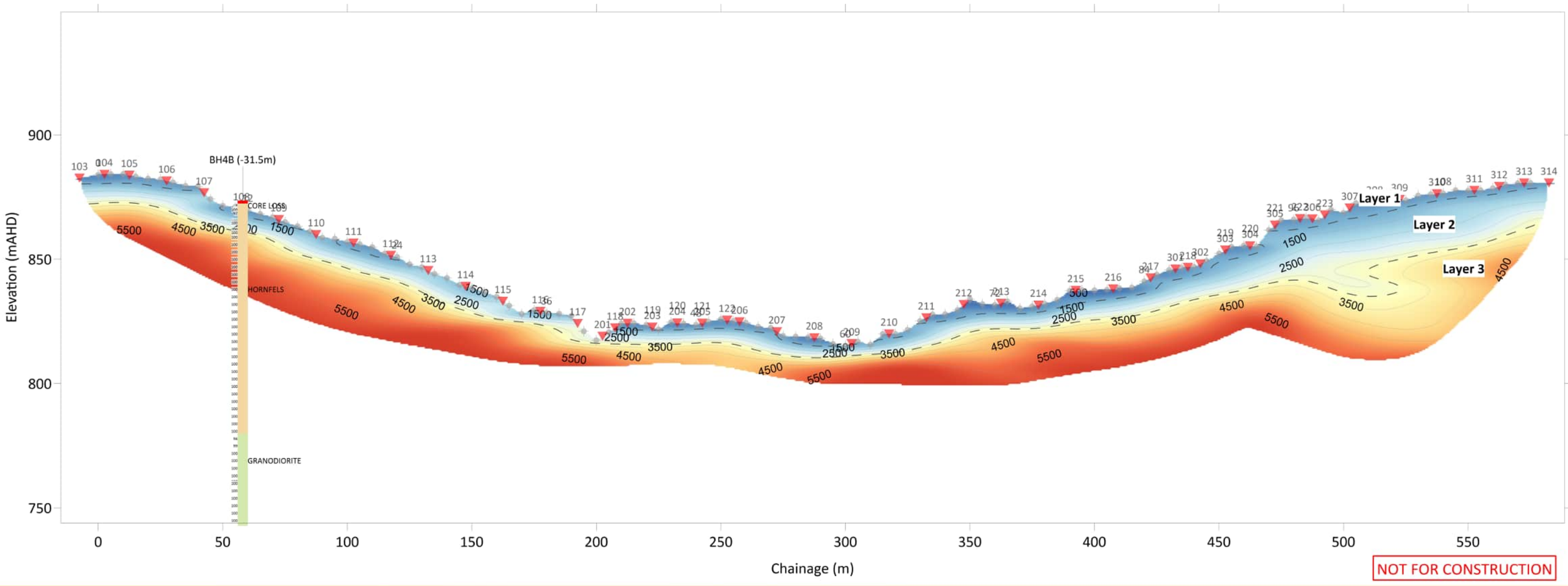
REFERENCE:

- *Seismic Receivers (Profile view)*
- *Seismic shot points (Profile view)*
- *Displayed SRT Line Location (Plan view)*
- *Surveyed SRT Line Location (Plan view)*
- *Borehole infomation*





SR01 RMS error 4.5%=2.01ms 40 WET itr. 50Hz Width 4.0% initial GRADIENT.GRD v. 4.01



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INTELLIGENT RESOURCES INC. SOFTWARE

Geodetic Parameters
Coordinate System: GDA94 Zone 56

drawn	RL
approved	
date	12/04/2022
scale	AS SHOWN
original size	A3

Survey Parameters:
- Geometrics Geode Seismograph
- 48 Channel 5m spaced cables
- 10Hz spiked geophones @5m
- Sledgehammer/metal plate Source

Sample Interval:31.25micro sec
Record Length: 1sec

*Lidar data provided by OMPH

client: Ovens Mountain Pumped Hydro Storage

project: Ovens Mountain Phase 1 - 15% Concept (Geophysical Investigation)

title: GEOPHYSICAL INVESTIGATION (SEISMIC REFRACTION PROFILES)

project no: 30018018

figure: SR01

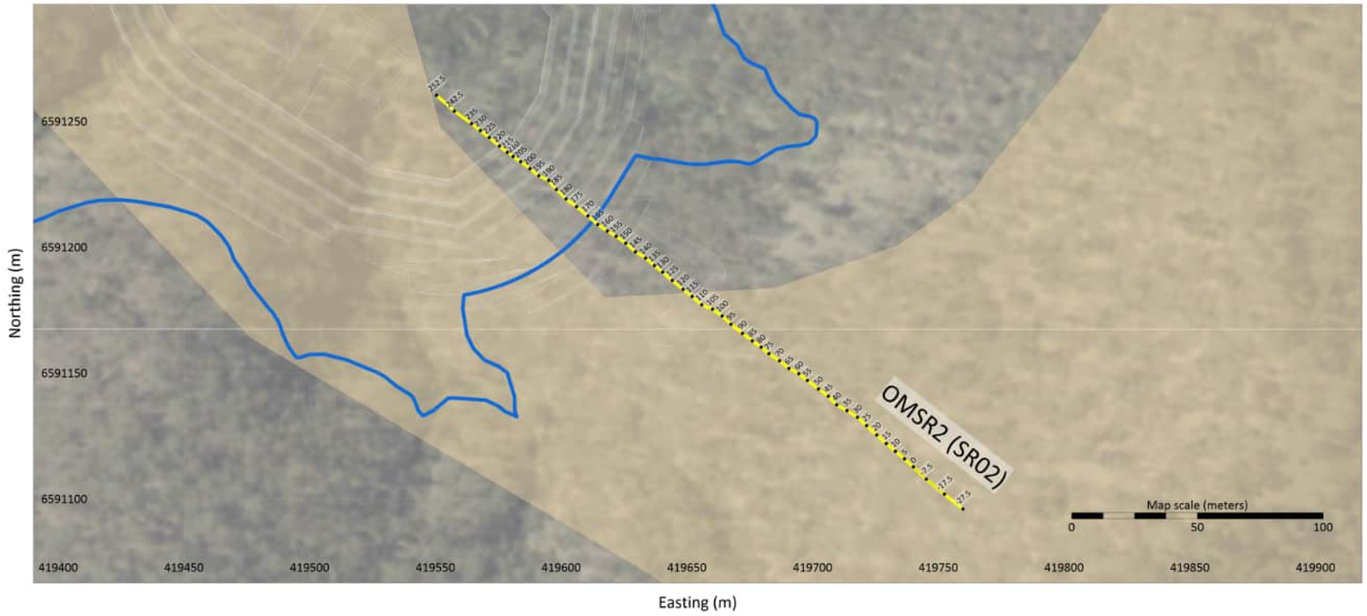
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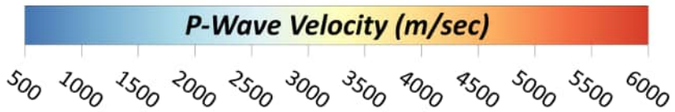
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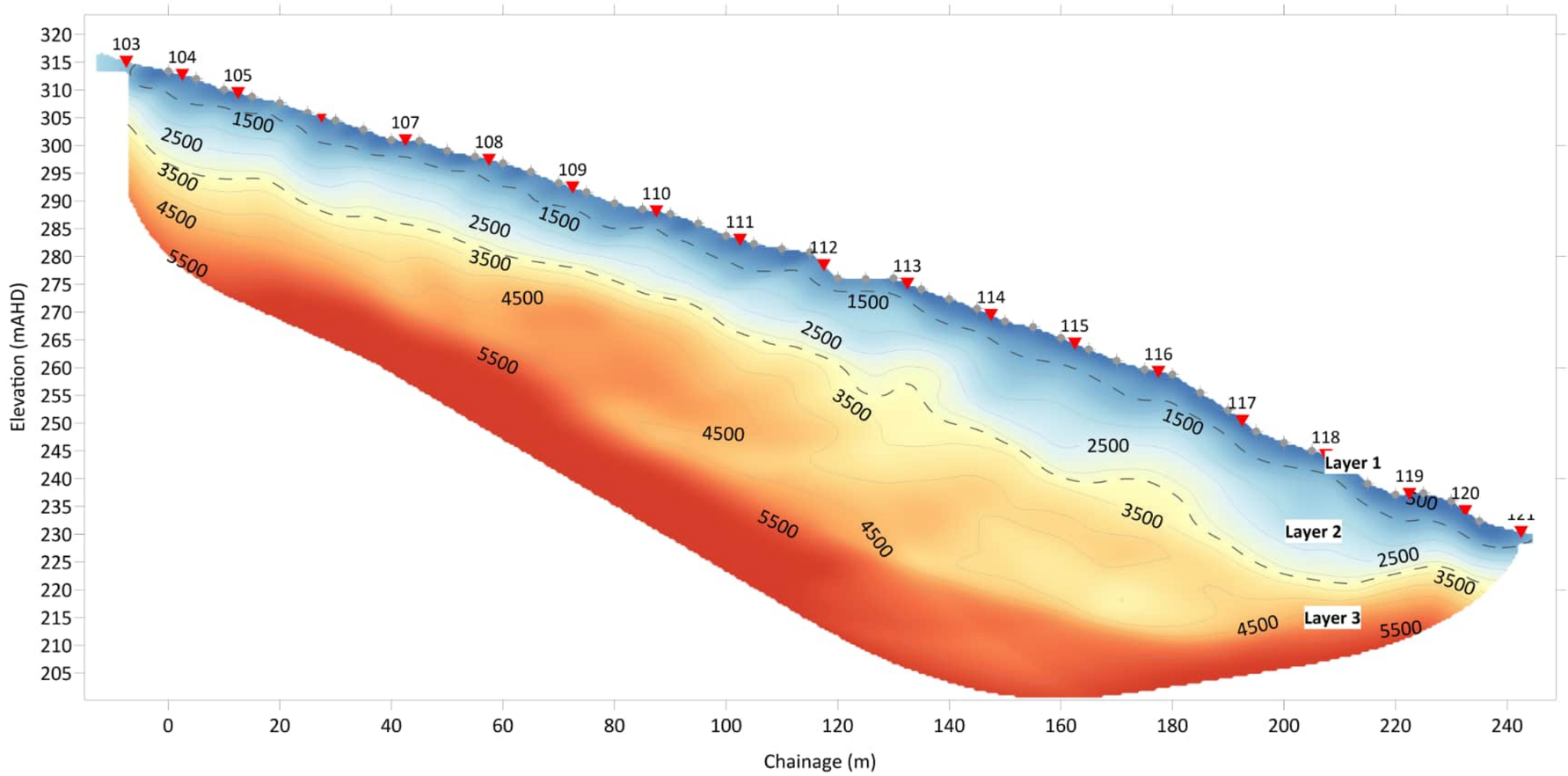
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- *Seismic shot points (Profile view)*
- *Displayed SRT Line Location (Plan view)*
- *Surveyed SRT Line Location (Plan view)*
- *Borehole infomation*





SR02 RMS error 4.6%=1.74ms 40 WET itr. 50Hz Width 4.0% initial GRADIENT.GRD v. 4.01



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Geodetic Parameters
Coordinate System: GDA94 Zone 56

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approved	
date	12/04/2022
scale	AS SHOWN
original size	A3

Survey Parameters:
- Geometrics Geode Seismograph
- 48 Channel 5m spaced cables
- 10Hz spiked geophones @5m
- Sledgehammer/metal plate Source

Sample Interval:31.25micro sec
Record Length: 1sec

*Lidar data provided by OMPH

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project: Ovens Mountain Phase 1 - 15% Concept (Geophysical Investigation)

title: GEOPHYSICAL INVESTIGATION (SEISMIC REFRACTION PROFILES)

project no: 30018018

figure: SR02

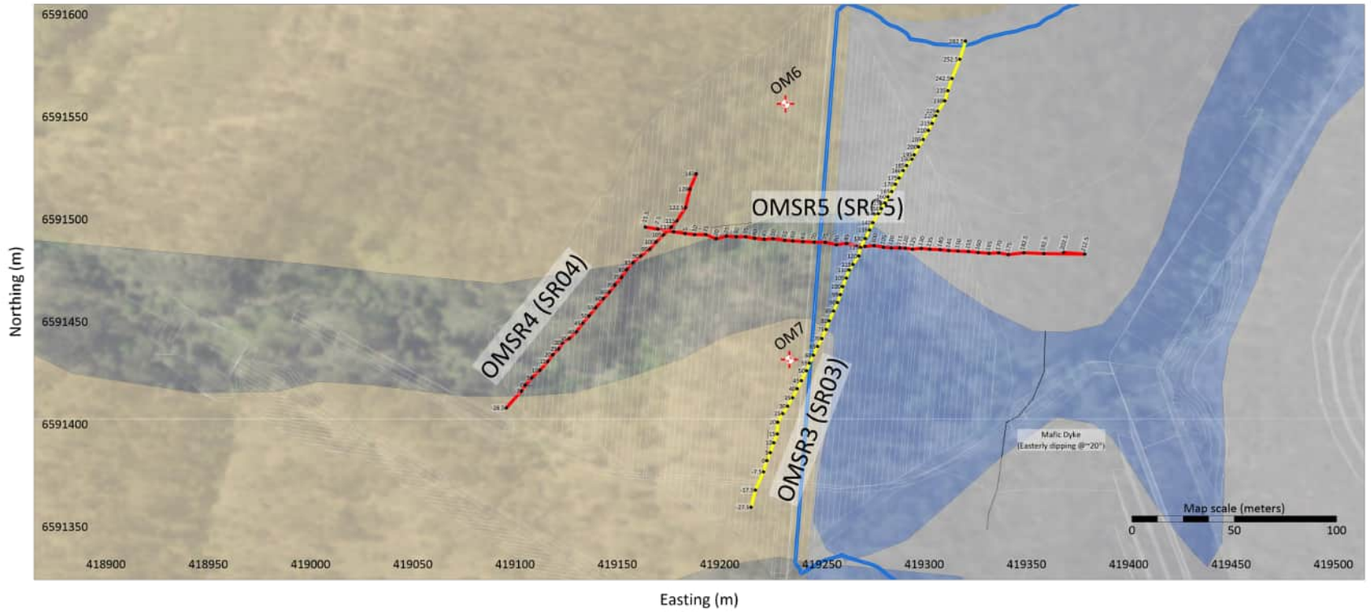
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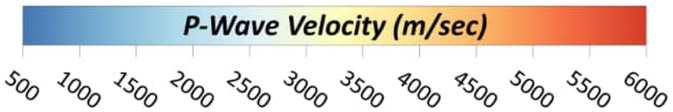
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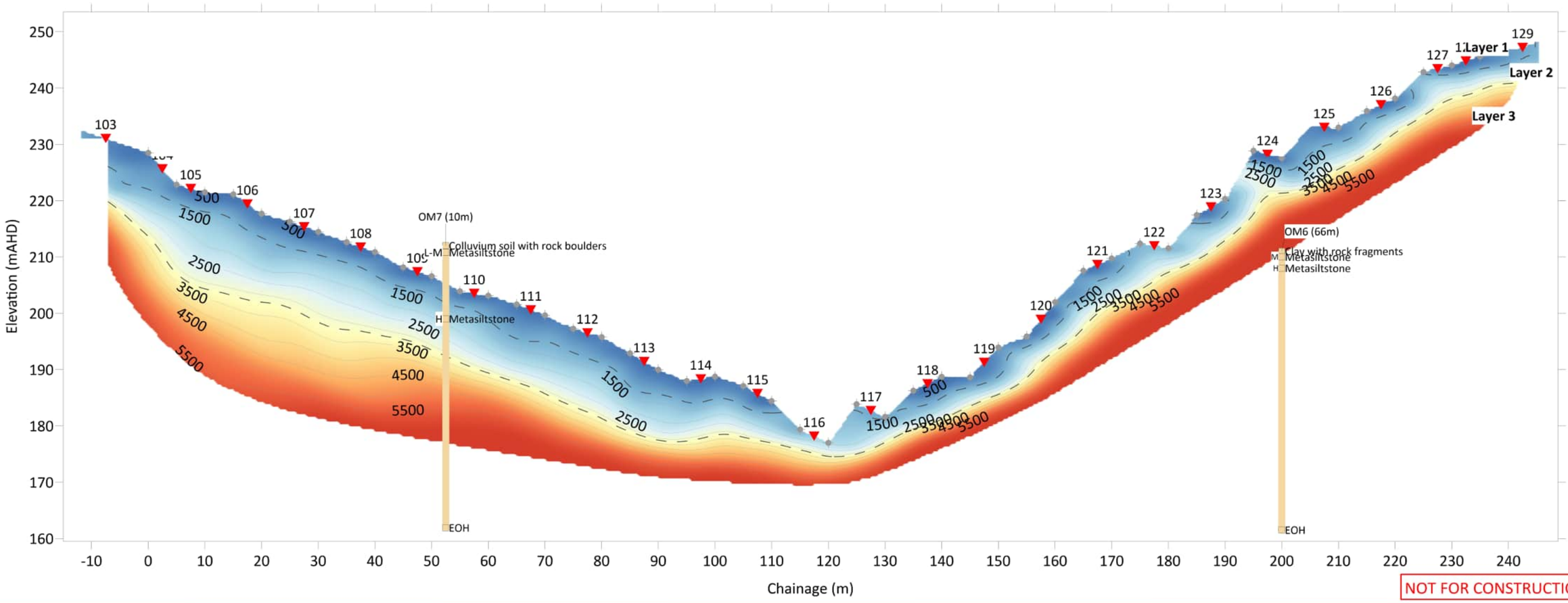
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- *Displayed SRT Line Location (Plan view)*
- *Surveyed SRT Line Location (Plan view)*
- *Borehole infomation*





SR03 RMS error 4.4%=1.24ms 40 WET itr. 50Hz Width 3.5% initial GRADIENT.GRD v. 4.01



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	SMEC GIR_DRAFT_Rev1	RL		12/04/2022

INTELLIGENT RESOURCES INC. SOFTWARE

Geodetic Parameters
Coordinate System: GDA94 Zone 56

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approved	
date	12/04/2022
scale	AS SHOWN
original size	A3

Survey Parameters:
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- 10Hz spiked geophones @5m
- Sledgehammer/metal plate Source

Sample Interval:31.25micro sec
Record Length: 1sec

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title: GEOPHYSICAL INVESTIGATION (SEISMIC REFRACTION PROFILES)
project no: 30018018
figure: SR03

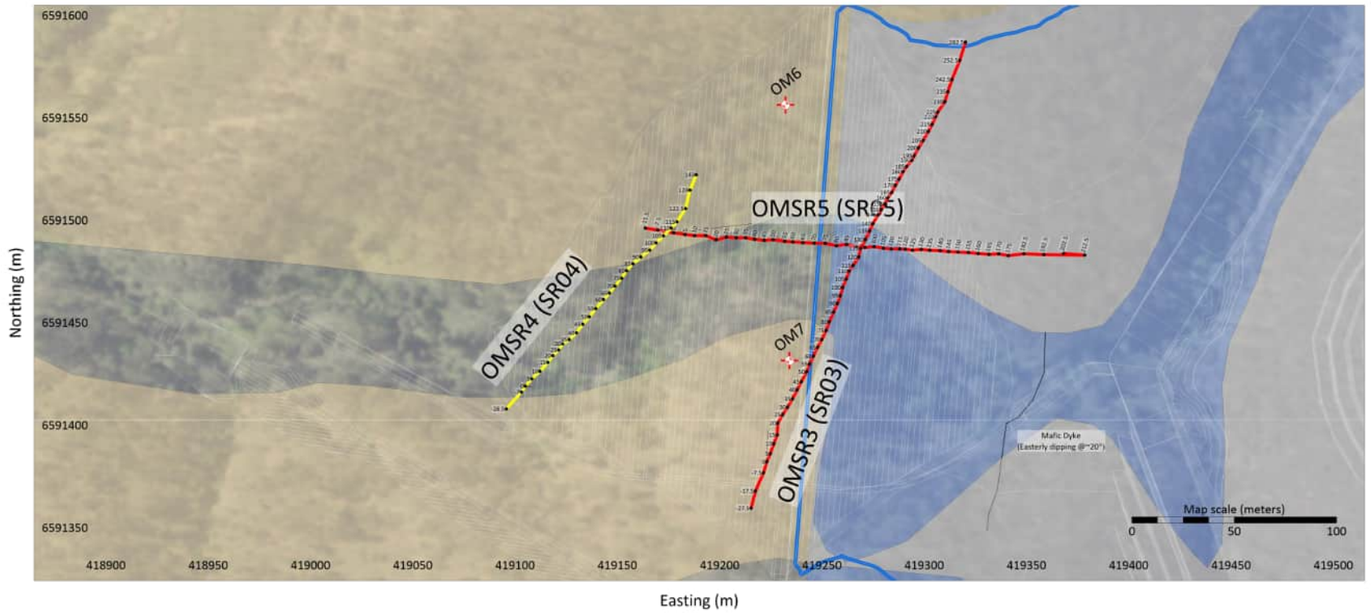
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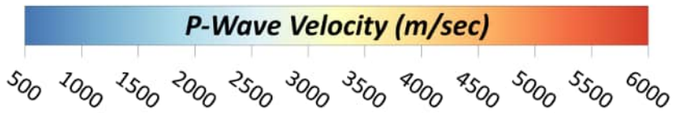
Interpreted seismic profiles are subject to uncertainties due to seismic signal to noise ratio and due to the normal limitations of seismic refraction interpretation where a simple 2/3 layered model is imposed on complex site with highly variable (laterally and vertically) anisotropic weathering and rock conditions.

The seismic and geological interpretation derived by SMEC and presented inthis figure has been prepared for the client only as a guide to likely subsurface conditions to aid the geotechnical interpretation and planning purposes.

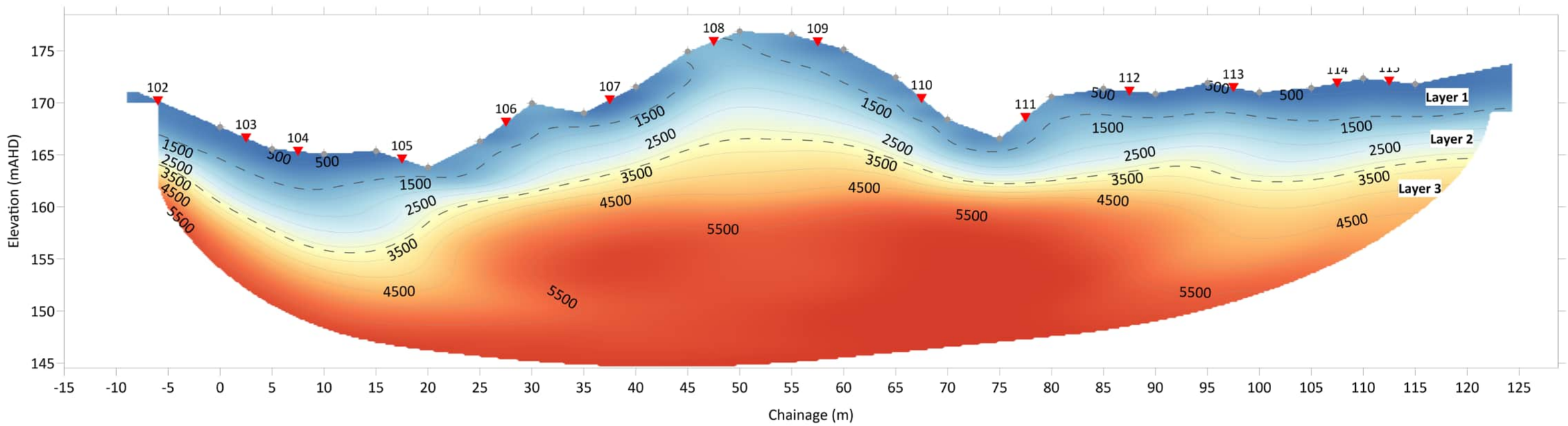
REFERENCE:

- *Seismic Receivers (Profile view)*
- *Seismic shot points (Profile view)*
- *Displayed SRT Line Location (Plan view)*
- *Surveyed SRT Line Location (Plan view)*
- *Borehole infomation*





SR04 RMS error 3.4%=0.68ms 30 WET itr. 50Hz Width 3.0% initial GRADIENT.GRD v. 4.01



NOT FOR CONSTRUCTION

SMEC
Member of the Surbana Jurong Group

OVEN MOUNTAIN PUMPED HYDRO STORAGE

Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia - T +61 2 9925 5555

Additional Data provided by: Australian Government Geoscience Australia; SJ Meijnl

revision	description	drawn	approved	date
	SMEC_DRAFT_Rev0	RL		17/11/2021
	SMEC GIR_DRAFT_Rev1	RL		12/04/2022

INTELLIGENT RESOURCES INC. SOFTWARE

Geodetic Parameters
Coordinate System: GDA94 Zone 56

drawn	RL
approved	
date	12/04/2022
scale	AS SHOWN
original size	A3

Survey Parameters:
- Geometrics Geode Seismograph
- 48 Channel 5m spaced cables
- 10Hz spiked geophones @5m
- Sledgehammer/metal plate Source

Sample Interval:31.25micro sec
Record Length: 1sec

*Lidar data provided by OMPH

client: Ovens Mountain Pumped Hydro Storage
project: Ovens Mountain Phase 1 - 15% Concept (Geophysical Investigation)
title: GEOPHYSICAL INVESTIGATION (SEISMIC REFRACTION PROFILES)
project no: 30018818
figure: SR04

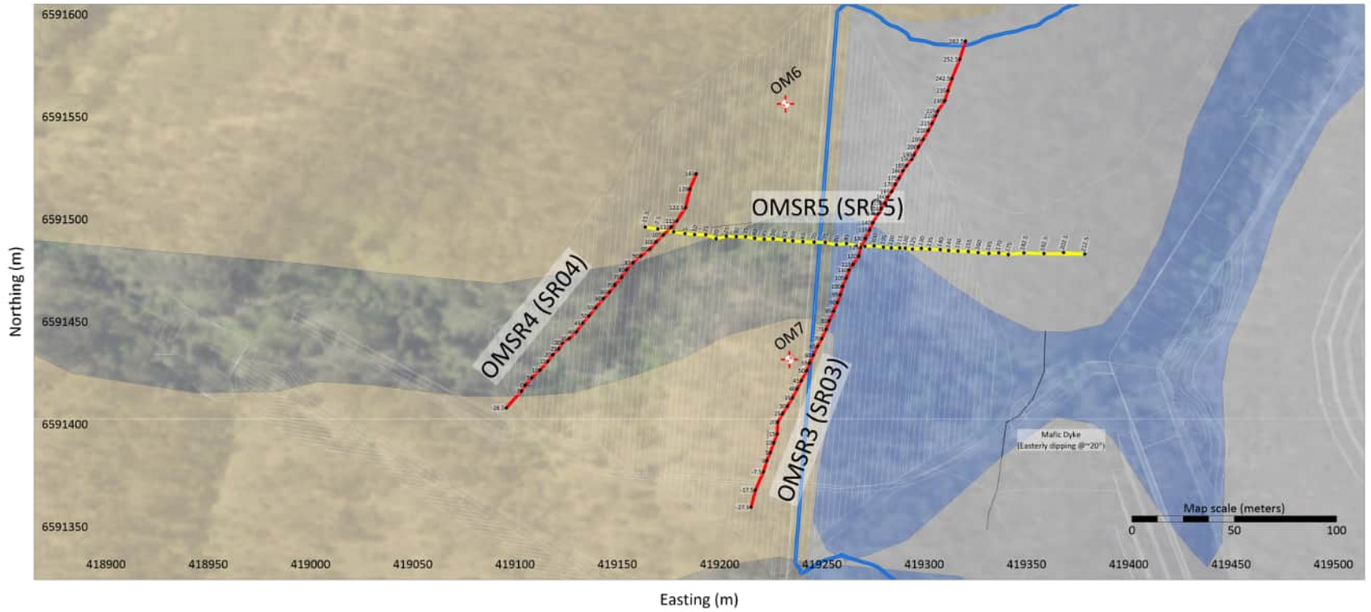
Disclaimer:

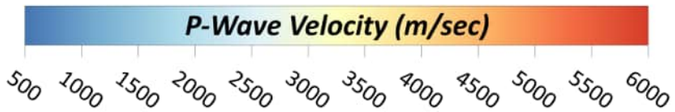
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The seismic and geological interpretation derived by SMEC and presented inthis figure has been prepared for the client only as a guide to likely subsurface conditions to aid the geotechnical interpretation and planning purposes.

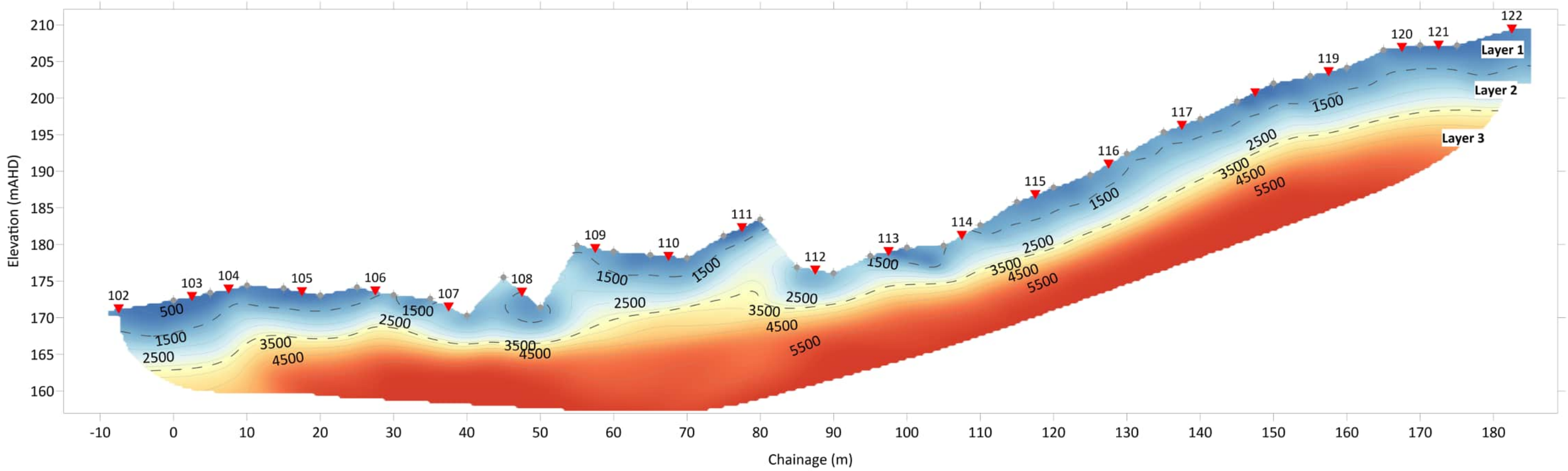
REFERENCE:

- *Seismic Receivers (Profile view)*
- *Seismic shot points (Profile view)*
- *Displayed SRT Line Location (Plan view)*
- *Surveyed SRT Line Location (Plan view)*
- *Borehole infomation*





SR05 RMS error 4.1%=0.91ms 30 WET itr. 50Hz Width 3.5% initial GRADIENT.GRD v. 4.01



NOT FOR CONSTRUCTION

SMEC
Member of the Surbana Jurong Group

OVEN MOUNTAIN
PUMPED HYDRO STORAGE

Level 5, 20 Berry Street, North Sydney, NSW, 2060, Australia - T +61 2 9925 5555

Additional Data provided by:
Australian Government Geoscience Australia
SJ Mojo

revision	description	drawn	approved	date
	SMEC_DRAFT_Rev0	RL		17/11/2021
	SMEC GIR_DRAFT_Rev1	RL		12/04/2022

INTELLIGENT RESOURCES INC. SOFTWARE

Geodetic Parameters
Coordinate System: GDA94 Zone 56

drawn	RL
approved	
date	12/04/2022
scale	AS SHOWN
original size	A3

Survey Parameters:
- Geometrics Geode Seismograph
- 48 Channel 5m spaced cables
- 10Hz spiked geophones @5m
- Sledgehammer/metal plate Source

Sample Interval:31.25micro sec
Record Length: 1sec

*Lidar data provided by OMPH

client: Ovens Mountain Pumped Hydro Storage
project: Ovens Mountain Phase 1 - 15% Concept (Geophysical Investigation)
title: GEOPHYSICAL INVESTIGATION (SEISMIC REFRACTION PROFILES)
project no: 30018018
figure: SR05

Appendix H EMM Hydrogeological Report

Oven Mountain pumped energy storage

Stage one hydrogeological drilling and testing report

Prepared for SMEC Australia Pty Limited

August 2022

Oven Mountain pumped energy storage

Stage one hydrogeological drilling and testing report

SMEC Australia Pty Limited

E210769 RP1

August 2022

Version	Date	Prepared by	Approved by	Comments
1	11 April 2022	Alex Bayer	Sean Cassidy	Draft
2	3 August 2022	Alex Bayer	Sean Cassidy	Final

Approved by



Sean Cassidy
Associate Hydrogeologist
4 August 2022

Ground floor 20 Chandos Street
St Leonards NSW 2065
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This report has been prepared in accordance with the brief provided by SMEC Australia Pty Limited and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of SMEC Australia Pty Limited and no responsibility will be taken for its use by other parties. SMEC Australia Pty Limited may, at its discretion, use the report to inform regulators and the public.

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1 Introduction

1.1 Project overview and background

EMM Consulting Pty Limited (EMM) was engaged on behalf of SMEC Australia Pty Limited (SMEC) to undertake a hydrogeological investigation program (HIP) for the proposed Oven Mountain Pumped Hydro Energy Storage project (the project), located near Carrai, NSW (the site, as outlined in Figure 1.1).

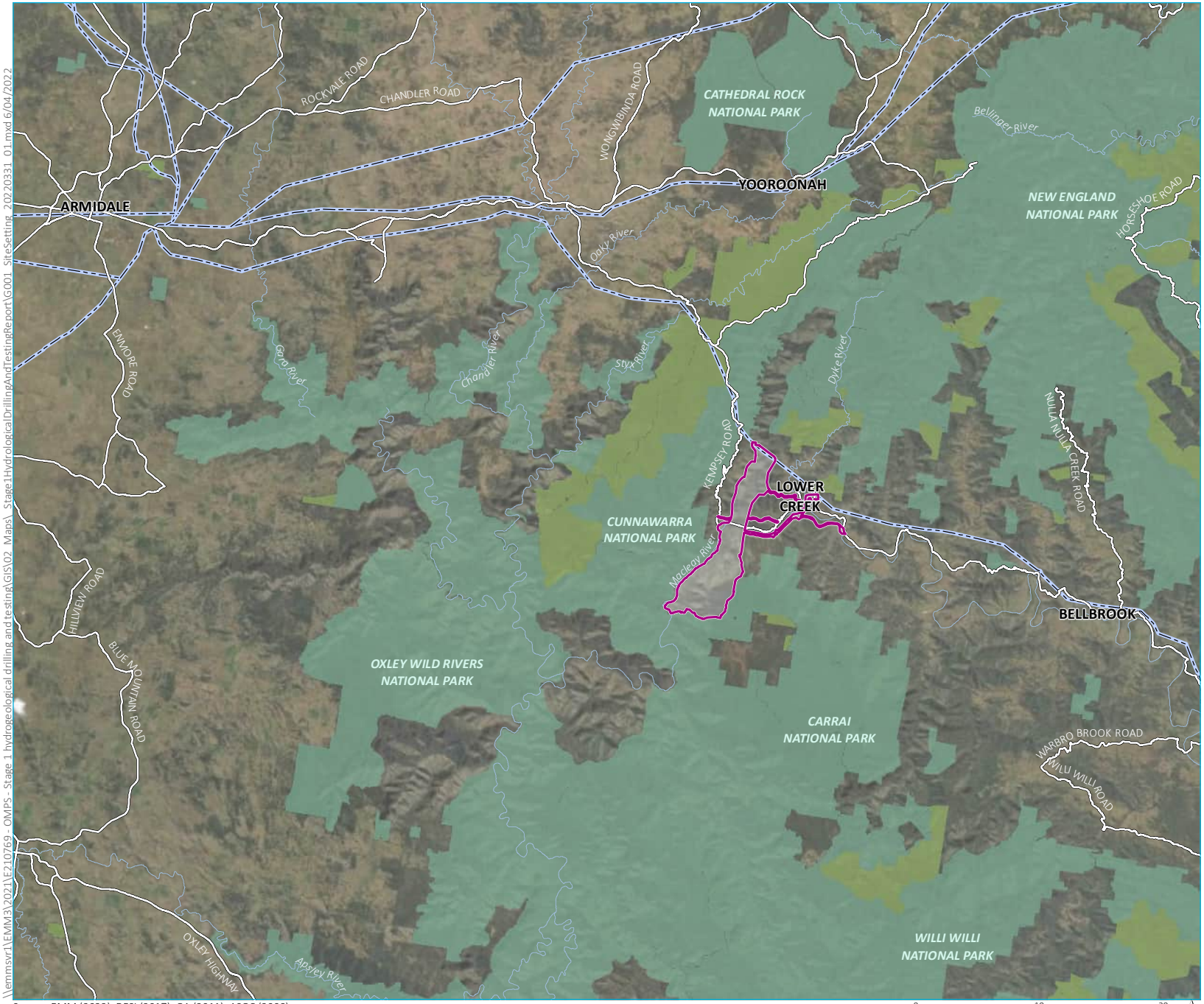
The HIP was designed by EMM to establish a groundwater monitoring network, facilitating the collection of baseline data in accordance with the project Secretary's Environmental Assessment Requirements (SEARs) issued on the 19 February 2021 to inform the proposed Environmental Impact Statement (EIS).

In accordance with the proposal (EMM 2021), EMM provided the client with the scope of works outlined in Section 1.2. This report provides a factual summary of the subsequent monitoring bore installation and testing program.

1.2 Scope of Works

The following agreed scope of works was undertaken:

1. installation of eight monitoring bores:
    a) one monitoring bore installed to assess groundwater within the Permian Nambucca Beds;
    b) two monitoring bores installed to assess groundwater within the Permian Parabell Beds; and
    c) five monitoring bores installed to assess groundwater within the Triassic Carrai Granodiorite;
2. bore development at each newly installed monitoring bore, in general accordance with Minimum Construction Requirements for Water Bores in Australia (NUDLC 2020);
3. collection of one groundwater chemistry sample, at each newly installed monitoring bores; noting the groundwater quality sample results from BH4A are not presented in this report, as we are awaiting laboratory analysis;
4. installation of one water level data logger at each newly installed monitoring bores, with one barometric data logger installed in the headspace of one monitoring bore;
5. installation of dedicated low flow pumps at each of the newly installed monitoring bores, noting that a dedicated pump is not currently installed in BH4A as installation is scheduled for late August;
6. *in-situ* hydraulic testing at each of the newly installed monitoring bores using a rising head test methodology, with the exception of BH4A where packer testing was undertaken by SMEC; and
7. provision of a hydrogeological drilling and testing report.





KEY

- Project area

Existing environment

- Major road
- Watercourse/drainage line
- Transmission line
- NPWS reserve
- State forest

Source: EMM (2022); DFSI (2017); GA (2011); ASGC (2006)

0 10 20 km

GDA 1994 MGA Zone 56

N

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Site setting

Oven Mountain Pumped Hydro Storage Project
Stage one hydrogeological drilling and testing report

Figure 1.1

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2 Site description

2.1 Topography and drainage

Topography within the site generally dips down from the Carrai Plateau (east) to the Macleay River (west). Elevation changes by approximately 900 m over a series of steep escarpments and slopes of up to 60°.

A series of incised valleys, trending east-west (along the axis) represent the dominant drainage feature, supporting ephemeral streams that discharge to the Macleay River. The ephemeral streams typically flow during periods of high rainfall with some attenuated flow following prolonged rainfall events.

2.2 Climate and river data

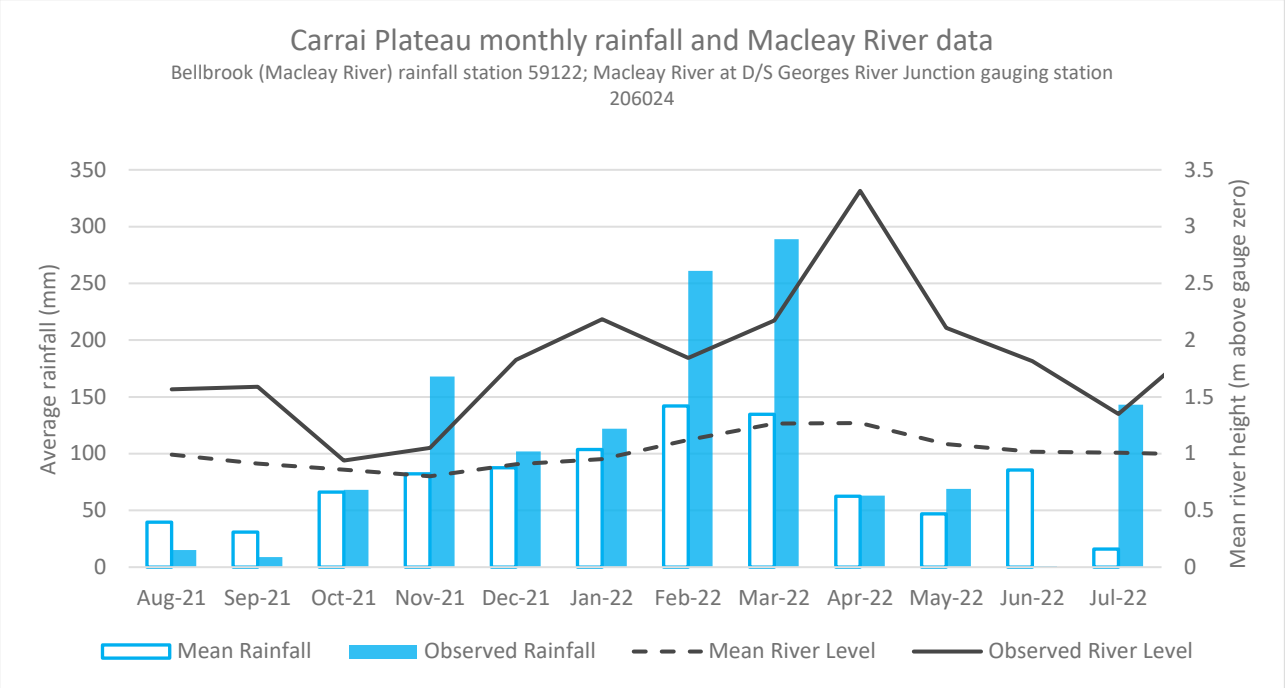
Rainfall data obtained from the Bureau of Meteorology (BoM) Bellbrook (Macleay River) rainfall station (BoM: 59122, located approximately 30 km east of the project area) indicates 52% of the yearly rainfall is typically received between December and March (BoM, 2022).

A summary of historical mean monthly rainfall and river height data compared to observed data from August 2021 to June 2022 is provided in Figure 2.1.

Macleay River height data obtained from the Macleay River D/S Georges River Junction gauging station (WaterNSW: 206024), located approximately 300 m north of the northern boundary of the project area, indicates river levels are typically higher between December and March, correlating with the periods of higher expected rainfall.

The observed monthly rainfall was typically equal to or greater than the historical mean monthly rainfall values. The largest falls were observed in February and March 2022. Observed mean monthly river levels were greater than the historical monthly mean for all months from August 2021 to July 2022. The highest river levels occurring in April 2022 as a response to the significant observed rainfall throughout February and March 2022.

Due to the steep and complex topography of the site, orographic microclimate effects may affect the overall reliability of rainfall and climate data.



Source: Rainfall data; Averaged monthly data August 2001-present at BOM station 59122 Bellbrook (BOM, 2022)
River height data; Averaged monthly data June 1969-present at NSW DPIE station 206024 Macleay D/S Georges (WaterNSW 2022)

Figure 2.1 Carrai Plateau monthly rainfall and Macleay River data

2.3 Geology

The project area lies within the southcentral portion of the Palaeozoic to early Mesozoic New England Orogeny. (Buckman and Bevin 2010). The New England Orogeny extends approximately 2,000 km along the east coast of Australia from Townsville, QLD (north) to Newcastle, NSW (south), and is bounded by the Sydney-Gunnedah--Bowen Basin system to the west (Jessop et al. 2019).

The New England Orogeny is characterised by volcanic arc and fore-arc regions (Day et al. 1978), typically comprising complex suites of:

- Devonian–Carboniferous sedimentary formations (conglomerate, sandstone and mudstone) (Leitch 1974); and
- Carboniferous ashfall tuffs and ignimbrites (Leitch 1974).

Differing geodynamics in the early Permian to Triassic led to the formation of the New England Batholith (O'Neil et al. 1977; Shaw and Flood 1981), a series of linked pluton structures within the southern portion of the New England Orogeny, including the Triassic Carrai Granodiorite pluton (the dominant geology within the site, refer Figure 2.1).

The Carrai Granodiorite typically comprises Hornblende-biotite granodiorite, monzogranite, and minor biotite leucogranite (Leitch & McDougall, 1979). Aplitic and porphyritic dykes are observed irregularly throughout the granodiorite (Leitch 1976).

The elevated margins of the Carrai Granodiorite are steeply dipping into the lower lying contact metamorphic boundaries with the surrounding sedimentary units. These include the late Permian metasedimentary strata and country rock of the Nambucca Beds and the Permian Parrabel Beds (intercepted by the project's proposed lower reservoir, refer Figure 2.2), which comprises conglomerates, sandstones, siltstone, and limestones (Kinny et al. 1985).

Colluvial and alluvial deposits occupy the valley floor, distributed by the floodwaters of the Macleay River and its tributaries.

The surface geology of the project area is shown on Figure 2.2.

2.4 Hydrogeology

2.4.1 Overview

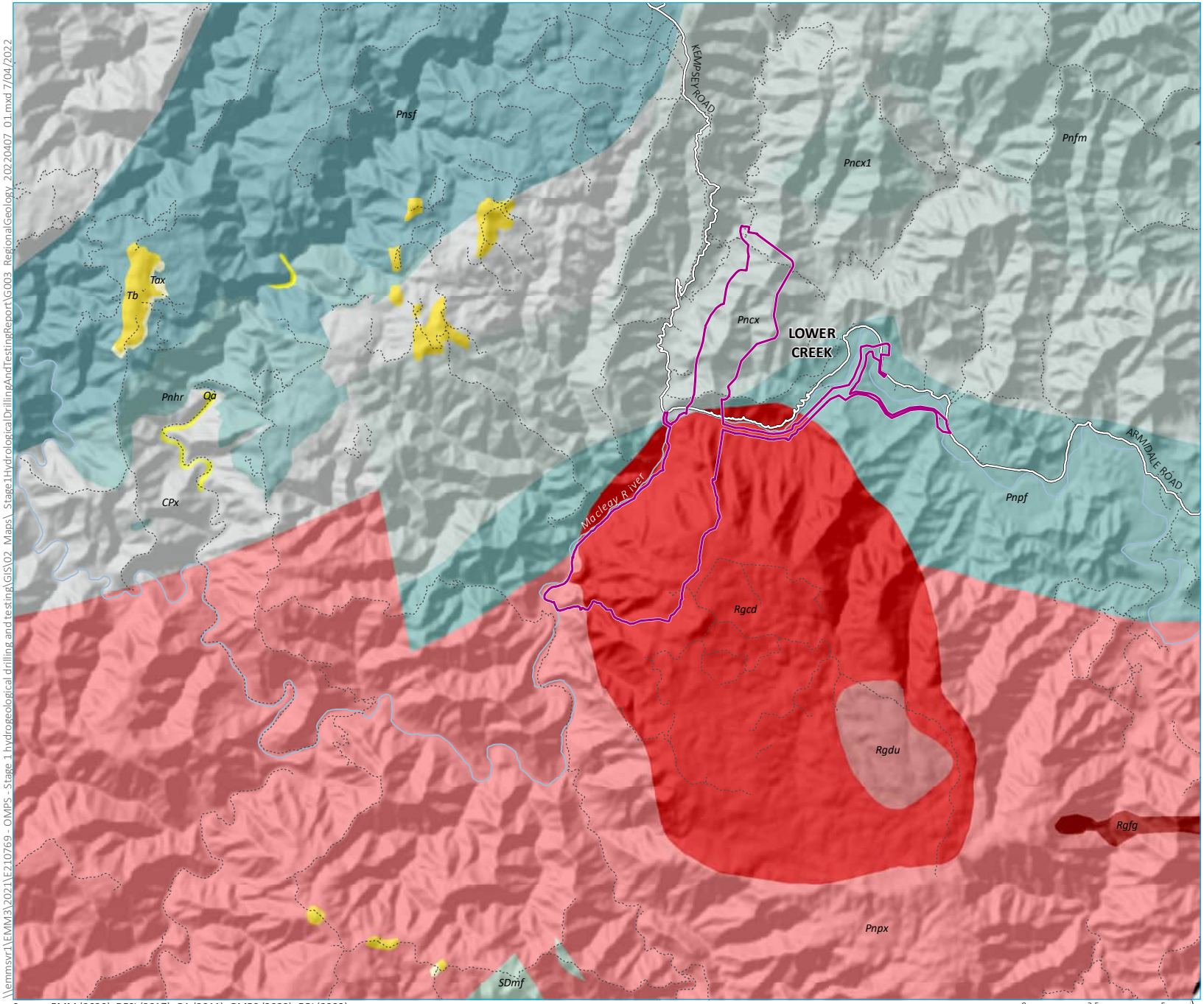
Hydrogeology across the site comprises two systems:

- a surficial localised groundwater system, within the unconsolidated colluvial and alluvial materials deposited within the incised valleys, and adjacent to the Macleay River; and
- a deeper fractured rock groundwater system, within the Triassic Carrai Granodiorite and Permian Parrabel Beds.

Groundwater recharge is predominantly via rainfall across the Carrai Plateau, infiltrating into the outcrops of the fractured rock groundwater system. Longer-term seepage from localised weathered geology likely contributes to attenuated infiltration.

Groundwater flow is dominant within the fractured rock groundwater system via interconnected fracture networks, with negligible flow through the rock matrix pore-space. Groundwater within the fractured rock system discharges to the Macleay River via:

- ephemeral streams, connected through surface expressions at discontinuities in the rock dominated stream bed;
- pore spaces within the surficial localised colluvial/alluvial groundwater systems (which are highly dependent on flow within the ephemeral streams); and
- direct baseflow contribution.



KEY

- Project area
- Major road
- Vehicular track
- Macleay River

Geology 250k period and formation

Quaternary
- Qa - Quaternary, unnamed

Tertiary
- Tax - Tertiary
- Tb - Tertiary

Permian
- Pnpx - Permian, Parrabel bed
- Rgcd - Permian, Carrai Granodiorite
- Rgdu - Permian, Daisy Plains Leucoadamellite
- Rgfg - Permian, Fife Adamellite

Carboniferous
- CPx - Carboniferous, Coffs Harbour association
- Pncx - Carboniferous
- Pncx1 - Carboniferous
- Pnfm - Carboniferous
- Pnhr - Carboniferous
- Pnpf - Carboniferous, Pee Dee bed
- Pnsf - Carboniferous

Silurian
- SDmf - Silurian - Myra bed

Source: EMM (2020); DFSI (2017); GA (2011); OMPS (2020); DPI (2003)

0 2.5 5 km

GDA 1994 MGA Zone 56

N

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Regional geology

Oven Mountain Pumped Hydro Storage Project
Stage one hydrogeological drilling and testing report
Figure 2.2

creating opportunities

3 Methodology

3.1 Overview

All drilling, bore construction and testing works were completed in accordance with the Drilling and Testing Plan (EMM 2021a).

3.2 Drilling

Numac Drilling Services Australia Pty Ltd (Numac), Terratest Pty Ltd (Terratest), and Mulligan Geotechnical Pty Ltd (Mulligan) were engaged by SMEC to complete the drilling, bore construction, and bore development activities for the HIP.

Boreholes were typically progressed through the surficial, unconsolidated strata using an 8" blade-bit with air circulation. Following installation of 8" PVC casing (to stabilise the unconsolidated strata), all boreholes, with the exception of BH4A, were continued to the designated target depth using a 5" or 6" pneumatic hammer with air/water circulation. BH4A was progressed using a 125 mm PQ coring methodology. Further drilling information is provided in the geological logs (Appendix A). It is noted that the geological log for BH4A will be included in the Geotechnical investigation report (GIR).

It is noted that due to adverse drilling conditions encountered during the drilling of MB02B that drilling had to be abandoned at this location, with activities shifted approximately 10 m south-east of the original location where more favourable drilling conditions were encountered.

An EMM hydrogeologist was onsite to collect. log and photograph geology samples and measure water quality and yields. Samples were typically collected at 1 m intervals and logged in general accordance with AS1726—2017 Geotechnical Site Investigation (Standards Australia, 2017). Water physico-chemical field parameters and indicative yields were typically measured with a calibrated water quality meter at the end of every drill rod. Sample photographs are included in Appendix B.

3.3 Monitoring bore construction

Monitoring bores were constructed from Class 18, 50 mm nominal diameter (ND) threaded uPVC with 0.4mm horizontal machine slotted slots for the screen sections. The bores typically comprised:

- sump (~1 m), with end cap;
- screen section (ranging from 3–12 m) above the sump, and
- blank casing to surface.

Bentonite was placed in the base of the monitoring bore beneath the sump. The annular space within the borehole around the casing/screen typically comprised:

- filter pack (nominal diameter 2–3 mm sand);
- slow-release bentonite chips;
- backfill (when required); and
- cement based grout to ground level.

Monitoring bores were completed with a ~0.6 m standpipe monument was installed within a 0.5 m x 0.5 m concrete plinth.

3.4 Monitoring bore development

Following drilling completion, boreholes were developed by circulating air throughout the full borehole profile until physico-chemical parameters stabilised and water clarity improved.

3.5 Water quality sampling

Representative groundwater samples were collected from each bore by an EMM hydrogeologist at the conclusion of development. Samples were collected using a submersible bailer and submitted to a NATA accredited laboratory for analysis of the following suite of analytes:

- general water suite (pH, electrical conductivity, total dissolved solids, alkalinity, sulfate, chloride, fluoride, major cations, major anions and ionic balance);
- twelve dissolved metals (aluminium, antimony, arsenic, cadmium, chromium, copper, manganese, mercury, nickel, lead, zinc and iron); and
- hydrocarbons (TRH(C6-C40) and BTEXN).

Water quality sampling is summarised in Table 4.3to Table 4.5 and certificates of analysis are attached as Appendix C. It is noted that water chemistry results from BH4A were not available at the time of reporting. These data will be summarised, incorporated into this report, and reissued once results are made available.

3.5.1 Quality control

In general accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC, 1999), quality control measures were adopted to improve confidence in the analytical data set. The following quality control samples were submitted to NATA accredited laboratories for analysis:

- one duplicate sample (intra-lab duplicate, referenced as QC01) submitted for analysis to the primary laboratory, providing an indication of the field sampling and primary laboratory consistency;
- one triplicate sample (inter-lab duplicate, referred to as QC02) submitted for similar analysis to a secondary laboratory, providing an indication of the primary laboratory's precision and reliability;
- one rinsate blank sample (referred to as Rinsate) taken from de-ionised water poured over the water level meter, providing an indication that the sampling equipment is appropriately de-contaminated;
- one trip blank sample (a vial of de-ionised water, referred to as TB) pre-organised by the primary laboratory and transported with the groundwater samples, providing an indicator if extraneous contamination (TRH and BTEXN) has entered the groundwater samples during transport; and
- one trip spike sample (a vial of de-ionised water 'spiked' with a known concentration of BTEXN, referred to as TS) pre-organised by the primary laboratory and transported with the groundwater samples, providing indication of appropriate TRH and BTEXN sample preservation.

The relative percentage difference (RPD) was calculated for duplicate and triplicate samples to provide a quantitative assessment of dataset reliability, as demonstrated in equation 1:

Equation 1; $$RPD\ (\%) = \frac{|C_1 - C_2|}{\frac{C_1 + C_2}{2}} \times 100$$

Where: RPD is relative percentage difference;

C_1 is the concentration of analyte from sample 1; and

C_2 is the concentration of analyte from sample 2.

In the absence of project site specific data quality objectives, EMM adopted the following acceptance criteria for quality control assessment:

- if primary sample analyte concentration is:
  - less than or equal to five (5) times the limit of reporting, RPD should be less than 100%; or
  - greater than five (5) times the limit of reporting, RPD should be less than 50%;
- trip spikes analyte concentrations are greater than or equal to 90% of known spiked concentrations; and
- rinsate and trip blank concentrations are less than the limit of reporting.

Results are provided in Section 4.4 and attached as Appendix C.

3.6 Hydraulic conductivity testing

Rising head tests were undertaken at all monitoring bores to infer the hydraulic conductivity of the respective lithology. Whilst BH4A also underwent hydraulic conductivity testing through the use of inflatable packers, this scope was undertaken by SMEC and as such results are not summarised in this report.

The testing undertaken by EMM was performed using a pneumatic slug testing apparatus (PST) as follows:

1. The PST was fitted at the top of the PVC stickup and a logger was temporarily installed to allow for automated data collection (nominally set to a 1 to 5 second interval).
2. A manual water level measurement was taken for logger depth calibration and to infer a representative static water level.
3. Air was pumped into the bore with a hand pump (for approximately 3 min) to pressurise the bore and cause a displacement in the static water level.
4. The pressurised seal was removed, and the monitoring bore was allowed to recover until the water level was close to the initial standing water level. Manual water level measurements were periodically taken to assess recovery.
5. The logger was removed, and data was downloaded.

Data was analysed using Aqtesolv software. A summary of processed results is provided in Table 4.2 and analytical models are attached as Appendix D.

3.7 Monitoring bore equipment installation and ongoing monitoring

3.7.1 Equipment installation

Loggers were installed in all monitoring bores to measure water levels at six-hour intervals. The initial water level was manually measured following installation for logger depth calibration. A barometric logger was installed in the headspace of MB02A to allow for atmospheric compensation. Water level hydrographs are presented in Appendix E.

Dedicated double valve pumps (DVP) and tubing were installed in all monitoring bores to collect reliable and representative water quality samples.

4 Results

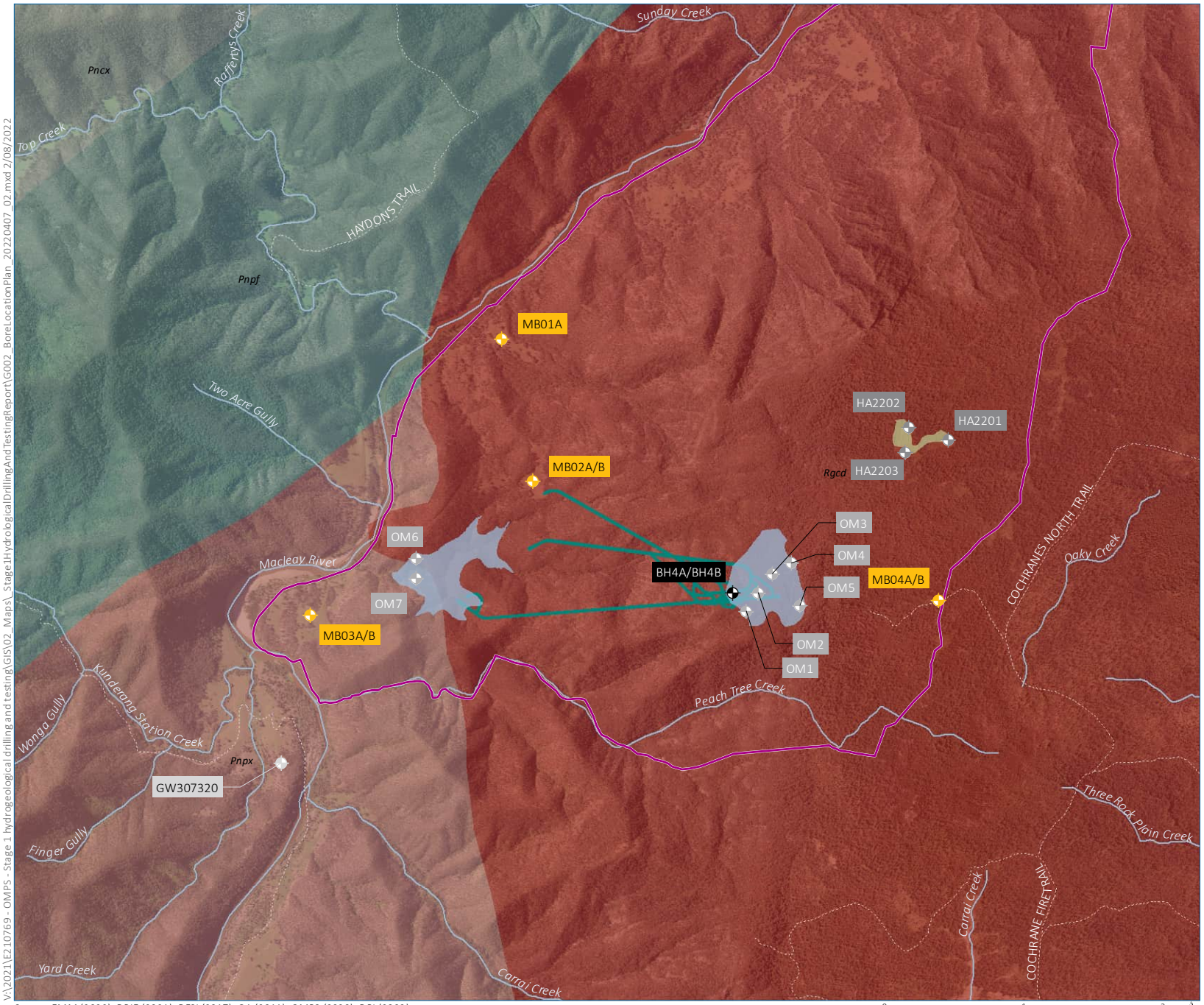
4.1 Monitoring bore summary

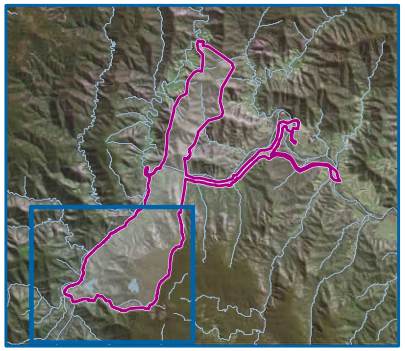
A summary of monitoring bore installations is provided in Table 4.1 and monitoring bore locations are shown in Figure 4.1. Further details regarding drilling and monitoring bore installations are provided in the geological logs attached as Appendix A, with the exception of BH4A, whereby further information is provided in the GIR.

Table 4.1 Installation and water data summary

Site	Bore	[1]Coordinate		Elevation		Drilling		Construction					Equipment Installation			
										Screen				Logger		
		Easting[1]	Northing	Top of casing (mAHD)[2]	Ground level (mAHD)	Depth (mbgl)[3]	Diameter (mm)	Material	Diameter (mm)	Top (mbgl)	Bottom (mbgl)	Formation	Water level (mbgl)	Depth (mAHD)	Serial number	DVP intake (mbgl)
1	MB01A	419853.6	6593143.5	183.9	182.8	36.5	125	PVC	50	28.5	34.5	Carrai Granodiorite	9.93	166.9	2143291	32
2	MB02A	420108.5	6592190.8	303.5	302.4	34.5	200	PVC	50	25.6	31.6	Carrai Granodiorite	19.27	275.5	2143293	29
	MB02B	420094.0	6592175.2	301.5	300.6	187	200	PVC	50	173.5	185.5	Carrai Granodiorite	19.05	261.5	2142820	183
3	MB03A	418650.9	6591232.3	167.3	166.5	23	200	PVC	50	15	21	Parrabel Beds	9.68	149.3	2143294	19
	MB03B	418645.8	6591223.6	167.8	167.0	100	200	PVC	50	86	98	Parrabel Beds	10.63	137.8	2142822	96
9	MB04A	423003.9	6591263.9	972.7	972.1	10.5	125	PVC	50	6.35	9.35	Carrai Granodiorite	0.25	962.2	2150410	8.5
	MB04B	422999.7	6591259.0	972.5	971.9	60.5	125	PVC	50	46.7	58.7	Carrai Granodiorite	1.01	942.5	2142821	56
8	BH4A	421495.5	6591273.5	884.5	883.8	77.8	125	PVC	50	63.8	75.8	Nambucca Beds	44.3	834.6	[4]—	—

Notes: 1. co-ordinates are provided in GDA1994/MGA zone 56. 2. mAHD = metres Australian Height Datum. 3. mbgl = metres below ground level. 4. Logger serial number not available





KEY

- Project area
- Access track
- Named watercourse
- Proposed reservoir footprint
- Proposed subsurface infrastructure
- High potential GDE

Stage one hydrogeological program bores

- Hydrogeological (nested bore)

Bore/boreholes additional to Stage one HIP

- Geotechnical / hydrogeological bore
- Fen monitoring bore
- Existing monitoring borehole (SMEC 1996)
- Registered bore (NGIS 2022)

Geology 250k period and formation

Permian

- Pnpx - Permian, Parrabel bed
- Rgcd - Permian, Carrai Granodiorite

Carboniferous

- Pncx - Carboniferous
- Pnpf - Carboniferous, Pee Dee bed

Source: EMM (2022); DPIE (2021); DFSI (2017); GA (2011); OMPS (2020); DPI (2003)

0 1 2 km

GDA 1994 MGA Zone 56

N

V:\2021\E210769 - OMPS - Stage 1 hydrogeological drilling and testing\GIS\02_Maps_Stage1HydrologicalDrillingAndTestingReport\G002_BoreLocationPlan_20220407_02.mxd 2/08/2022

Bore location plan

Oven Mountain Pumped Hydro Storage Project
Stage one hydrogeological drilling and testing report
Figure 4.1

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4.2 Hydraulic conductivity testing

A summary of hydraulic conductivity results is provided in Table 4.2, with Aqtesolv analysis provided in Appendix D.

Table 4.2 Hydraulic conductivity testing results

Site	Bore	Formation	Lithology	Screen details (mbgl)[1]	Hydraulic conductivity (m/s)[2]	Assumptions		Analytical method Confinement
						Confinement	Penetration	
1	MB01A	Carrai Granodiorite	Granodiorite, fresh to slightly weathered	28.5 – 34.5	5.4×10^{-7}	Unconfined	Partial	KGS
2	MB02A	Carrai Granodiorite	Granodiorite, fresh to slightly weathered	25.6 – 31.6	4.3×10^{-6}	Unconfined	Partial	KGS
	MB02B	Carrai Granodiorite	Granodiorite, fresh to slightly weathered	173.5 – 185.5	5.0×10^{-7}	Unconfined	Partial	KGS
3	MB03A	Parrabel Beds	Hornfels, fresh	15 –21	2.0×10^{-5}	Unconfined	Partial	KGS (w/skin)
	MB03B	Parrabel Beds	Phyllite and hornfels, fresh	86– 98	1.7×10^{-7}	Unconfined	Partial	KGS
9	MB04A	Residual Carrai Granodiorite	Sand and extremely weathered granodiorite	6.35 – 9.35	2.8×10^{-5}	Unconfined	Partial	KGS
	MB04B	Carrai Granodiorite	Granodiorite, fresh to slightly weathered	46.7 – 58.7	3.3×10^{-6}	Unconfined	Partial	Springer and Gelhar
8	BH4A	Nambucca Beds	Hornfels, fresh	63.8—75.8	—	—	—	—

Notes: 1. mbgl = metres below ground level. 2. m/s = metres per second
Source: KGS analytical method sourced via AQTESOLV software (Hyder et al. 1994); and Springer and Gelhar analytical method sourced via AQTESOLV software (Springer and Gelhar 1991).

4.3 Water quality

A summary of field and laboratory water quality results are provided in Table 4.3 to Table 4.5 and laboratory certificate of analysis are attached as Appendix C.

Table 4.3 General water quality summary

Site	Bore	Stratigraphy	Temperature (°C)	pH		Electrical conductivity (µg/L)[2]		Hardness (mg/L)[1]
			Field	Field	Laboratory	Field	Laboratory	Field
1	MB01A	Carrai Granodiorite	20.8	7.23	7.40	647	698	163
2	MB02A	Carrai Granodiorite	21.6	6.96	7.38	620	825	257
	MB02B	Carrai Granodiorite	20.7	8.14	7.36	495	694	208
3	MB03A	Parrabel Beds	24.2	8.39	6.78	1,166	986	366
	MB03B	Parrabel Beds	22.1	8.43	7.36	636	966	319
9	MB04A	Residual Carrai Granodiorite	21.6	5.93	6.02	75.7	120	2
	MB04B	Carrai Granodiorite	18.8	6.35	6.34	171.2	157	38
8	BH4A[2]	Nambucca Beds	13.4	9.50	—	179.3	—	—

Notes: 1. Milligrams per litre. 2. Microsiemens per litre 2. Water chemistry results from BH4A were not available at the time of reporting.

Table 4.4 Water chemistry results—metals summary

Site	Bore	Stratigraphy	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Alkalinity (as CaCO3)	Sulfate (SO4)	Chloride (Cl)	Fluoride (Fl)	Total Anions	Total Cations	Ionic Balance
			[1]mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	[2]meq/L	meq/L	%
1	MB01A	Carrai Granodiorite	47	11	98	5	305	26	43	0.8	7.85	7.64	1.34
2	MB02A	Carrai Granodiorite	80	14	71	6	132	254	39	0.5	9.02	8.39	3.67
	MB02B	Carrai Granodiorite	62	13	80	4	228	99	35	1.2	7.60	7.74	0.92
3	MB03A	Parrabel Beds	112	21	82	8	285	176	75	ND	ND	ND	ND
	MB03B	Parrabel Beds	90	23	108	11	358	122	56	ND	ND	ND	ND
9	MB04A	Residual Carrai Granodiorite	1	<1	12	2	39	2	10	<0.1	1.10	1.04	[3]—
	MB04B	Carrai Granodiorite	12	2	23	2	98	2	7	<0.1	2.20	1.94	—
8	[4]BH4A	Nambucca Beds	—	—	—	—	—	—	—	—	—	—	—

Notes: 1. Milligrams per litre. 2. Milliequivalents per litre. 3. — indicates limited cation/anion concentrations cannot be differentiated. 4. Water chemistry results from BH4A were not available at the time of reporting.

Table 4.5 Water chemistry results—metals summary

Site	Bore	Stratigraphy	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Nickel (Ni)	Zinc (Zn)	Iron (Fe)
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	MB01A	Carrai Granodiorite	0.04	[1]<0.005	<0.01	<0.01	<0.01	<0.01	0.05	<0.05
2	MB02A	Carrai Granodiorite	0.001	<0.0001	<0.001	0.001	<0.001	0.009	0.024	<0.05
	MB02B	Carrai Granodiorite	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	0.04	0.05
3	MB03A	Parrabel Beds	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	0.02	0.40
	MB03B	Parrabel Beds	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	1.14
9	MB04A	Residual Carrai Granodiorite	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	0.03	0.38
	MB04B	Carrai Granodiorite	<0.01	<0.005	<0.01	<0.01	<0.01	0.01	0.07	1.54
8	[2]BH4A	Nambucca Beds	—	—	—	—	—	—	—	—

Notes: 1. < indicates analytes were not detected above the limit of reporting for the respective analysis method. 2. Water sampling results from BH4A were not available at the time of reporting.

4.4 Quality control

Duplicate and triplicate samples were all within the acceptable criteria limits presented in Section 3.5.1, with the exception of Ionic balance concentrations between the primary/inter-lab samples (Appendix C). A summary is provided in Table 4.6.

Trip spike analyte concentrations were within the acceptable criteria limits presented in Section 3.5.1, a summary is provided in Table 4.7 and certificates of analysis are attached as Appendix C

Rinsate blanks and the trip blank analyte concentrations were all below the limit of reporting. A summary is provided in Table 4.8 and certificates of analysis are attached as Appendix C.

Table 4.6 Quality control exceedance summary

Analytes	Units	[1]LOR	Concentrations			Relative percentage differences (%)	
			Primary (MB01A)	Intra-lab (QC01)	Primary (MB01A)	Intra-lab (QC01)	Primary (MB01A)
			14/12/2021	14/12/2021	14/12/2021		
Ionic balance	%	0.01	5.58	4.56	-4.0	20	213

Notes: 1. Limit of reporting.

Table 4.7 Trip spike concentrations

Analyte	Unit	Result	Initial concentration	Retained (%)
Benzene	µg/L[1]	23.30	25	93.1
Toluene	µg/L	23.50	25	94.0
Ethylbenzene	µg/L	26.75	25	107.0
meta- & para-Xylene	µg/L	26.75	25	107.0
ortho-Xylene	µg/L	27.50	25	110.0
Naphthalene	µg/L	24.60	25	98.5

Notes: 1. Micrograms per litre.

Table 4.8 Rinsate and trip blank concentrations

Analyte	Unit	[1]LOR	Results	
			Trip blank	Rinsate
			14/12/2021	14/12/2021
Aluminium (filtered)	[3]mg/L	0.1	0.01	[2]—
Arsenic (filtered)	mg/L	0.01	<0.001	—
Antimony (filtered)	mg/L	0.01	<0.001	—
Cadmium (filtered)	mg/L	0.005	<0.0001	—
Chromium (III+VI) (filtered)	mg/L	0.01	<0.001	—
Copper (filtered)	mg/L	0.01	<0.001	—
Iron (filtered)	mg/L	0.05	<0.05	—
Lead (filtered)	mg/L	0.01	<0.001	—
Manganese (filtered)	mg/L	0.01	<0.001	—
Mercury (filtered)	mg/L	0.0001	<0.0001	—
Nickel (filtered)	mg/L	0.01	<0.001	—
Zinc (filtered)	mg/L	0.01	<0.005	—
Benzene	µg/L	1	<1	<1
Toluene	µg/L	2	<2	<2
Ethylbenzene	µg/L	2	<2	<2
meta- & para-Xylene	µg/L	2	<2	<2
ortho-Xylene	µg/L	2	<2	<2
Total Xylenes	[4]µg/L	2	<2	<2
Sum of BTEX	µg/L	1	<1	<1
Naphthalene	µg/L	5	<5	<5
C10-C16	µg/L	100	<100	—
C10-C16 (F2 minus Naphthalene)	µg/L	100	<100	—
C10-C40 (Sum of total)	µg/L	100	<100	—
C16-C34	µg/L	100	<100	—
C34-C40	µg/L	100	<100	—
C6-C10	µg/L	20	<20	<20
C6-C10 (F1 minus BTEX)	µg/L	20	<20	<20
+C10-C36 (Sum of total)	µg/L	50	<50	—
C15-C28	µg/L	100	<100	—

Table 4.8 Rinsate and trip blank concentrations

Analyte	Unit	[1]LOR	Results	
			Trip blank	Rinsate
			14/12/2021	14/12/2021
C10-C14	µg/L	50	<50	—
C29-C36	µg/L	50	<50	—
C6-C9	µg/L	20	<20	<20

Notes: 1. Limit of reporting. 2. — indicates analyte was not tested by the lab. 3. milligram per litre.
4. microgram per litre.

5 Summary and recommendations

A monitoring bore network was installed to facilitate the collection of baseline data in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued on the 19 February 2021 to inform the proposed Environmental Impact Statement (EIS).

In order to increase confidence in hydrogeological conceptualisation, EMM recommends further monitoring to obtain additional groundwater level data and water quality data to facilitate background data collection for the EIS.

6 References

BOM 2022, Climate Data Online, Accessed 2 04, 2022. http://www.bom.gov.au/climate/data/index.shtml?zoom=1&lat=-26.9635&lon=133.4635&dp=IDC10002&p_nccObsCode=139&p_display_type=dataFile

BOM 2022a, National Groundwater Information System. Accessed 2 04, 2022. http://www.bom.gov.au/water/groundwater/ngis/

Buckman, S, and Bevin, P. 2010, Preface in *Proceedings of a conference held at the University of New England, Armidale, New South Wales, Australia, November 2010*. 1-4

Day, R.W., Murray, C.G. and Whitaker, W.G. 1978, The eastern part of the Tasman Orogenic Zone, *Tectonophysics*, 48(3-4), 327-364.

EMM 2021, Oven Mountain Pumped Hydro StorageHydrogelogical drilling and testing plan, prepared for SMEC Australia Pty Limited by EMM Consulting Pty Ltd.

EMM 2021, Proposal, Stage 1 hydrogeological investigation program, prepared for SMEC Australia Pty Limited by EMM Consulting Pty Ltd.

Jessop, K., Daczko, N.R. and Piazolo, S. 2019, Tectonic cycles of the New England Orogen, eastern Australia: a review, *Australian Journal of Earth Sciences*, 66(4),.459-496.

Kinny, P. D., Leitch, E. C., & Vallance, T. G. 1985, Thermal metamorphism near Willi Willi, New South Wales. Australian Journal of Earth Sciences, 32(4), 333-342.

Leitch, E.C. 1974, The geological development of the southern part of the New England Fold Belt. *Journal of the Geological Society of Australia*, 21(2),.133-156.

Leitch, E.C. 1976, Emplacement of an epizonal granodiorite pluton λ by vertical block elevation, *Geological Magazine*, 113(6), 553-560.

C. Leitch, E. and McDougall, I. 1979, The age of orogenesis in the Nambucca Slate Belt: AK-Ar study of low-grade regional metamorphic rocks, *Journal of the Geological Society of Australia*. 26(3-4), 111-119.

NUDLC 2020, Minimum construction requirements for water bores in Australia, Technical guideline, Melbourne: National Uniform Drillers Licensing Committee.

O'neil, J.R., Shaw, S.E. and Flood, R.H. 1977, Oxygen and hydrogen isotope compositions as indicators of granite genesis in the New England Batholith, Australia, *Contributions to Mineralogy and Petrology*. 62(3), 313-328.

Shaw, S.E. and Flood, R.H. 1981, The New England Batholith, eastern Australia: geochemical variations in time and space, *Journal of Geophysical Research: Solid Earth*. 86(B11), 10530-10544.

Standards Australia 2017, AS1726:2017 Geotechnical site investigations.

WaterNSW 2022, “Continuous water monitoring network”, Accessed 2 04, 2022. https://realtimedata.waternsw.com.au/

Appendix A
Geological logs

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Hydrogeological notes and symbols

In general accordance with AS1726-2017

Groundwater observations

Ø Yield test Water strike Water dip Water level

Soil

Components	Division	Size (mm)	Fraction	Components	Size (mm)	Fraction
Boulder		>200	Oversize	Silt	0.002-0.075	Fine grained
Cobble		63-200		Clay	<0.002	
Gravel	Coarse Medium Fine	19.00-63.00 6.70-19.00 2.36-6.70	Coarse grained	Peat	Soil comprising >25% organic content	
Sand	Coarse Medium Fine	0.60-2.36 0.21-0.60 0.075-0.21		Fill	Anthropogenic or collapsed material	

Rock

Sedimentary	Metamorphic	Igneous	Duricrust
Limestone	Gneiss	Gabbro	Ferricrete
Conglomerate	Schist	Dolerite	Gypcrete
Breccia	Phyllite	Basalt	Calcrete
Sandstone	Slate	Diorite	Silicrete
Siltstone	Marble	Microdiorite	
Claystone	Serpentinite	Andesite	
Coal	Hornfel	Granite	
Tuff	Quartzite	Microgranite	
Gypsum/Rocksalt etc.		Rhyolite	

Well construction

Bentonite	Gravel pack	Grout	Pipe	Screen
Mudex, TR30, 1/4" coated bentonite chips	Blue Circle specialised sand, 2 mm, washed	Cement based grout, approximately 1:1 mix	PVC, 50 mm diameter, class 18, threaded with O-ring	PVC, 50 mm diameter, class 18, horizontal slots, 0.4 mm aperture, threaded with O-ring

mbgl = metres below ground level

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Monitoring bore

ID: MB01A

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	HJN
Date:	17–21 October 2021

Easting:	419853.6
Northing:	6593143.5
Spatial reference:	MGA Zone 56
Elevation (collar):	183.9 mAHD
Elevation (ground):	182.8 mAHD
Nominal diameter:	125 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 9.93 mbgl

Screened depth: 28.5–34.5 mbgl **Total depth:** 36.5 mbgl **Level date; time:** 21 October 2021, 12:12

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
0	125 mm pneumatic hammer			Residual	SAND: Medium toCoarse, brown, angular with clay, brown, trace organics, roots ~1-3 mm, dry, residual.				
				Carrai Granodiorite	SAND: Extremely weathered monzogranite; Coarse grained, pale brown, 50% quartz, 50% mixed feldspar, dry.				180
					SYENOGRANITE: Coarse grained, pale pinkish brown, ~60% quartz, 30% biotite, 10% plagioclase, dry, moderately weathered.				
					SAND: Extremely weathered monzogranite; Coarse grained, pale brown, 50% quartz, 50% plagioclase, dry.				
					GRANODIORITE: Coarse grained, pale pinkish brown, ~60% quartz, 30% biotite, 10% plagioclase, dry, highly weathered.				
10						▼	9.93 m: Recovered water level		
					GRANODIORITE: Coarse grained, reddish brown, 5% quartz, 80% plagioclase, 15% horneblende, highly weathered, moist.	⊠	12.35 m: Very low yield, depleting		170
					GRANODIORITE: Coarse grained, pale greyish red, 40% quartz, 40% plagioclase, 15% biotite, 5% pyrite, fresh, dry.				
					GRANODIORITE: Coarse grained, white and dark grey, 60% quartz, 10% biotite, 10% plagioclase, 20% horneblende, fresh, dry.				

Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 7.23; SPC = 647 µs/cm; Temp = 20.8°C; ORP = 95.1 mV

Driller: Justin Collyer **Termination details:** Borehole terminated at target depth of 36.5 m

File path: MB01A.ldat8

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Monitoring bore

ID: MB01A

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	HJN
Date:	17–21 October 2021

Easting:	419853.6
Northing:	6593143.5
Spatial reference:	MGA Zone 56
Elevation (collar):	183.9 mAHD
Elevation (ground):	182.8 mAHD
Nominal diameter:	125 mm

Screened lithology: Carrai Granodiorite
Screened depth: 28.5–34.5 mbgl
Drilling method/s: Pneumatic hammer
Total depth: 36.5 mbgl
Water level depth: 9.93 mbgl
Level date; time: 21 October 2021, 12:12

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
20	125 mm pneumatic hammer			Carrai Granodiorite		∅	21 m: 0.5 L/sec, pH 7.86, SPC 630 µS/cm, Temp 17.5°C, Eh 152.8 mV		160
					GRANODIORITE: As above, pale grey, pale green and dark grey, trace slightly weathered chips in return, likely aplite instrusions throughout granodiorite.				
					GRANODIORITE: As above, 50% quartz, 10% plagioclase, 20% horneblende, 10% biotite, 10% pyrite.				
30						⋈	32.8 m: 0.2 L/sec, pH 8.27, SPC 401 µS/cm, Temp 21.0°C, Eh 94.1 mV		150
						∅	34 m: 0.2 L/sec, pH 8.71, SPC 361 µS/cm, Temp 22.9°C, Eh 86.0 mV		

Company: Numac Drilling Services Pty Ltd
Driller: Justin Collyer
Water quality: pH = 7.23; SPC = 647 µs/cm; Temp = 20.8°C; ORP = 95.1 mV
Termination details: Borehole terminated at target depth of 36.5 m

File path: MB01A.ldat8

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Monitoring bore

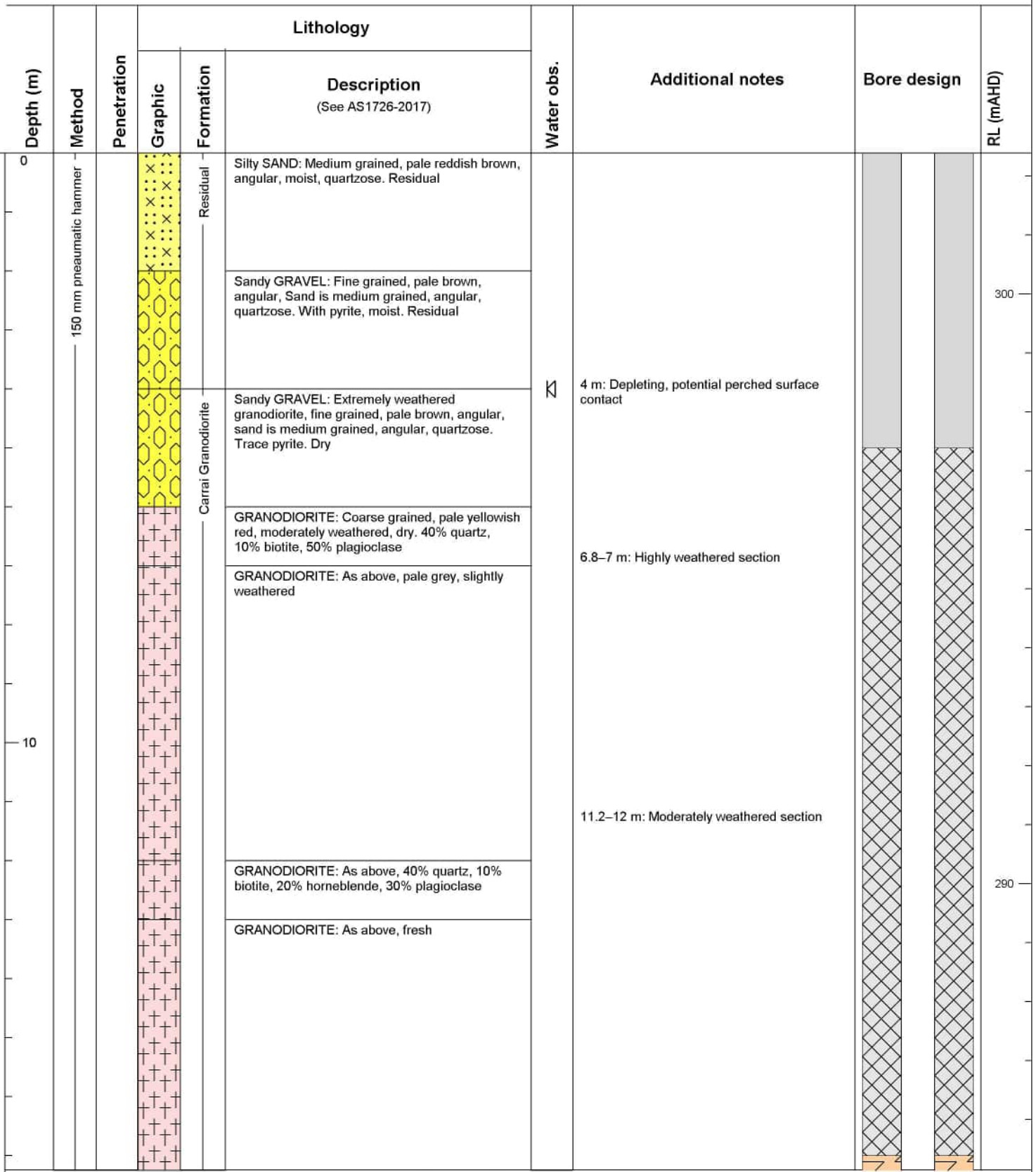
ID: MB02A

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	HJN
Date:	10–11 December 2021

Easting:	420108.5
Northing:	6592190.8
Spatial reference:	MGA Zone 56
Elevation (collar):	303.5 mAHD
Elevation (ground):	302.4 mAHD
Nominal diameter:	150 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 19.27 mbgl

Screened depth: 25.6–31.6 mbgl **Total depth:** 34.5 m **Level date; time:** 25 January 2022, 09:44



Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 6.96; SPC = 620 µs/cm; Temp = 21.6°C; ORP = 71.7 mV

Driller: Steffan Colls **Termination details:** Borehole terminated at target depth of 34.5 m.

File path: MB02A.ldat8

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Monitoring bore

ID: MB02A

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	HJN
Date:	10–11 December 2021

Easting:	420108.5
Northing:	6592190.8
Spatial reference:	MGA Zone 56
Elevation (collar):	303.5 mAHD
Elevation (ground):	302.4 mAHD
Nominal diameter:	150 mm

Screened lithology: Carrai Granodiorite
Screened depth: 25.6–31.6 mbgl
Drilling method/s: Pneumatic hammer
Total depth: 34.5 m
Water level depth: 19.27 mbgl
Level date; time: 25 January 2022, 09:44

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
20	150 mm pneaumatic hammer			Carrai Granodiorite			17.9 m: No yield, colour change in rock and slightly damp 19.27 m: Recovered water level		280
30							28 m: <0.01L/sec 29–34.5 m: Moderately weathered chip samples 31 m: 0.02 L/sec, pH 8.30, SPC 1110 µS/cm, Temp 18.8°C, Eh 36.0 mV		270

Company: Numac Drilling Services Pty Ltd
Driller: Steffan Colls
Water quality: pH = 6.96; SPC = 620 µs/cm; Temp = 21.6°C; ORP = 71.7 mV
Termination details: Borehole terminated at target depth of 34.5 m.

File path: MB02A.ldat8

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Monitoring bore

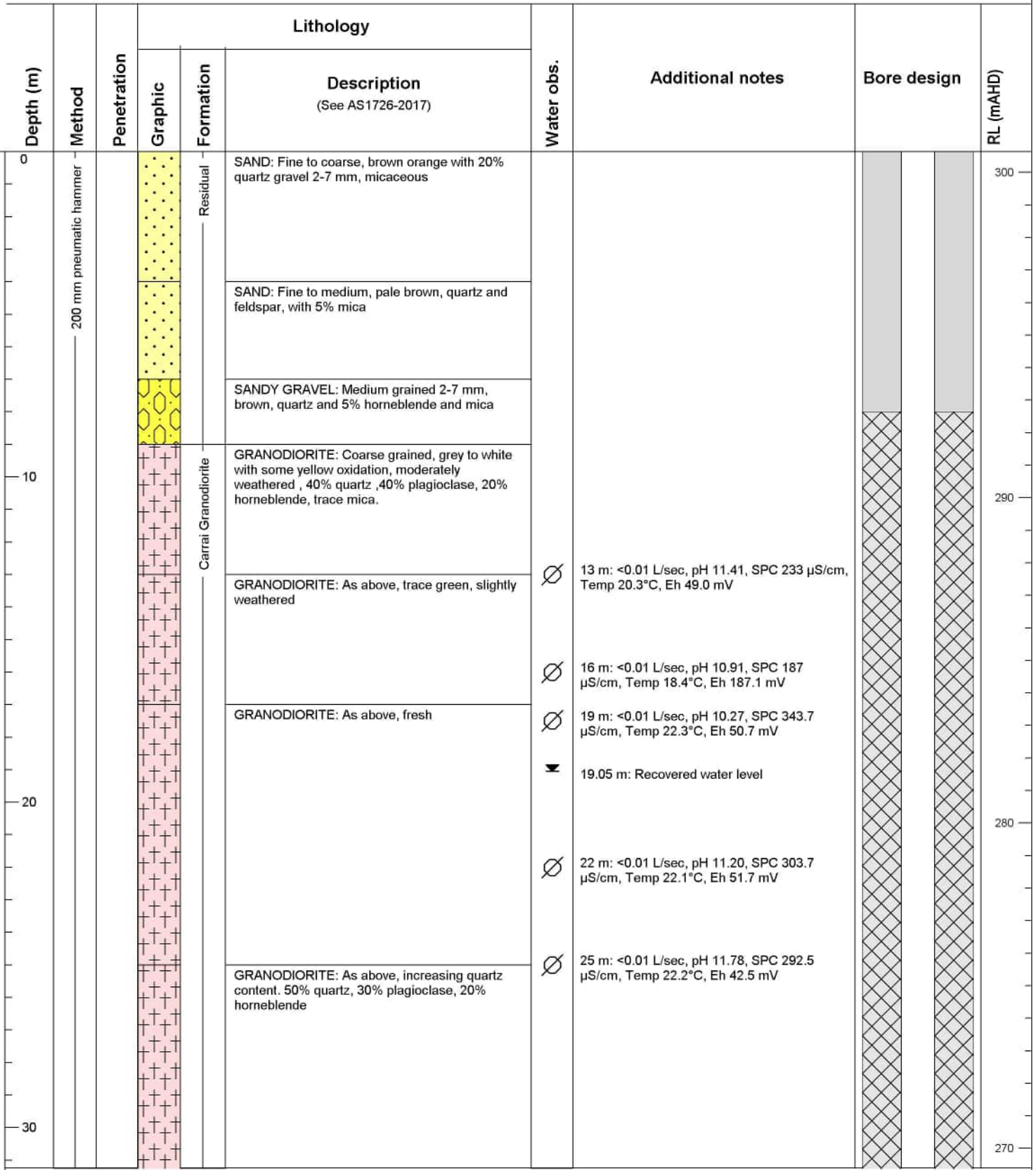
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Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	QB AB
Date:	15 January–9 February 2022

Easting:	420094
Northing:	6592175.2
Spatial reference:	MGA Zone 56
Elevation (collar):	301.5 mAHD
Elevation (ground):	300.6 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 19.05 mbgl

Screened depth: 173.5–185.5 mbgl **Total depth:** 187 mbgl **Level date; time:** 10 February 2022; 12:00



Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 8.14; SPC = 495 µs/cm; Temp = 20.7°C; ORP = 82.9 mV

Driller: Steffan Colls **Termination details:** Borehole terminated at target depth of 187 m.

File path: MB02B.ldat8

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Monitoring bore

ID: MB02B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	QB AB
Date:	15 January–9 February 2022

Easting:	420094
Northing:	6592175.2
Spatial reference:	MGA Zone 56
Elevation (collar):	301.5 mAHD
Elevation (ground):	300.6 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 19.05 mbgl

Screened depth: 173.5–185.5 mbgl **Total depth:** 187 mbgl **Level date; time:** 10 February 2022; 12:00

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
	200 mm pneumatic hammer			Carrai Granodiorite	GRANODIORITE: As above, slightly weathered				
					GRANODIORITE: As above, fresh	∅	34 m: <0.02 L/sec, pH 10.66, SPC 335.1 µS/cm, Temp 19.3°C, Eh 122.3 mV		
						∅	37 m: <0.02 L/sec, pH 10.56, SPC 373.6 µS/cm, Temp 18.6°C, Eh 128.7 mV		
40						∅	40 m: <0.02 L/sec, pH 5.50, SPC 381.8 µS/cm, Temp 19.8°C, Eh 120.1 mV		260
						∅	43 m: no WQ, too much foam		
50									250
					GRANODIORITE: As above, slightly weathered	∅	52 m: <0.02 L/sec, pH 11.3, SPC 325.9 µS/cm, Temp 21.4°C, Eh 105.2 mV		
					GRANODIORITE: As above, fresh	∅	55 m: <0.02 L/sec		
60						∅	58 m: <0.02 L/sec, pH 11.93, SPC 335.6 µS/cm, Temp 21.7°C, Eh 68.8 mV		240

Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 8.14; SPC = 495 µs/cm; Temp = 20.7°C; ORP = 82.9 mV

Driller: Steffan Colls **Termination details:** Borehole terminated at target depth of 187 m.

File path: MB02B.ldat8

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Monitoring bore

ID: MB02B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	QB AB
Date:	15 January–9 February 2022

Easting:	420094
Northing:	6592175.2
Spatial reference:	MGA Zone 56
Elevation (collar):	301.5 mAHD
Elevation (ground):	300.6 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 19.05 mbgl

Screened depth: 173.5–185.5 mbgl **Total depth:** 187 mbgl **Level date; time:** 10 February 2022; 12:00

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
	200 mm pneumatic hammer			Carrai Granodiorite	GRANODIORITE: As above , trace clay in return, potential weathered seam.		65.5 m: <1 L/sec, pH 11.83, SPC 543.0 µS/cm, Temp 21.4°C, Eh -21.4 mV		
					GRANODIORITE: As above, fresh				
70					GRANODIORITE: As above, trace low durability chips in return, slightly weathered		70 m: <1 L/sec, pH 11.80, SPC 532.6 µS/cm, Temp 20.9°C, Eh -24.9 mV		230
					GRANODIORITE: As above, 70% horneblende 30% quartz		76 m: <1 L/sec		
					GRANODIORITE: As above, fresh				
80							79 m: <1 L/sec, pH 10.61, SPC 494.1 µS/cm, Temp 20.3°C, Eh 31.3 mV		220
							82 m: <1 L/sec, pH 11.48, SPC 518.4 µS/cm, Temp 20.6°C, Eh 121.6 mV		
							85 m: <1 L/sec, pH 11.01, SPC 528.0 µS/cm, Temp 20.1°C, Eh 4.3 mV		
							88 m: <1 L/sec, pH 10.92, SPC 529.0 µS/cm, Temp 20.0°C, Eh 6.4 mV		
90							91 m: <1 L/sec, pH 10.60, SPC 536.0 µS/cm, Temp 20.0°C, Eh -0.3 mV		210

Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 8.14; SPC = 495 µs/cm; Temp = 20.7°C; ORP = 82.9 mV

Driller: Steffan Colls **Termination details:** Borehole terminated at target depth of 187 m.

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Monitoring bore

ID: MB02B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	QB AB
Date:	15 January–9 February 2022

Easting:	420094
Northing:	6592175.2
Spatial reference:	MGA Zone 56
Elevation (collar):	301.5 mAHD
Elevation (ground):	300.6 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 19.05 mbgl

Screened depth: 173.5–185.5 mbgl **Total depth:** 187 mbgl **Level date; time:** 10 February 2022; 12:00

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
	200 mm pneumatic hammer			Carrai Granodiorite	GRANODIORITE: Coarse grained, pale grey and dark grey, fresh, dry, 60% quartz, 25% biotite	∅	94 m: <1 L/sec, pH 11.18, SPC 547.5 µS/cm, Temp 19.9°C, Eh -8.7 mV		
						∅	97 m: <0.5 L/sec, pH 8.17, SPC 472.2 µS/cm, Temp 20.4°C, Eh 127.9 mV		
100					GRANODIORITE: Grey, pale orange and dark grey, ferruginous colouring, moderately to slightly weathered		100.5m: Potential fracture		200
							103 m: Minor Potential fracture		
						∅	103 m: <0.7 L/sec, pH 9.27, SPC 451 µS/cm, Temp 21.3°C, Eh 90.7 mV		
					GRANODIORITE: Pale grey, dark grey, fresh				
					GRANODIORITE: Grey and dark grey, minor ferruginous colouring, slightly weathered				
						∅	109 m: <0.5 L/sec, pH 8.17, SPC 492 µS/cm, Temp 20.1°C, Eh 121.3 mV		
110					GRANODIORITE: Increasing feldspar, 60% quartz, 25% biotite, 15% feldspar				190
					GRANODIORITE: Grey, pale orange, dark grey, ferruginous colouring, slight to moderately weathered		112–113 m: Potential fracture		
							115 m: Potential fracture		
						∅	115 m: <0.5 L/sec, pH 8.28, SPC 489.6 µS/cm, Temp 20.3°C		
					GRANODIORITE: Grey and dark grey, minor ferruginous colouring, slightly weathered				
						∅	118–123 m: Potential fracture		
120									
						∅	121 m: <0.5 L/sec, pH 8.36, SPC 503.3 µS/cm, Temp 21.7°C		180
					GRANODIORITE: Grey to pale orange and dark grey, ferruginous colouring observed, slightly to		124–127 m: Potential fracture		

Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 8.14; SPC = 495 µs/cm; Temp = 20.7°C; ORP = 82.9 mV

Driller: Steffan Colls **Termination details:** Borehole terminated at target depth of 187 m.

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Monitoring bore

ID: MB02B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	QB AB
Date:	15 January–9 February 2022

Easting:	420094
Northing:	6592175.2
Spatial reference:	MGA Zone 56
Elevation (collar):	301.5 mAHD
Elevation (ground):	300.6 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 19.05 mbgl

Screened depth: 173.5–185.5 mbgl **Total depth:** 187 mbgl **Level date; time:** 10 February 2022; 12:00

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
	200 mm pneumatic hammer			Carrai Granodiorite	moderately weathered	∅	127 m: <0.6 L/sec, pH 8.32, SPC 498.2 µS/cm, Temp 21.8°C, Eh 108.9 mV		
130					GRANODIORITE: Pale grey and dark grey, very minor ferruginous staining, slightly weathered				170
					GRANODIORITE: Pale grey and dark grey, fresh	∅	133 m: <0.9 L/sec, pH 8.20, SPC 500.5 µS/cm, Temp 22.3°C, Eh 102.2 mV		
					GRANODIORITE: Grey, pale orange, and dark grey, slightly to moderately weathered		135 m: Potential fracture		
					GRANODIORITE: Grey and dark grey, minor ferruginous colouring, slightly weathered	∅	139 m: <0.7 L/sec, pH 8.38, SPC 502 µS/cm, Temp 22.1°C, Eh 67.0 mV		
140									160
					GRANODIORITE: Pale grey and dark grey, fresh	∅	145 m: <0.7 L/sec, pH 8.39, SPC 511.2 µS/cm, Temp 23.0°C, Eh 96.2 mV		
150						∅	151 m: <0.7 L/sec, pH 8.47, SPC 526 µS/cm, Temp 23.0°C, Eh 68.5 mV		150
					GRANODIORITE: Grey and dark grey, minor ferruginous colouring, slightly weathered				
					GRANODIORITE: Pale grey and dark grey, fresh				

Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 8.14; SPC = 495 µs/cm; Temp = 20.7°C; ORP = 82.9 mV

Driller: Steffan Colls **Termination details:** Borehole terminated at target depth of 187 m.

File path: MB02B.ldat8

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Monitoring bore

ID: MB02B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	QB AB
Date:	15 January–9 February 2022

Easting:	420094
Northing:	6592175.2
Spatial reference:	MGA Zone 56
Elevation (collar):	301.5 mAHD
Elevation (ground):	300.6 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 19.05 mbgl

Screened depth: 173.5–185.5 mbgl **Total depth:** 187 mbgl **Level date; time:** 10 February 2022; 12:00

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes
	200 mm pneumatic hammer			Carrai Granodiorite		∅	157 m: <0.6 L/sec, pH 8.40, SPC 520 µS/cm, Temp 22.3°C, Eh 97.5 mV
						∅	163 m: <0.6 L/sec, pH 8.45, SPC 525 µS/cm, Temp 22.9°C, Eh 73.6 mV
					GRANODIORITE: Grey and dark grey, trace ferruginous colouring, slightly weathered	∅	169 m: <0.6 L/sec, pH 8.40, SPC 523 µS/cm, Temp 23.5°C, Eh 57.9 mV
					GRANODIORITE: Pale grey and dark grey, fresh	∅	175 m: <0.7 L/sec, pH 8.32, SPC 528 µS/cm, Temp 23.3°C, Eh 102.2 mV
					GRANODIORITE: Grey and dark grey, trace ferruginous colouring, slightly weathered	∅	181 m: <0.6 L/sec, pH 8.26, SPC 524 µS/cm, Temp 23.3°C, Eh 78.2 mV
					GRANODIORITE: Pale grey and dark grey, fresh		
					GRANODIORITE: Grey and dark grey, trace ferruginous colouring, slightly weathered		
					GRANODIORITE: Pale grey and dark grey, fresh	∅	187 m: <0.6 L/sec, pH 8.30, SPC 541 µS/cm, Temp 23.5°C, Eh 69.7 mV

Bore design

RL (mAHD): 140, 130, 120

Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 8.14; SPC = 495 µs/cm; Temp = 20.7°C; ORP = 82.9 mV

Driller: Steffan Colls **Termination details:** Borehole terminated at target depth of 187 m.

File path: MB02B.ldat8

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Monitoring bore

ID: MB03A

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	JdB
Date:	20–21 March 2022

Easting:	418650.9
Northing:	6591232.3
Spatial reference:	MGA Zone 56
Elevation (collar):	167.3 mAHD
Elevation (ground):	166.5 mAHD
Nominal diameter:	200 mm

Screened lithology: Parrabel beds
Screened depth: 15–21 mbgl
Drilling method/s: Pneumatic hammer
Total depth: 23 mbgl
Water level depth: 9.68 mbgl
Level date; time: 20/3/2022

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
0	200 mm pneumatic hammer			Residual	CLAY: High plasticity, brown, with silt, moisture at palstic limit. Residual				
					Gravelly CLAY: Extremely weathered hornfels, fine to medium, brown to dark grey. Clay is medium plasticity, brown. Moisture above plastic limit				
				Parrabel Beds	SLATE: Fine grained, dark grey, defined celavage, distinct fabric with planes 0.1–0.3 m thick, high durability, slightly weathered				
10						▼	9.68 m: Recovered water level		160
					SLATE: As above, highly weathered, medium durability				
					HORNFELS: Fine grained, dark grey, non distinct cleavage or fabric, extremely high durability, fresh				150
20									

Company: Numac Drilling Services Pty Ltd
Driller: John Burns-Hind
Water quality: pH = 8.39; SPC = 1166 µs/cm; Temp = 24.2°C; ORP = 70.4 mV
Termination details: Borehole termianted at target depth of 23 mbgl

File path: MB03A.ldat8

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Monitoring bore

ID: MB03B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	JdB
Date:	22 February–20 March 2022

Easting:	418645.8
Northing:	6591223.6
Spatial reference:	MGA Zone 56
Elevation (collar):	167.8 mAHD
Elevation (ground):	167 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite
Screened depth: 86–98 mbgl
Drilling method/s: Pneumatic hammer
Total depth: 100 mbgl
Water level depth: 10.63 mbgl
Level date; time: 19/3/2022: 09:30

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
0	200 mm pneumatic hammer			Parrabel Beds	CLAY: High plasticity, brown, with silt, moisture at palstic limit. Residual				
					Gravelly CLAY: Extremely weathered hornfels, fine to medium, brown to dark grey. Clay is medium plasticity, brown. Moisture above plastic limit				
					SLATE: Fine grained, dark grey, defined celavage, distinct fabric with planes 0.1–0.3 m thick, high durability, slightly weathered				160
10					HORNFELS: Fine grained, dark grey, non distinct cleavage or fabric, extremely high durability, fresh	▼	10.63 m: Recovered water level		
							16–17 m: Potential quartz sill		150
					SLATE: Fine grained, dark grey, defined celavage, distinct fabric with planes 0.1–0.3 m thick, extremely high durability,fresh				
20									
									140
30					HORNFELS: Fine grained, dark grey, non distinct cleavage or fabric, extremely high durability, fresh				
							36–37 m: Aplitic intrusion, with pyrite, likely sill from nearby pluton		130
40									
					SLATE: Fine grained, dark grey, defined celavage, distinct fabric with planes 0.1–0.3 m thick, extremely high durability,fresh				120
50									

Company: Numac Drilling Services Pty Ltd
Driller: John Burns-Hind
Water quality: pH = 8.43; SPC = 636 µs/cm; Temp = 22.1°C; ORP = 116.3 mV
Termination details: Borehole terminated at target depth of 100 m

File path: MB03B.ldat8

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Monitoring bore

ID: MB03B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	JdB
Date:	22 February–20 March 2022

Easting:	418645.8
Northing:	6591223.6
Spatial reference:	MGA Zone 56
Elevation (collar):	167.8 mAHD
Elevation (ground):	167 mAHD
Nominal diameter:	200 mm

Screened lithology: Carrai Granodiorite
Screened depth: 86–98 mbgl
Drilling method/s: Pneumatic hammer
Total depth: 100 mbgl
Water level depth: 10.63 mbgl
Level date; time: 19/3/2022: 09:30

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
60	200 mm pneumatic hammer			Parrabel Beds	PHYLLITE: Fine grained, pale grey, banded foliation ~0.3 mm thick, extremely high durability, fresh				110
					PHYLLITE: As above, brownish dark grey, moderately weathered				
					PHYLLITE: As above , pale grey				
70					PHYLLITE: As above, brownish dark grey, moderately weathered				100
					PHYLLITE: As above , pale grey				
					HORNFELS: Fine grained, dark grey, non distinct cleavage or fabric, extremely high durability, fresh		74–78 m: Potential quartz sill, with pyrite		90
80							83–85 m: Potential quartz sill, with pyrite		80
					PHYLLITE: Fine grained, pale grey, banded foliation ~0.3 mm thick, extremely high durability, fresh				
					HORNFELS: Fine grained, dark grey, non distinct cleavage or fabric, extremely high durability, fresh		88–89m: Potential quartz sill, with pyrite		
90							93–97 m: Aplitic intrusion, with pyrite, likely sill from nearby pluton		70
100									

Company: Numac Drilling Services Pty Ltd
Driller: John Burns-Hind
Water quality: pH = 8.43; SPC = 636 µs/cm; Temp = 22.1°C; ORP = 116.3 mV
Termination details: Borehole terminated at target depth of 100 m

File path: MB03B.ldat8

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Monitoring bore

ID: MB04A

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	HJN
Date:	29–31 January 2022

Easting:	423003.9
Northing:	6591263.9
Spatial reference:	MGA Zone 56
Elevation (collar):	972.7 mAHD
Elevation (ground):	972.1 mAHD
Nominal diameter:	125 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Tri cone **Water level depth:** 0.25 mbgl

Screened depth: 6.35 - 9.35 mbgl **Total depth:** 10.5 m **Level date; time:** 31 January 2022; 17:21

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes	Bore design	RL (mAHD)
0	Tri-cone with HWT string			Colluvium	SILTY SAND: Fine to medium grained, dark grey, subrounded, trace clay, wet. Colluvium		0.25 m: Recovered water level		
							1.4 m: 0.5 L/sec		970
				Residual	SAND: Medium to coarse grained, grey, angular, quartzose, with clay, pale grey, dry. Residual				
				Carrai Granodiorite	SAND: As above, wet				
	Shoe bit on PWT casing						6 m: 4 L/sec Casing method doesnt allow sampling		
10					SAND: Extremely weathered granodiorite; Sand, medium to coarse grained, pale grey, angular, 80% quartz, wet				

Company: Terratest Pty Ltd **Water quality:** pH = 5.93; SPC = 75.7 µs/cm; Temp = 21.6°C; ORP = 101.4 mV

Driller: Toby Osborne **Termination details:** Borehole terminated on competent rock at 10.5 m

File path: MB04A.ldat8

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Monitoring bore

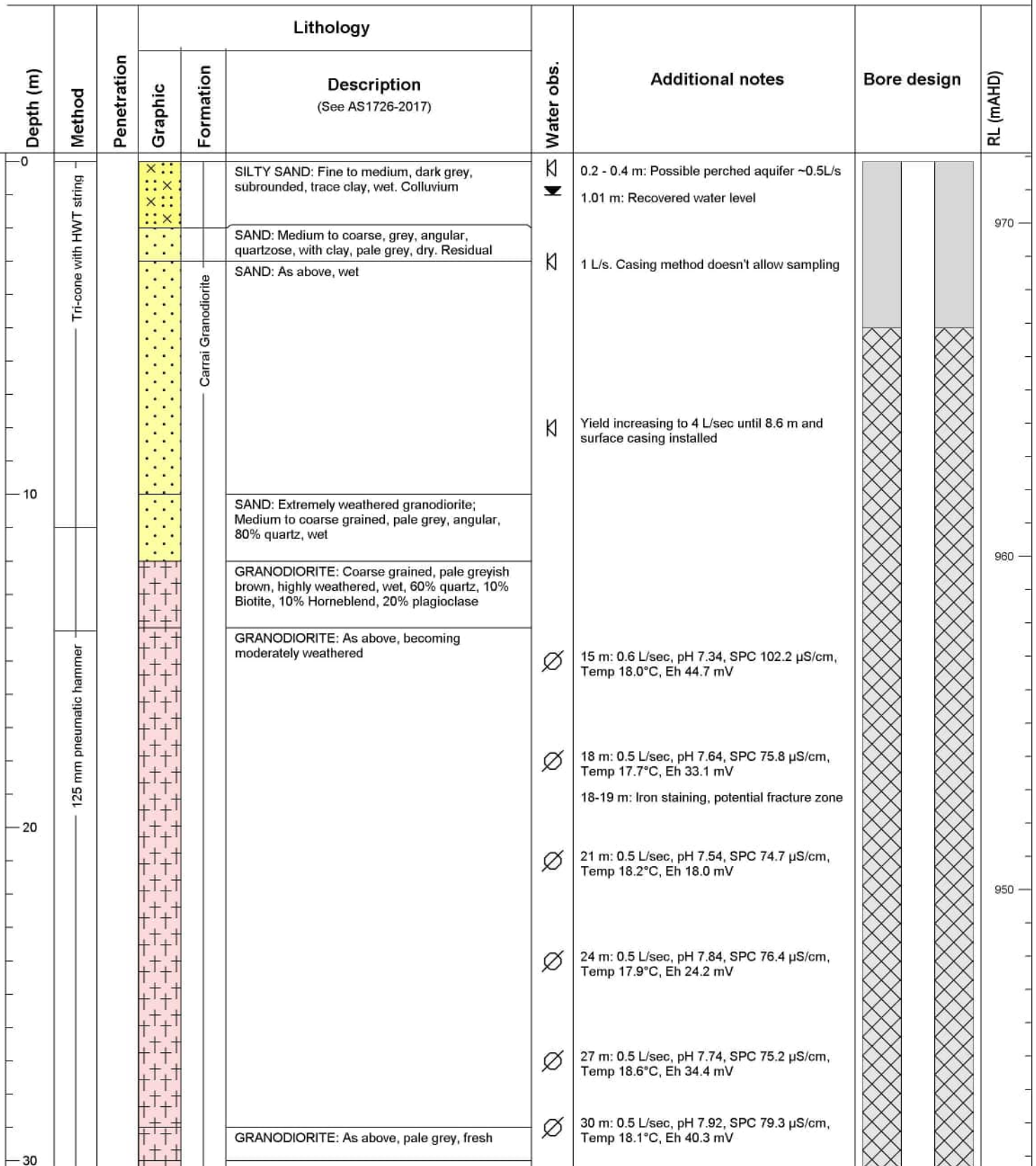
ID: MB04B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	HJN
Date:	29–31 January 2022

Easting:	422999.7
Northing:	6591259
Spatial reference:	MGA Zone 56
Elevation (collar):	972.5 mAHD
Elevation (ground):	971.9 mAHD
Nominal diameter:	125 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 1.01 mbgl

Screened depth: 46.7–58.7 mbgl **Total depth:** 60.5 mbgl **Level date; time:** 31 January 2022



Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 6.35; SPC = 171.2 µs/cm; Temp = 18.8°C; ORP = 17.2 mV

Driller: Toby Osborne **Termination details:** Borehole terminated at target depth of 60.5 m.

File path: MB04B.ldat8

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Monitoring bore

ID: MB04B

Project:	OMPS-Stage 1 hydrogeological drilling
Project ID:	E210769
Client:	SMEC Australia Pty Limited
Site:	Oven Mountain, Carrai, NSW
Logged by:	HJN
Date:	29–31 January 2022

Easting:	422999.7
Northing:	6591259
Spatial reference:	MGA Zone 56
Elevation (collar):	972.5 mAHD
Elevation (ground):	971.9 mAHD
Nominal diameter:	125 mm

Screened lithology: Carrai Granodiorite **Drilling method/s:** Pneumatic hammer **Water level depth:** 1.01 mbgl

Screened depth: 46.7–58.7 mbgl **Total depth:** 60.5 mbgl **Level date; time:** 31 January 2022

Depth (m)	Method	Penetration	Lithology: Graphic	Lithology: Formation	Lithology: Description (See AS1726-2017)	Water obs.	Additional notes
	125 mm pneumatic hammer			Carrai Granodiorite	GRANODIORITE: As above, slightly weathered	∅	33 m: 0.4 L/sec, pH 7.78, SPC 72.1 µS/cm, Temp 19.1°C, Eh 39.5 mV
						∅	36 m: 0.4 L/sec, pH 7.78, SPC 72.1 µS/cm, Temp 19.1°C, Eh 39.5 mV
						∅	39 m: 2 L/sec, pH 7.46, SPC 110.8 µS/cm, Temp 18.8°C, Eh 44.4 mV
40						∅	42 m: 0.04 L/sec, pH 8.73, SPC 177.0 µS/cm, Temp 22.9°C, Eh 70.0 mV
					GRANODIORITE: As above, fresh, pale green and pale grey		42 m: Likely extremely high strength rock
						∅	45 m: 0.03 L/sec, pH 8.63, SPC 112.6 µS/cm, Temp 23.7°C, Eh 67.0 mV
					GRANODIORITE: As above, slightly weathered, pale orangey grey		45-47 m: Iron staining, potential fracture zone
						∅	48 m: 0.04 L/sec, pH 8.86, SPC 106.5 µS/cm, Temp 24.6°C, Eh 68.0 mV
					GRANODIORITE: As above		49-50 m: Iron staining, potential fracture zone
50						∅	51 m: 0.04 L/sec, pH 9.03, SPC 149.6 µS/cm, Temp 24.3°C, Eh 54.4 mV
							51-54 m: easier drilling, iron staining, potential fracture zone
						∅	54 m: 0.05 L/sec, pH 8.73, SPC 148.6 µS/cm, Temp 25.5°C, Eh 31.5 mV
						∅	57 m: 0.04 L/sec, pH 8.62, SPC 160.1 µS/cm, Temp 25.8°C, Eh 35.3 mV
60							

Bore design

RL (mAHD): 940, 930, 920

Company: Numac Drilling Services Pty Ltd **Water quality:** pH = 6.35; SPC = 171.2 µs/cm; Temp = 18.8°C; ORP = 17.2 mV

Driller: Toby Osborne **Termination details:** Borehole terminated at target depth of 60.5 m.

File path: MB04B.ldat8

Appendix B
Photographic plates

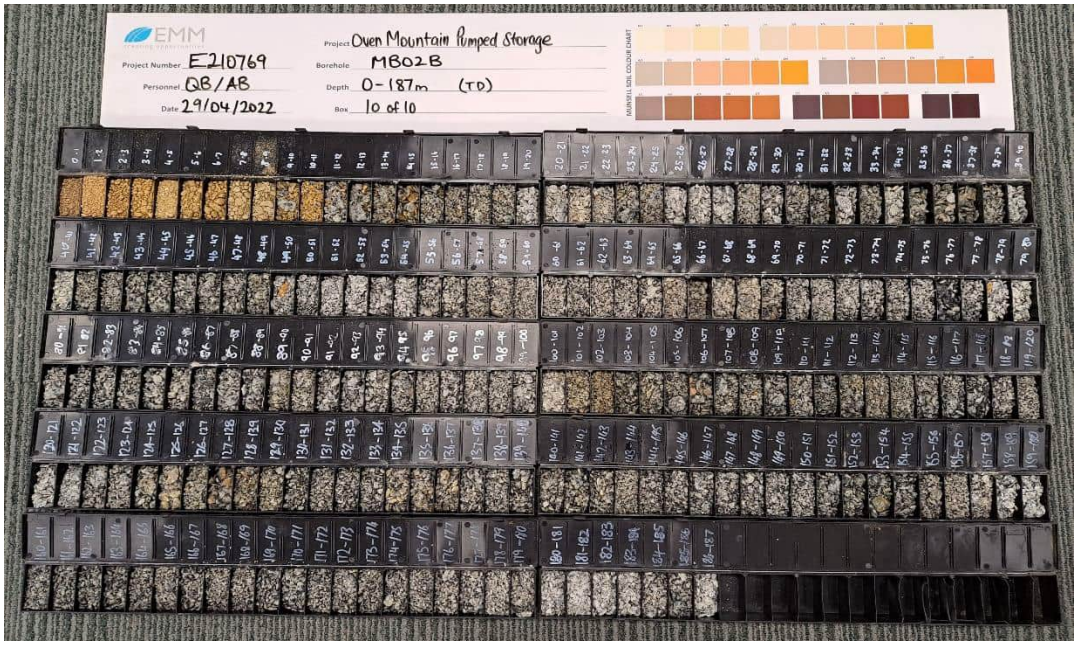
EMM
creating opportunities



MB01A chip trays from 0—36 m below ground level
21 October 2021
Oven Mountain Pumped Storage Project
Photograph B.1



MB02A complete chip trays from 0—34 m below ground level
10 December 2021
Oven Mountain Pumped Storage Project
Photograph B.2



MB02B chip trays from 0—187 m below ground level
29 April 2022
Oven Mountain Pumped Storage Project
Photograph B.3



MB03A chip trays from 0—23 m below ground level
6 April 2022
Oven Mountain Pumped Storage Project
Photograph B.4



MB03B chip trays from 0—100 m below ground level
6 April 2022
Oven Mountain Pumped Storage Project
Photograph B.5



MB04A chip trays from 0—10 m below ground level
6 April 2022
Oven Mountain Pumped Storage Project
Photograph B.6



MB04B chip trays from 0—60 m below ground level
6 April 2022
Oven Mountain Pumped Storage Project
Photograph B.7

Appendix C
Laboratory certificates of analysis

EMM
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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2138245**	Page	: 1 of 6
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: E210769 OMPS-Stage 1 Hydrogeological drilling/Testing	Date Samples Received	: 22-Oct-2021 14:00
Order number	: E210769	Date Analysis Commenced	: 23-Oct-2021
C-O-C number	: ----	Issue Date	: 28-Oct-2021 13:56
Sampler	: HENRY NOAKES		
Site	: ----		
Quote number	: EN/112/20 Primary work		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Senior Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB01A	----	----	----	----
			Sampling date / time	21-Oct-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2138245-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.40**	----	----	----	----
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	**3.34**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**698**	----	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**454**	----	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**163**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**305**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**305**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**26**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**43**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**47**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**11**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**98**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**5**	----	----	----	----
EG005(ED093)F: Dissolved Metals by ICP-AES								
Aluminium	7429-90-5	0.10	mg/L	<0.10	----	----	----	----
Antimony	7440-36-0	0.01	mg/L	**0.02**	----	----	----	----
Arsenic	7440-38-2	0.01	mg/L	**0.04**	----	----	----	----
Cadmium	7440-43-9	0.005	mg/L	<0.005	----	----	----	----
Chromium	7440-47-3	0.01	mg/L	<0.01	----	----	----	----
Copper	7440-50-8	0.01	mg/L	<0.01	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----
Lead	7439-92-1	0.01	mg/L	<0.01	----	----	----	----
Manganese	7439-96-5	0.01	mg/L	**0.13**	----	----	----	----
Nickel	7440-02-0	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MB01A	----	----	----	----
				Sampling date / time	21-Oct-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2138245-001	--------	--------	--------	--------
					Result	----	----	----	----
EG005(ED093)F: Dissolved Metals by ICP-AES - Continued									
Zinc	7440-66-6	0.01	mg/L		**0.05**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.8**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.02**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.30**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.30**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.4**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**0.7**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.06**	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**7.85**	----	----	----	----
ø **Total Cations**	----	0.01	meq/L		**7.64**	----	----	----	----
ø **Ionic Balance**	----	0.01	%		**1.34**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L		**190**	----	----	----	----
C29 - C36 Fraction	----	50	µg/L		**80**	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		**270**	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MB01A	----	----	----	----
				Sampling date / time	21-Oct-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2138245-001	--------	--------	--------	--------
					Result	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L		**230**	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	----	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		**230**	----	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	----	----	----
Toluene	108-88-3	2	µg/L		<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ **Total Xylenes**	----	2	µg/L		<2	----	----	----	----
^ **Sum of BTEX**	----	1	µg/L		<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**98.0**	----	----	----	----
Toluene-D8	2037-26-5	2	%		**97.5**	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		**96.2**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2146435**	Page	: 1 of 6
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 17-Dec-2021 17:00
Order number	: J200096	Date Analysis Commenced	: 17-Dec-2021
C-O-C number	: ----	Issue Date	: 24-Dec-2021 15:22
Sampler	: ----		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EK040: Poor spike recovery for Fluoride, however insuffiicent sample amount for reanalysis.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB02A				
			Sampling date / time	15-Dec-2021 00:00				
Compound	CAS Number	LOR	Unit	ES2146435-001				
				Result				
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.38**				
EA006: Sodium Adsorption Ratio (SAR)								
^ **Sodium Adsorption Ratio**	----	0.01	-	**1.92**				
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**825**				
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**536**				
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**----**				
EA045: Turbidity								
Turbidity	----	0.1	NTU	**----**				
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**257**				
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1				
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1				
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**132**				
Total Alkalinity as CaCO3	----	1	mg/L	**132**				
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**254**				
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**39**				
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**80**				
Magnesium	7439-95-4	1	mg/L	**14**				
Sodium	7440-23-5	1	mg/L	**71**				
Potassium	7440-09-7	1	mg/L	**6**				
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.02**				
Antimony	7440-36-0	0.001	mg/L	**0.008**				
Arsenic	7440-38-2	0.001	mg/L	**0.001**				
Cadmium	7440-43-9	0.0001	mg/L	<0.0001				
Chromium	7440-47-3	0.001	mg/L	<0.001				

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB02A				
			Sampling date / time	15-Dec-2021 00:00				
Compound	CAS Number	LOR	Unit	ES2146435-001				
				Result				
EG020F: Dissolved Metals by ICP-MS - Continued								
Copper	7440-50-8	0.001	mg/L	**0.001**				
Nickel	7440-02-0	0.001	mg/L	**0.009**				
Lead	7439-92-1	0.001	mg/L	<0.001				
Zinc	7440-66-6	0.005	mg/L	**0.024**				
Manganese	7439-96-5	0.001	mg/L	**0.248**				
Iron	7439-89-6	0.05	mg/L	<0.05				
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001				
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.5**				
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01				
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01				
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.03**				
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.03**				
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.8**				
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**0.8**				
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.08**				
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01				
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**9.02**				
ø Total Cations	----	0.01	meq/L	**8.39**				
ø Ionic Balance	----	0.01	%	**3.67**				
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20				
C10 - C14 Fraction	----	50	µg/L	<50				

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MB02A				
				Sampling date / time	15-Dec-2021 00:00				
Compound	CAS Number	LOR	Unit	ES2146435-001					
				Result					
EP080/071: Total Petroleum Hydrocarbons - Continued									
C15 - C28 Fraction	----	100	µg/L	<100					
C29 - C36 Fraction	----	50	µg/L	<50					
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50					
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20					
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20					
>C10 - C16 Fraction	----	100	µg/L	<100					
>C16 - C34 Fraction	----	100	µg/L	<100					
>C34 - C40 Fraction	----	100	µg/L	<100					
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100					
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100					
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1					
Toluene	108-88-3	2	µg/L	<2					
Ethylbenzene	100-41-4	2	µg/L	<2					
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2					
ortho-Xylene	95-47-6	2	µg/L	<2					
^ Total Xylenes	----	2	µg/L	<2					
^ Sum of BTEX	----	1	µg/L	<1					
Naphthalene	91-20-3	5	µg/L	<5					
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%	**83.9**					
Toluene-D8	2037-26-5	2	%	**116**					
4-Bromofluorobenzene	460-00-4	2	%	**114**					

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2205754**	Page	: 1 of 19
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: J200096 Oven Mountain pumpe Storage Project	Date Samples Received	: 18-Feb-2022 12:30
Order number	: J200096	Date Analysis Commenced	: 19-Feb-2022
C-O-C number	: ----	Issue Date	: 25-Feb-2022 19:21
Sampler	: AB/JT		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 23		
No. of samples analysed	: 23		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG035: LOR raised for Mercury due to sample matrix (High TSS).
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EK057G:LOR raised due to sample matrix.
- ED041G:LOR raised due to sample matrix.
- EK059G:LOR rasised due to sample matrix.
- EN055: Ionic Balance out of acceptable limits for sample ES2205754-#021 due to analytes not quantified in this report.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB02B				
			Sampling date / time	16-Feb-2022 00:00				
Compound	CAS Number	LOR	Unit	ES2205754-010				
				Result				
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.36**				
EA006: Sodium Adsorption Ratio (SAR)								
^ **Sodium Adsorption Ratio**	----	0.01	-	**2.41**				
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**694**				
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**451**				
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**208**				
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1				
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1				
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**228**				
Total Alkalinity as CaCO3	----	1	mg/L	**228**				
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**99**				
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**35**				
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**62**				
Magnesium	7439-95-4	1	mg/L	**13**				
Sodium	7440-23-5	1	mg/L	**80**				
Potassium	7440-09-7	1	mg/L	**4**				
EG005(ED093)F: Dissolved Metals by ICP-AES								
Aluminium	7429-90-5	0.10	mg/L	<0.10				
Antimony	7440-36-0	0.01	mg/L	<0.01				
Arsenic	7440-38-2	0.01	mg/L	<0.01				
Cadmium	7440-43-9	0.005	mg/L	<0.005				
Chromium	7440-47-3	0.01	mg/L	<0.01				
Copper	7440-50-8	0.01	mg/L	<0.01				
Iron	7439-89-6	0.05	mg/L	**0.05**				
Lead	7439-92-1	0.01	mg/L	<0.01				
Manganese	7439-96-5	0.01	mg/L	**0.16**				
Nickel	7440-02-0	0.01	mg/L	<0.01				

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MB02B				
				Sampling date / time	16-Feb-2022 00:00				
Compound	CAS Number	LOR	Unit		ES2205754-010				
					Result				
EG005(ED093)F: Dissolved Metals by ICP-AES - Continued									
Zinc	7440-66-6	0.01	mg/L		**0.04**				
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001				
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**1.2**				
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01				
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01				
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01				
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01				
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.6**				
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**0.6**				
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.12**				
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01				
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**7.60**				
ø **Total Cations**	----	0.01	meq/L		**7.74**				
ø **Ionic Balance**	----	0.01	%		**0.92**				
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20				
C10 - C14 Fraction	----	50	µg/L		<50				
C15 - C28 Fraction	----	100	µg/L		<100				
C29 - C36 Fraction	----	50	µg/L		<50				
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50				
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20				

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MB02B				
				Sampling date / time	16-Feb-2022 00:00				
Compound	CAS Number	LOR	Unit	ES2205754-010					
				Result					
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	<20					
>C10 - C16 Fraction	----	100	µg/L	<100					
>C16 - C34 Fraction	----	100	µg/L	<100					
>C34 - C40 Fraction	----	100	µg/L	<100					
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	<100					
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L	<100					
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1					
Toluene	108-88-3	2	µg/L	<2					
Ethylbenzene	100-41-4	2	µg/L	<2					
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2					
ortho-Xylene	95-47-6	2	µg/L	<2					
^ **Total Xylenes**	----	2	µg/L	<2					
^ **Sum of BTEX**	----	1	µg/L	<1					
Naphthalene	91-20-3	5	µg/L	<5					
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%	**133**					
Toluene-D8	2037-26-5	2	%	**129**					
4-Bromofluorobenzene	460-00-4	2	%	**116**					

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2203887**	Page	: 1 of 6
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: E210769 OMPS-Stage 1 Hydrogeological drilling/Testing	Date Samples Received	: 04-Feb-2022 14:50
Order number	: E210769	Date Analysis Commenced	: 07-Feb-2022
C-O-C number	: ----	Issue Date	: 10-Feb-2022 16:32
Sampler	: ----		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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- Surrogate Control Limits

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP080: Positive result for ES2203887-02 has been confirmed by re-analysis.
- LOR raised due to sample matrix.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB04A	MB04B	----	----	----
			Sampling date / time	31-Jan-2022 18:00	31-Jan-2022 17:30	----	----	----
Compound	CAS Number	LOR	Unit	ES2203887-001	ES2203887-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.02**	**6.34**	----	----	----
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	**2.44**	**1.62**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**120**	**157**	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**78**	**102**	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**2**	**38**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**39**	**98**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**39**	**98**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2**	**2**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**10**	**7**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**1**	**12**	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	**2**	----	----	----
Sodium	7440-23-5	1	mg/L	**12**	**23**	----	----	----
Potassium	7440-09-7	1	mg/L	**2**	**2**	----	----	----
EG005(ED093)F: Dissolved Metals by ICP-AES								
Aluminium	7429-90-5	0.10	mg/L	**2.45**	<0.10	----	----	----
Antimony	7440-36-0	0.01	mg/L	<0.01	<0.01	----	----	----
Arsenic	7440-38-2	0.01	mg/L	<0.01	<0.01	----	----	----
Cadmium	7440-43-9	0.005	mg/L	<0.005	<0.005	----	----	----
Chromium	7440-47-3	0.01	mg/L	<0.01	<0.01	----	----	----
Copper	7440-50-8	0.01	mg/L	<0.01	<0.01	----	----	----
Iron	7439-89-6	0.05	mg/L	**0.38**	**1.54**	----	----	----
Lead	7439-92-1	0.01	mg/L	<0.01	<0.01	----	----	----
Manganese	7439-96-5	0.01	mg/L	<0.01	**0.10**	----	----	----
Nickel	7440-02-0	0.01	mg/L	<0.01	**0.01**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB04A	MB04B	----	----	----
			Sampling date / time	31-Jan-2022 18:00	31-Jan-2022 17:30	----	----	----
Compound	CAS Number	LOR	Unit	ES2203887-001	ES2203887-002	--------	--------	--------
				Result	Result	----	----	----
EG005(ED093)F: Dissolved Metals by ICP-AES - Continued								
Zinc	7440-66-6	0.01	mg/L	**0.03**	**0.07**	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	**0.02**	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.25**	**0.55**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.25**	**0.55**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.7**	<0.2	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**2.0**	**0.6**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.65**	**0.23**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	----	----	----
EN055: Ionic Balance								
ø **Total Anions**	----	0.01	meq/L	**1.10**	**2.20**	----	----	----
ø **Total Cations**	----	0.01	meq/L	**1.04**	**1.94**	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	----	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	----	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	----	<50	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	----	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB04A	MB04B	----	----	----
			Sampling date / time	31-Jan-2022 18:00	31-Jan-2022 17:30	----	----	----
Compound	CAS Number	LOR	Unit	ES2203887-001	ES2203887-002	--------	--------	--------
				Result	Result	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L	----	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L	----	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	----	<100	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	----	<100	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L	----	<100	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----
Toluene	108-88-3	2	µg/L	<2	**2**	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----
^ **Total Xylenes**	----	2	µg/L	<2	<2	----	----	----
^ **Sum of BTEX**	----	1	µg/L	<1	**2**	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**109**	**113**	----	----	----
Toluene-D8	2037-26-5	2	%	**105**	**105**	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	**98.2**	**96.7**	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2146443**	Page	: 1 of 10
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 17-Dec-2021 17:00
Order number	: J200096	Date Analysis Commenced	: 18-Dec-2021
C-O-C number	: ----	Issue Date	: 30-Dec-2021 12:12
Sampler	: ----		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

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- Analytical Results
- Surrogate Control Limits

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Signatories

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Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
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General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EK055G: LOR raised for Ammonia 9 due to sample matrix.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EG020A-F: Positive results for sample ES2146443-011 have been confirmed by re-analysis.
- EK057G:LOR raised due to sample matrix.
- ED041G: LOR raised for Sulfate due to sample matrix
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	---- OM1	---- OM2	---- OM3	---- OM4	---- OM5
			Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit	ES2146443-001	ES2146443-002	ES2146443-003	ES2146443-004	ES2146443-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	5.23	5.49	6.57	6.01	5.59
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	1.00	0.90	0.84	1.44	1.44
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	386	158	266	77	38
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	251	103	173	50	25
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	101	40	96	9	<1
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	3	9	102	14	4
Total Alkalinity as CaCO3	----	1	mg/L	3	9	102	14	4
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	156	54	20	2	3
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	20	6	13	11	5
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	14	6	32	2	<1
Magnesium	7439-95-4	1	mg/L	16	6	4	1	<1
Sodium	7440-23-5	1	mg/L	23	13	19	10	6
Potassium	7440-09-7	1	mg/L	13	3	3	2	1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	1.16	0.11	<0.01	0.12	0.12
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.007	0.001	0.001
Arsenic	7440-38-2	0.001	mg/L	0.004	0.003	0.008	0.008	<0.001
Cadmium	7440-43-9	0.0001	mg/L	0.0004	0.0010	0.0009	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	0.005	<0.001	<0.001	0.001	0.001
Copper	7440-50-8	0.001	mg/L	0.006	0.007	0.004	0.001	0.013
Nickel	7440-02-0	0.001	mg/L	0.049	0.027	0.013	0.018	0.140
Lead	7439-92-1	0.001	mg/L	0.002	<0.001	<0.001	0.002	<0.001
Zinc	7440-66-6	0.005	mg/L	0.252	0.314	0.403	0.064	0.092

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	---- OM1	---- OM2	---- OM3	---- OM4	---- OM5
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146443-001	ES2146443-002	ES2146443-003	ES2146443-004	ES2146443-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L		0.799	0.320	0.323	0.200	0.094
Iron	7439-89-6	0.05	mg/L		3.58	0.06	0.06	1.75	0.18
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		0.4	0.1	1.1	0.2	0.2
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.04	<0.01	0.04	0.12	0.02
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	0.02	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	0.14	0.04	0.03
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	0.16	0.04	0.03
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		2.0	0.6	0.2	0.4	0.4
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		2.0	0.6	0.4	0.4	0.4
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.18	0.10	0.19	0.03	0.02
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		3.87	1.47	2.82	0.63	0.28
ø Total Cations	----	0.01	meq/L		3.67	----	----	----	----
ø Total Cations	----	0.01	meq/L		----	1.44	2.83	0.67	0.29
ø Ionic Balance	----	0.01	%		2.69	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	----	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	----	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	----	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	----	<50	<50	<50

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	---- OM1	---- OM2	---- OM3	---- OM4	---- OM5
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146443-001	ES2146443-002	ES2146443-003	ES2146443-004	ES2146443-005
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	----	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	----	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	----	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	----	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	----	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ **Total Xylenes**	----	2	µg/L		<2	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**98.8**	**98.5**	**99.3**	**97.3**	**97.4**
Toluene-D8	2037-26-5	2	%		**105**	**105**	**101**	**102**	**101**
4-Bromofluorobenzene	460-00-4	2	%		**102**	**102**	**100**	**98.5**	**101**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	---- OM6	---- OM7	---- MB01A	---- QC01	---- Rinsate
			Sampling date / time	15-Dec-2021 00:00	15-Dec-2021 00:00	15-Dec-2021 00:00	15-Dec-2021 00:00	17-Dec-2021 00:00
Compound	CAS Number	LOR	Unit	ES2146443-006	ES2146443-007	ES2146443-008	ES2146443-009	ES2146443-011
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.26**	**7.95**	**8.00**	**7.96**	----
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	**1.47**	**4.00**	**0.94**	**0.90**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**255**	**1540**	**532**	**512**	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**166**	**1000**	**346**	**333**	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**64**	**388**	**209**	**211**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**96**	**447**	**266**	**260**	----
Total Alkalinity as CaCO3	----	1	mg/L	**96**	**447**	**266**	**260**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**4**	**186**	**9**	**9**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**25**	**165**	**28**	**28**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**19**	**83**	**54**	**55**	----
Magnesium	7439-95-4	1	mg/L	**4**	**44**	**18**	**18**	----
Sodium	7440-23-5	1	mg/L	**27**	**181**	**31**	**30**	----
Potassium	7440-09-7	1	mg/L	**4**	**60**	**4**	**4**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.13**	**0.64**	<0.01	<0.01	**0.01**
Antimony	7440-36-0	0.001	mg/L	**0.005**	**0.001**	**0.004**	**0.005**	<0.001
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.003**	**0.014**	**0.014**	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	**0.004**	**0.007**	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.001**	**0.001**	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	**0.014**	**0.015**	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	**0.001**	**0.002**	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.053**	**0.234**	**0.009**	**0.008**	<0.005

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	---- OM6	---- OM7	---- MB01A	---- QC01	---- Rinsate
				Sampling date / time	15-Dec-2021 00:00	15-Dec-2021 00:00	15-Dec-2021 00:00	15-Dec-2021 00:00	17-Dec-2021 00:00
					ES2146443-006	ES2146443-007	ES2146443-008	ES2146443-009	ES2146443-011
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Manganese	7439-96-5	0.001	mg/L		**0.222**	**0.925**	**0.100**	**0.100**	<0.001
Iron	7439-89-6	0.05	mg/L		**2.78**	**5.98**	<0.05	<0.05	<0.05
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	**0.5**	**0.8**	**0.8**	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.14**	**1.06**	<0.01	<0.10	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.10	<0.01	<0.01	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.03**	<0.10	**0.02**	**0.01**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.03**	<0.10	**0.02**	**0.01**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.6**	**5.0**	<0.1	**0.1**	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**1.6**	**5.0**	<0.1	**0.1**	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.11**	**1.09**	**0.03**	**0.03**	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	**0.70**	<0.01	<0.01	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**2.71**	**17.4**	**6.29**	**6.17**	----
ø **Total Cations**	----	0.01	meq/L		**2.55**	**17.2**	**5.63**	**5.63**	----
ø **Ionic Balance**	----	0.01	%		**----**	**0.83**	**5.58**	**4.56**	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	---- OM6	---- OM7	---- MB01A	---- QC01	---- Rinsate
				Sampling date / time	15-Dec-2021 00:00	15-Dec-2021 00:00	15-Dec-2021 00:00	15-Dec-2021 00:00	17-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146443-006	ES2146443-007	ES2146443-008	ES2146443-009	ES2146443-011
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**98.2**	**99.2**	**97.7**	**99.6**	**101**
Toluene-D8	2037-26-5	2	%		**102**	**105**	**99.1**	**102**	**101**
4-Bromofluorobenzene	460-00-4	2	%		**100**	**103**	**98.6**	**99.3**	**99.2**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	---- TS	---- TB	----	----	----
			Sampling date / time	06-Dec-2021 00:00	07-Dec-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2146443-012	ES2146443-013	--------	--------	--------
				Result	Result	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	**----**	<20	**----**	**----**	**----**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	**----**	<20	**----**	**----**	**----**
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	**----**	<20	**----**	**----**	**----**
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	**16**	<1	**----**	**----**	**----**
Toluene	108-88-3	2	µg/L	**18**	<2	**----**	**----**	**----**
Ethylbenzene	100-41-4	2	µg/L	**18**	<2	**----**	**----**	**----**
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	**18**	<2	**----**	**----**	**----**
ortho-Xylene	95-47-6	2	µg/L	**19**	<2	**----**	**----**	**----**
^ **Total Xylenes**	----	2	µg/L	**37**	<2	**----**	**----**	**----**
^ **Sum of BTEX**	----	1	µg/L	**89**	<1	**----**	**----**	**----**
Naphthalene	91-20-3	5	µg/L	**19**	<5	**----**	**----**	**----**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**94.9**	**93.5**	**----**	**----**	**----**
Toluene-D8	2037-26-5	2	%	**114**	**119**	**----**	**----**	**----**
4-Bromofluorobenzene	460-00-4	2	%	**127**	**125**	**----**	**----**	**----**

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2146443**	Page	: 1 of 12
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 17-Dec-2021
Order number	: J200096	Date Analysis Commenced	: 18-Dec-2021
C-O-C number	: ----	Issue Date	: 30-Dec-2021
Sampler	: ----		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 4086065)									
ES2146042-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.27	6.40	2.1	0% - 20%
ES2146384-006	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	8.47	8.48	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 4086071)									
ES2146405-010	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	2950	2940	0.4	0% - 20%
ES2146407-008	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	123	123	0.0	0% - 20%
ES2146407-018	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	315	300	5.2	0% - 20%
ES2146450-009	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	10200	10200	0.4	0% - 20%
ES2146443-009	QC01	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	512	518	1.3	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4086070)									
ES2146441-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	3	2	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	3	2	0.0	No Limit
ES2146384-006	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	67	71	5.1	0% - 20%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	681	673	1.2	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	748	744	0.6	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4086073)									
ES2146443-009	QC01	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	260	265	1.8	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	260	265	1.8	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4085492)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4085492) - continued									
ES2146335-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	516	509	1.2	0% - 20%
ES2146443-006	OM6	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	4	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 4085493)									
ES2146335-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	2410	2450	1.9	0% - 20%
ES2146443-006	OM6	ED045G: Chloride	16887-00-6	1	mg/L	25	25	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 4092045)									
ES2146428-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	16	16	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	9	9	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	49	49	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.0	No Limit
ES2146442-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	14	14	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	2	2	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	10	10	0.0	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	1	1	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4092043)									
ES2146428-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.539	0.522	3.2	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.183	0.182	0.8	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
ES2146442-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4092046)									
ES2146473-004	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4092046) - continued									
ES2146473-004	Anonymous	EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.002	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.001	0.002	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.032	0.032	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.012	0.011	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.55	0.57	3.6	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.92	0.94	2.3	0% - 50%
ES2146444-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.007	0.005	33.3	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.313	0.313	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.008	0.008	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.07	0.07	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4092044)									
ES2146441-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2146443-002	OM2	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4086072)									
ES2146441-007	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
ES2146443-009	QC01	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.8	0.8	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4089353)									
ES2146377-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	39.3	38.9	1.1	0% - 20%
ES2146443-002	OM2	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4085490)									
ES2146136-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2146135-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4085495)									
ES2146443-006	OM6	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4089354)									
ES2146383-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	12.5	12.7	2.1	0% - 20%
ES2146443-002	OM2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4089352)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4089352) - continued									
ES2146443-001	OM1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.0	1.8	11.7	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4089351)									
ES2146349-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.36	0.37	0.0	0% - 20%
ES2146443-001	OM1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.18	0.18	0.0	0% - 50%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 4085491)									
ES2146136-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2146443-006	OM6	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4088979)									
ES2146492-002	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4096811)									
ES2146408-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2146443-001	OM1	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4088979)									
ES2146492-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4096811)									
ES2146408-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2146443-001	OM1	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4088979)									
ES2146492-002	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP080: BTEXN (QC Lot: 4096811)									
ES2146408-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2146443-001	OM1	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP080: BTEXN (QC Lot: 4096811) - continued									
ES2146443-001	OM1	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 4086065)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.8	101
				----	7 pH Unit	99.8	99.2	101
EA010P: Conductivity by PC Titrator (QCLot: 4086071)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	95.7	91.1	107
				<1	2100 µS/cm	97.6	93.2	108
ED037P: Alkalinity by PC Titrator (QCLot: 4086070)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	107	81.0	111
				----	50 mg/L	80.0	80.0	120
ED037P: Alkalinity by PC Titrator (QCLot: 4086073)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	106	81.0	111
				----	50 mg/L	105	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4085492)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	108	82.0	122
				<1	500 mg/L	101	82.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 4085493)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	100	80.9	127
				<1	1000 mg/L	94.3	80.9	127
ED093F: Dissolved Major Cations (QCLot: 4092045)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	98.1	80.0	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	96.4	90.0	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	96.2	82.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	94.1	85.0	113
EG020F: Dissolved Metals by ICP-MS (QCLot: 4092043)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	89.8	80.0	116
EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	0.02 mg/L	89.7	70.0	130
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	93.6	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.2	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	93.4	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	91.4	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.1	83.0	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	91.6	82.0	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	90.7	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	92.9	81.0	117
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	95.4	82.0	112

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4092046)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	89.8	80.0	116
EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	0.02 mg/L	83.8	70.0	130
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	90.4	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.0	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	96.2	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	89.0	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	94.3	83.0	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	94.1	82.0	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	90.3	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.4	81.0	117
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.2	82.0	112
EG035F: Dissolved Mercury by FIMS (QCLot: 4092044)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	97.4	83.0	105
EK040P: Fluoride by PC Titrator (QCLot: 4086072)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	106	82.0	116
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4089353)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	107	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4085490)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	106	82.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4085495)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	108	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4089354)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	96.2	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4089352)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	89.8	69.0	101
				<0.1	1 mg/L	104	70.0	118
				<0.1	5 mg/L	101	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4089351)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	94.0	71.0	101
				<0.01	0.442 mg/L	106	72.0	108
				<0.01	1 mg/L	104	70.0	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 4085491)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	96.2	85.0	117
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4086077)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	70.0	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	89.6	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	78.2	56.0	121

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4087140)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	69.0	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	90.9	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	89.1	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4087219)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	79.0	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	83.3	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	79.6	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4088979)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	90.4	75.0	127
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4096811)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	89.4	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4086077)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	71.0	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	96.7	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	103	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4087140)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	73.5	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	93.5	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	82.3	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4087219)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	68.0	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	80.4	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	67.0	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4088979)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	92.6	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4096811)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	98.2	75.0	127
EP080: BTEXN (QCLot: 4088979)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	85.2	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	95.0	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	99.3	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	98.3	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	98.5	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	106	70.0	120
EP080: BTEXN (QCLot: 4096811)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	85.3	70.0	122

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080: BTEXN (QCLot: 4096811) - continued								
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	85.6	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	93.1	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	91.7	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	93.6	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	96.6	70.0	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4085492)							
ES2146335-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4085493)							
ES2146335-001	Anonymous	ED045G: Chloride	16887-00-6	50 mg/L	# Not Determined	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4092043)							
ES2146428-002	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	95.9	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	101	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	99.9	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	99.2	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	94.6	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	102	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	97.6	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	102	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4092046)							
ES2146443-011	Rinsate	EG020A-F: Arsenic	7440-38-2	1 mg/L	73.6	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	82.2	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	86.2	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	78.7	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	80.0	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	84.2	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	77.6	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	78.8	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 4092044)							
ES2146398-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	93.4	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4086072)							
ES2146441-007	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	102	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4089353)							
ES2146377-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4085490)							
ES2146135-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	130	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4085495)							
ES2146443-006	OM6	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	130	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4089354)							
ES2146383-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4089352)							
ES2146443-001	OM1	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	86.2	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4089351)							
ES2146377-001	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	# Not Determined	70.0	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 4085491)							
ES2146136-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.5 mg/L	118	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4088979)							
ES2146492-002	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	99.7	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4096811)							
ES2146408-001	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	111	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4088979)							
ES2146492-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	100	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4096811)							
ES2146408-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	116	70.0	130
EP080: BTEXN (QCLot: 4088979)							
ES2146492-002	Anonymous	EP080: Benzene	71-43-2	25 µg/L	93.1	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	94.0	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	107	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	107	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080: BTEXN (QCLot: 4088979) - continued							
ES2146492-002	Anonymous	EP080: ortho-Xylene	95-47-6	25 µg/L	110	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	98.5	70.0	130
EP080: BTEXN (QCLot: 4096811)							
ES2146408-001	Anonymous	EP080: Benzene	71-43-2	25 µg/L	80.8	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	79.8	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	82.1	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	81.7	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	84.4	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	91.3	70.0	130

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2213920**	Page	: 1 of 9
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 22-Apr-2022 15:00
Order number	: J200096	Date Analysis Commenced	: 23-Apr-2022
C-O-C number	: ----	Issue Date	: 29-Apr-2022 17:36
Sampler	: KB		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EK040: Poor spike recovery for Fluoride, however insufficent sample amount remaining for confirmation analysis.
- EP080: Batch ES2213920-7 Result has been confirmed by re-analysis.
- EK055G:LOR raised due to sample matrix.
- EK057G:LOR raised due to sample matrix.
- ED041G:LOR raised due to sample matrix.
- It has been noted that Reactive P is greater than Total P, however this difference is within the limits of experimental variation.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	TS	TB	RIN	OM6	OM7
			Sampling date / time	15-Mar-2022 00:00	15-Mar-2022 00:00	21-Apr-2022 00:00	21-Apr-2022 00:00	20-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2213920-001	ES2213920-002	ES2213920-003	ES2213920-004	ES2213920-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	----	----	6.37	6.93	7.10
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	----	----	0.12	1.13	3.94
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	----	<1	209	1160
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	----	----	<1	136	754
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	----	----	<1	59	286
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	----	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	----	<1	86	379
Total Alkalinity as CaCO3	----	1	mg/L	----	----	<1	86	379
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	----	<1	<1	<10
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	----	----	<1	19	142
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	----	<1	17	60
Magnesium	7439-95-4	1	mg/L	----	----	<1	4	33
Sodium	7440-23-5	1	mg/L	----	----	<1	20	153
Potassium	7440-09-7	1	mg/L	----	----	<1	4	59
EG005(ED093)F: Dissolved Metals by ICP-AES								
Aluminium	7429-90-5	0.10	mg/L	----	----	----	<0.10	1.03
Antimony	7440-36-0	0.01	mg/L	----	----	----	<0.01	<0.01
Arsenic	7440-38-2	0.01	mg/L	----	----	----	<0.01	<0.01
Cadmium	7440-43-9	0.005	mg/L	----	----	----	<0.005	<0.005
Chromium	7440-47-3	0.01	mg/L	----	----	----	<0.01	0.01
Copper	7440-50-8	0.01	mg/L	----	----	----	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	----	----	----	2.26	2.31
Lead	7439-92-1	0.01	mg/L	----	----	----	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/L	----	----	----	0.18	0.86
Nickel	7440-02-0	0.01	mg/L	----	----	----	0.01	0.02

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	TS	TB	RIN	OM6	OM7
			Sampling date / time	15-Mar-2022 00:00	15-Mar-2022 00:00	21-Apr-2022 00:00	21-Apr-2022 00:00	20-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2213920-001	ES2213920-002	ES2213920-003	ES2213920-004	ES2213920-005
				Result	Result	Result	Result	Result
EG005(ED093)F: Dissolved Metals by ICP-AES - Continued								
Zinc	7440-66-6	0.01	mg/L	----	----	----	**0.19**	**0.04**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	----	----	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	----	----	<0.1	<0.1	**0.4**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	----	----	<0.01	**0.13**	**1.91**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	----	----	<0.01	<0.01	<0.10
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	----	----	<0.01	<0.01	<0.10
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	----	----	<0.01	<0.01	<0.10
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	----	----	<0.1	**1.2**	**3.7**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	----	----	<0.1	**1.2**	**3.7**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	----	----	<0.01	**0.07**	**1.11**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	----	----	<0.01	<0.01	**1.19**
EN055: Ionic Balance								
ø **Total Anions**	----	0.01	meq/L	----	----	<0.01	**2.25**	**11.6**
ø **Total Cations**	----	0.01	meq/L	----	----	<0.01	**2.15**	**13.9**
ø **Ionic Balance**	----	0.01	%	----	----	----	----	**9.02**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	----	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	----	----	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	----	----	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	----	----	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	----	----	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	----	<20	<20	<20	<20

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	TS	TB	RIN	OM6	OM7
			Sampling date / time	15-Mar-2022 00:00	15-Mar-2022 00:00	21-Apr-2022 00:00	21-Apr-2022 00:00	20-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2213920-001	ES2213920-002	ES2213920-003	ES2213920-004	ES2213920-005
				Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	----	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L	----	----	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	----	----	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	----	----	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	----	----	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L	----	----	<100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	**14**	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	**14**	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	**14**	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	**15**	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	**16**	<2	<2	<2	<2
^ **Total Xylenes**	----	2	µg/L	**31**	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L	**73**	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	**18**	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**106**	**108**	**105**	**107**	**124**
Toluene-D8	2037-26-5	2	%	**102**	**101**	**97.9**	**102**	**123**
4-Bromofluorobenzene	460-00-4	2	%	**107**	**108**	**107**	**110**	**127**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MB01A	MB02A	MB02B	MB03A	MB03B
			Sampling date / time	20-Apr-2022 00:00	20-Apr-2022 00:00	20-Apr-2022 00:00	21-Apr-2022 00:00	21-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2213920-006	ES2213920-007	ES2213920-008	ES2213920-009	ES2213920-010
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.06	6.77	6.69	6.78	7.36
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	0.88	1.57	1.32	1.86	2.63
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	509	685	520	986	966
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	331	445	338	641	628
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	232	249	172	366	319
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	241	280	157	285	358
Total Alkalinity as CaCO3	----	1	mg/L	241	280	157	285	358
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	12	86	88	176	122
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	27	20	25	75	56
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	55	80	36	112	90
Magnesium	7439-95-4	1	mg/L	23	12	20	21	23
Sodium	7440-23-5	1	mg/L	31	57	40	82	108
Potassium	7440-09-7	1	mg/L	4	10	4	8	11
EG005(ED093)F: Dissolved Metals by ICP-AES								
Aluminium	7429-90-5	0.10	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Antimony	7440-36-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	7440-38-2	0.01	mg/L	0.06	0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	7440-47-3	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	1.32	0.54	0.23	0.40	1.14
Lead	7439-92-1	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/L	0.14	3.74	0.10	0.10	0.52
Nickel	7440-02-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MB01A	MB02A	MB02B	MB03A	MB03B
				Sampling date / time	20-Apr-2022 00:00	20-Apr-2022 00:00	20-Apr-2022 00:00	21-Apr-2022 00:00	21-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213920-006	ES2213920-007	ES2213920-008	ES2213920-009	ES2213920-010
					Result	Result	Result	Result	Result
EG005(ED093)F: Dissolved Metals by ICP-AES - Continued									
Zinc	7440-66-6	0.01	mg/L		<0.01	**0.01**	<0.01	**0.02**	<0.01
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.7**	**0.7**	**1.1**	**0.2**	**0.6**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.02**	**0.30**	<0.01	<0.01	**0.04**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	**0.03**	**0.18**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	**0.03**	**0.18**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	**0.8**	<0.1	**0.1**	<0.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		<0.1	**0.8**	<0.1	**0.3**	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.15**	**0.58**	**0.05**	**0.45**	**0.08**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**5.83**	**7.95**	**5.67**	**11.5**	**11.3**
ø Total Cations	----	0.01	meq/L		**6.09**	**7.71**	**5.28**	**11.1**	**11.4**
ø Ionic Balance	----	0.01	%		**2.20**	**1.50**	**3.55**	**1.71**	**0.40**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MB01A	MB02A	MB02B	MB03A	MB03B
				Sampling date / time	20-Apr-2022 00:00	20-Apr-2022 00:00	20-Apr-2022 00:00	21-Apr-2022 00:00	21-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213920-006	ES2213920-007	ES2213920-008	ES2213920-009	ES2213920-010
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	**2**	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	**4**	<2	<2	<2
^ **Total Xylenes**	----	2	µg/L		<2	**6**	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L		<1	**6**	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**108**	**111**	**113**	**102**	**109**
Toluene-D8	2037-26-5	2	%		**106**	**108**	**107**	**99.0**	**107**
4-Bromofluorobenzene	460-00-4	2	%		**112**	**114**	**115**	**105**	**111**

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Appendix D

Hydraulic conductivity analytical outputs

EMM
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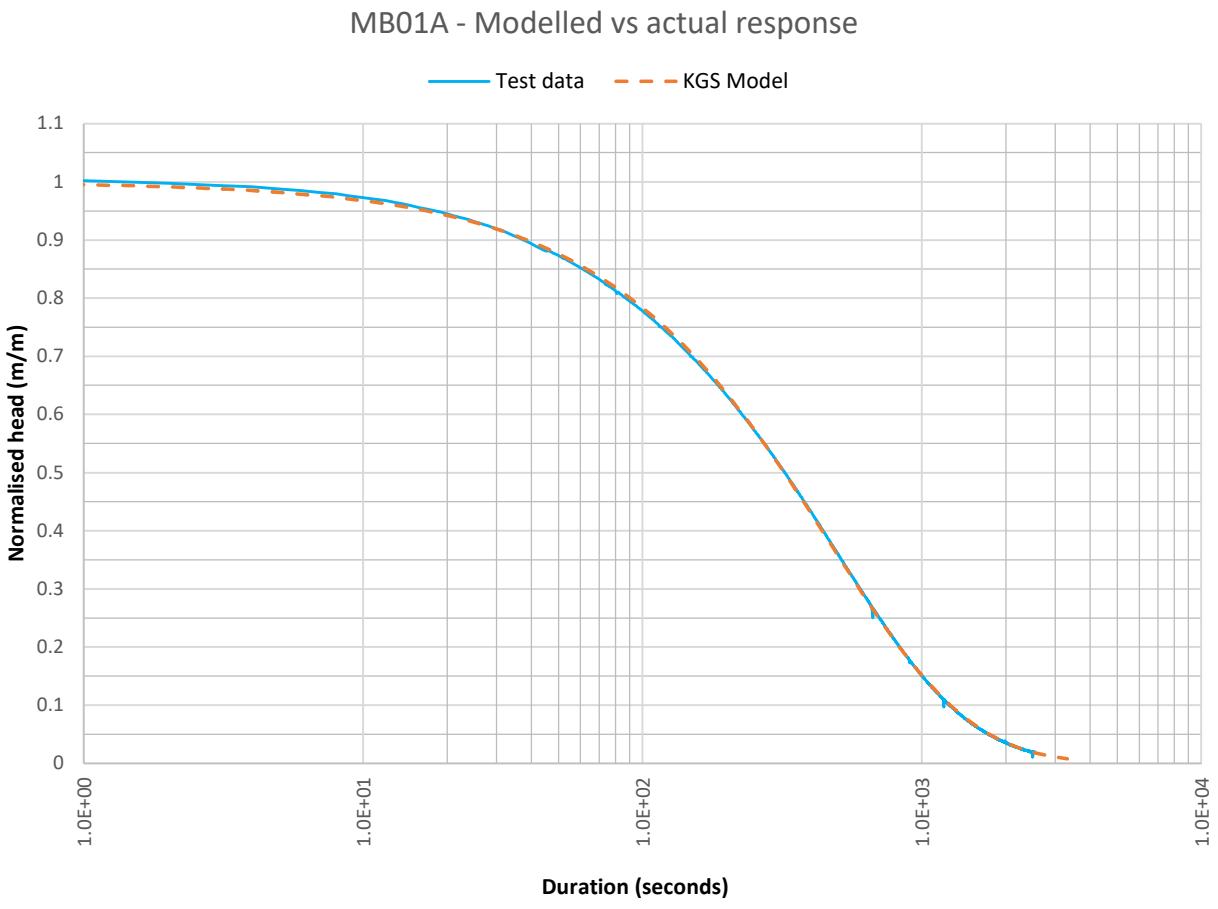
Permeability assessment

ID: MB01A

Client:	SMEC Australia Pty Limited	**Test type:**	Rising head test
Site:	Oven Mountain, Carrai NSW	**Equipment:**	Pneumatic apparatus
Project:	Oven Mountain Pumped Hydro	**Test start:**	15 February 2022; 14:16
Reference:	E210769	**Test finish:**	15 February 2022; 14:58
Field personnel:	AB	**Duration:**	42 minutes
Analysed by:	HJN	**Data method:**	Automated (transducer)

Testing stratigraphy:	Triassic Carrai Granodiorite	**Aquifer type:**	Unconfined
General description:	Granodiorite, fresh to slightly weathered	**Bore construction:**	Partial penetration
Drill method:	125 mm diameter air hammer	**Analytical model:**	KGS (Hyder et al. 1994)

Well type:	PVC monitoring bore	**Logger depth:**	15.03 m
Screen top depth:	28.5 m	**Initial water depth:**	8.43 m
Screen bottom depth:	34.5 m	**Final water depth:**	8.43 m
Screen length:	6 m	**Approximate recovery:**	100%
Casing radius:	25 mm	**Induced displacement:**	1.48 m
Well radius:	62.5 mm	**Water column height:**	26.08 m
Well skin radius:	- Note 1	**Saturated thickness:**	26.08 m Note 2



K = 5.4 x 10^{-7} m/s

Notes;

Note 1 well skin radius considered negligible the referenced analytical model;

Note 2 saturated thickness assumed to be equal to water column height for partially penetrating wells;

Reference (as accessed through Hydrosolve Inc - Aqtesolv software)

Hyder, Z, Butler, J, McElwee, C & Liu, W 1994. Slug tests in partially penetrating wells, *Water Resources Research* , vol. 30, no. 11, pp. 2945-2957.

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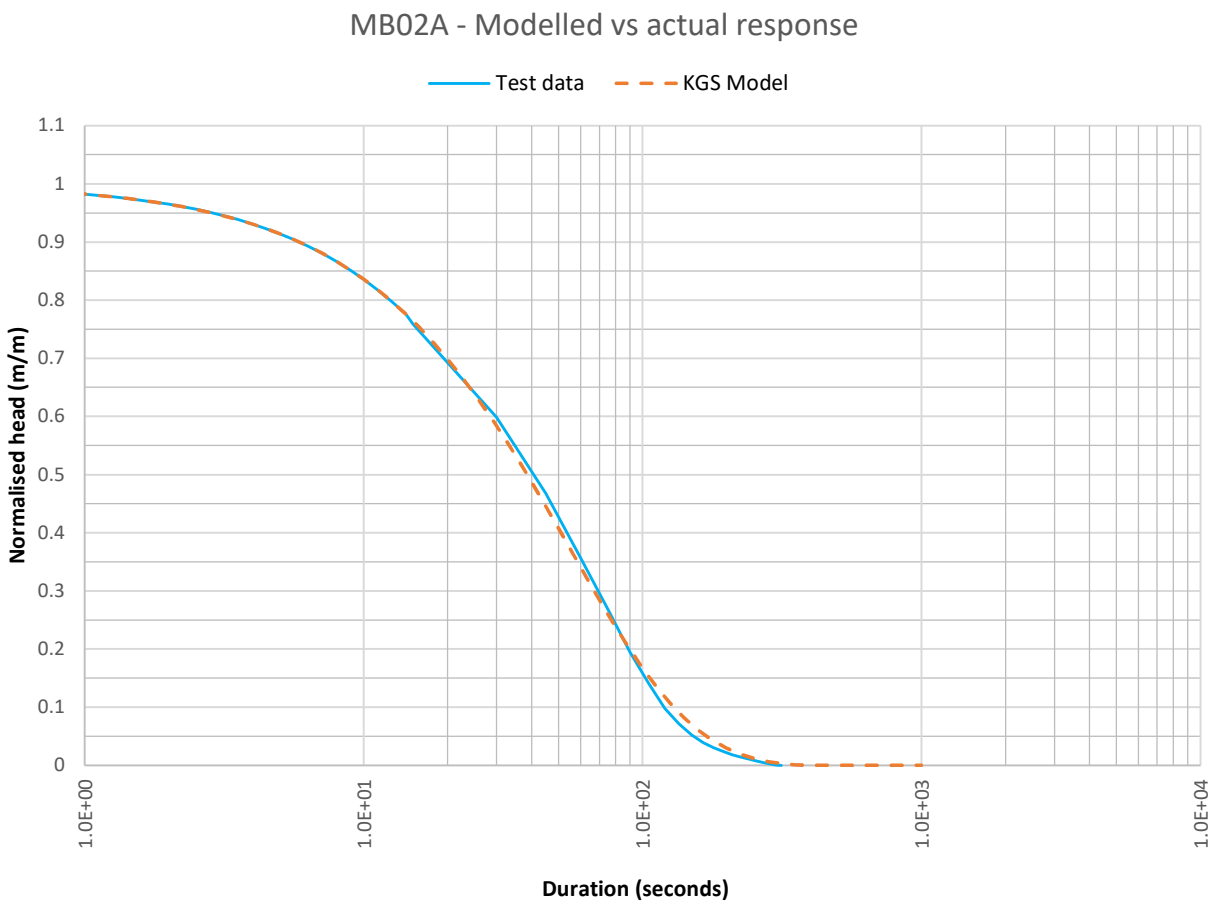
Permeability assessment

ID: MB02A

Client:	SMEC Australia Pty Limited	**Test type:**	Rising head test
Site:	Oven Mountain, Carrai NSW	**Equipment:**	Pneumatic apparatus
Project:	Oven Mountain Pumped Hydro	**Test start:**	15 February 2022; 09:45
Reference:	E210769	**Test finish:**	15 February 2022; 09:50
Field personnel:	HJN	**Duration:**	5 minutes
Analysed by:	HJN	**Data method:**	Automated (transducer)

Testing stratigraphy:	Triassic Carrai Granodiorite	**Aquifer type:**	Unconfined
General description:	Granodiorite, fresh to slightly weathered	**Bore construction:**	Partial penetration
Drill method:	125 mm diameter air hammer	**Analytical model:**	KGS (Hyder et al. 1994)

Well type:	PVC monitoring well	**Logger depth:**	23.73 m
Screen top depth:	25.6 m	**Initial water depth:**	19.42 m
Screen bottom depth:	31.6 m	**Final water depth:**	19.42 m
Screen length:	3.1 m	**Approximate recovery:**	100%
Casing radius:	25 mm	**Induced displacement:**	1.08 m
Well radius:	62.5 mm	**Water column height:**	12.18 m
Well skin radius:	- Note 1	**Saturated thickness:**	12.18 m Note 2



K = 4.3 x 10^{-6} m/s

Notes;

Note 1 well skin radius not accounted for in the referenced analytical model;

Note 2 saturated thickness assumed to be equal to water column height for partially penetrating wells;

Reference (as accessed through Hydrosolve Inc - Aqtesolv software)

Hyder, Z, Butler, J, McElwee, C & Liu, W 1994. Slug tests in partially penetrating wells, *Water Resources Research* , vol. 30, no. 11, pp. 2945-2957.

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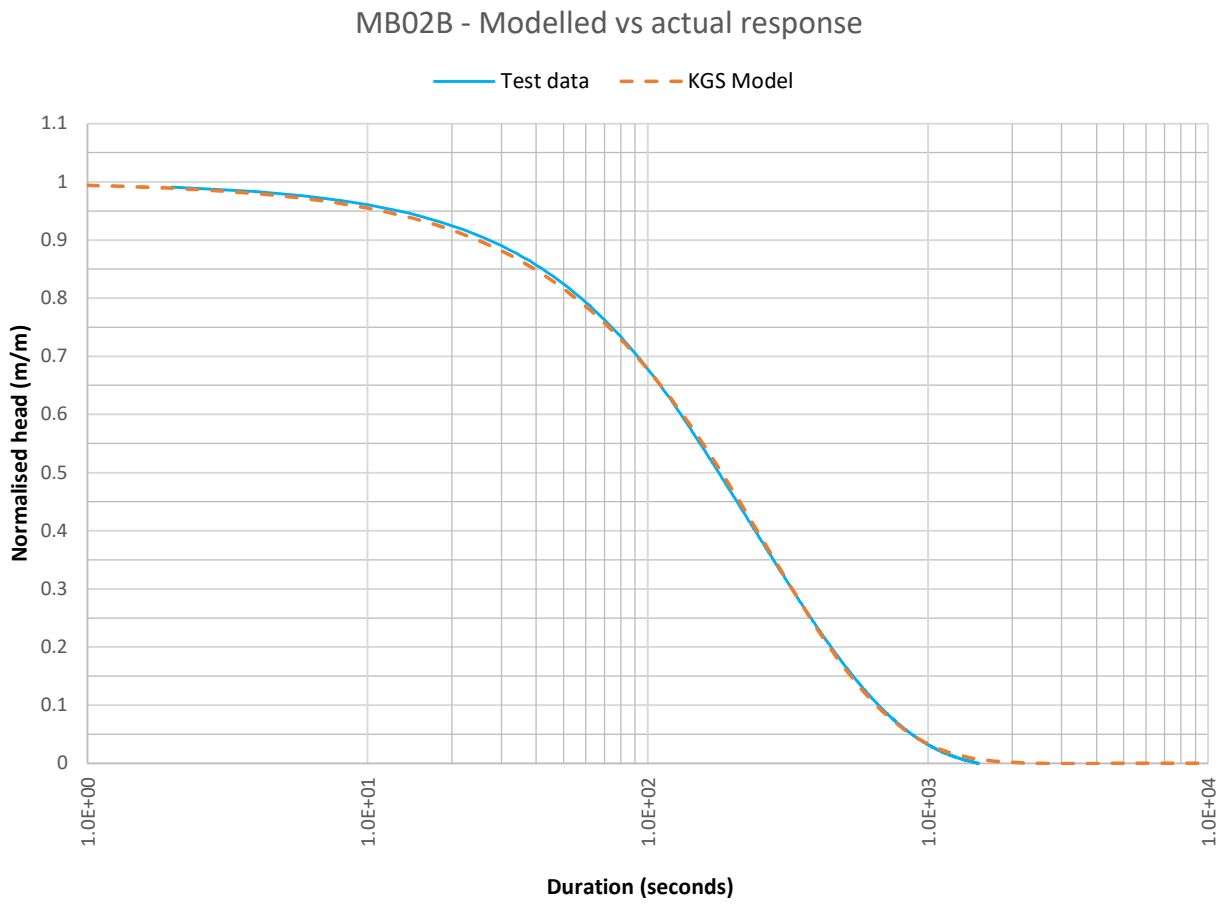
Permeability assessment

ID: MB02B

Client:	SMEC Australia Pty Limited	**Test type:**	Rising head test
Site:	Oven Mountain, Carrai NSW	**Equipment:**	Pneumatic apparatus
Project:	Oven Mountain Pumped Hydro	**Test start:**	20 April 2022; 12:57
Reference:	E210769	**Test finish:**	20 April 2022; 13:22
Field personnel:	AB	**Duration:**	24 minutes
Analysed by:	AB	**Data method:**	Automated (transducer)

Testing stratigraphy:	Triassic Carrai Granodiorite	**Aquifer type:**	Unconfined
General description:	Granodiorite, fresh to slightly weathered	**Bore construction:**	Partial penetration
Drill method:	152.4 mm diameter air hammer	**Analytical model:**	KGS (Hyder et al. 1994)

Well type:	PVC monitoring well	**Logger depth:**	43.13 m
Screen top depth:	173.5 m	**Initial water depth:**	18.57 m
Screen bottom depth:	185.5 m	**Final water depth:**	18.57 m
Screen length:	12 m	**Approximate recovery:**	100%
Casing radius:	25 mm	**Induced displacement:**	2.38 m
Well radius:	76.2 mm	**Water column height:**	166.93 m
Well skin radius:	- Note 1	**Saturated thickness:**	166.93 m Note 2



K = 5.0 x 10^{-7} m/s

Notes;

Note 1 well skin radius not accounted for in the referenced analytical model;

Note 2 saturated thickness assumed to be equal to water column height for partially penetrating wells;

Reference (as accessed through Hydrosolve Inc - Aqtesolv software)

Springer, R.K. and L.W. Gelhar, 1991. Characterization of large-scale aquifer heterogeneity in glacial outwash by analysis of slug tests with oscillatory response, Cape Cod, Massachusetts, U.S. Geol. Surv. Water Res. Invest. Rep. 91-4034, pp. 36-40

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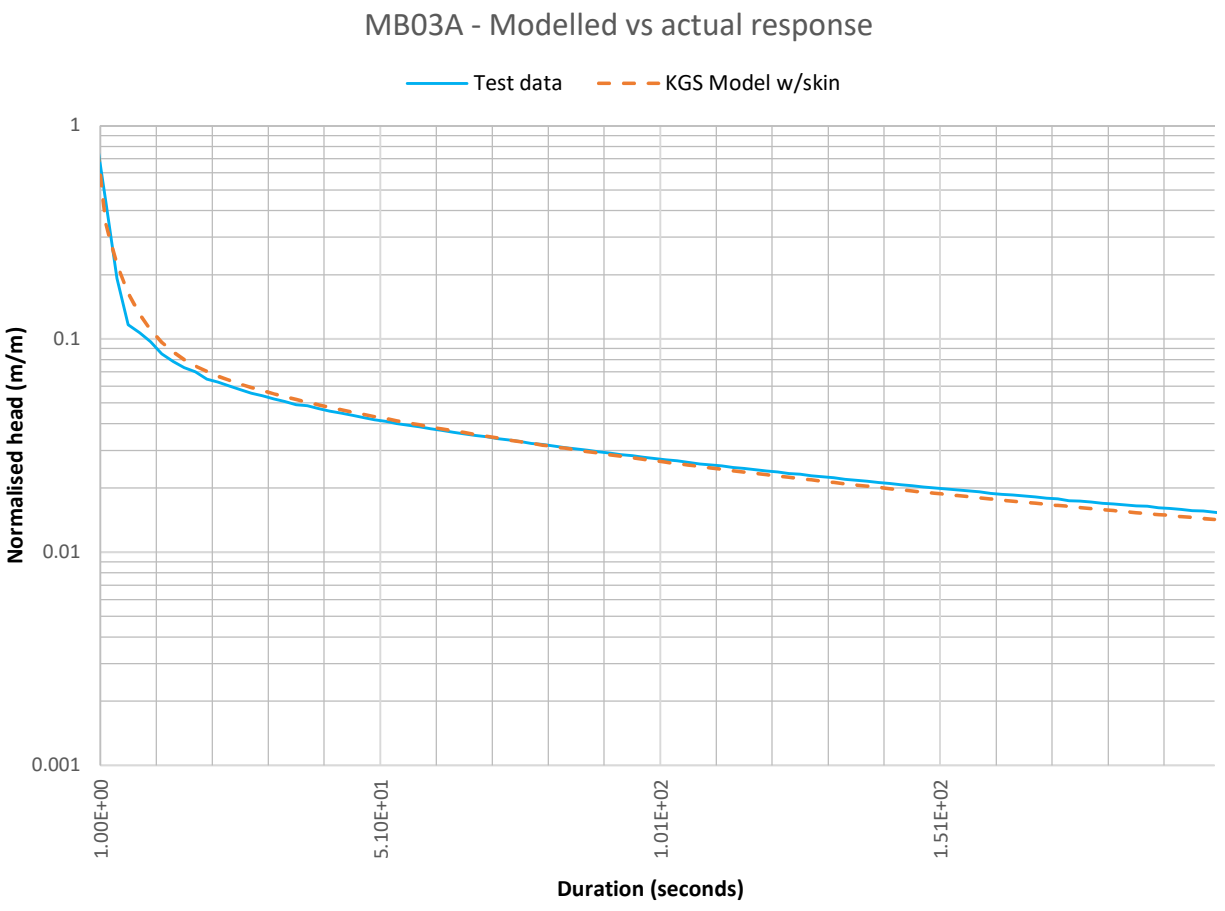
Permeability assessment

ID: MB03A

Client:	SMEC Australia Pty Limited	**Test type:**	Rising head test
Site:	Oven Mountain, Carrai NSW	**Equipment:**	Pneumatic apparatus
Project:	Oven Mountain Pumped Hydro	**Test start:**	21 April 2022; 09:12
Reference:	E210769	**Test finish:**	21 April 2022; 09:35
Field personnel:	AB	**Duration:**	22 minutes
Analysed by:	AB	**Data method:**	Automated (transducer)

Testing stratigraphy:	Triassic Carrai Granodiorite	**Aquifer type:**	Unconfined
General description:	Granodiorite, fresh to slightly weathered	**Bore construction:**	Partial penetration
Drill method:	152.4 mm diameter air hammer	**Analytical model:**	KGS (Hyder et al. 1994) w/skin

Well type:	PVC monitoring well	**Logger depth:**	11.72 m
Screen top depth:	15 m	**Initial water depth:**	3.127 m
Screen bottom depth:	21 m	**Final water depth:**	3.127 m
Screen length:	6 m	**Approximate recovery:**	100%
Casing radius:	25 mm	**Induced displacement:**	2.71 m
Well radius:	76.2 mm	**Water column height:**	17.873 m
Well skin radius:	0.4 m	**Saturated thickness:**	17.873 m Note 1



K = 2.0 x 10^{-5} m/s

Notes;

Note 1 saturated thickness assumed to be equal to water column height for partially penetrating wells;

Reference (as accessed through Hydrosolve Inc - Aqtesolv software)

Hyder, Z, Butler, J, McElwee, C & Liu, W 1994. Slug tests in partially penetrating wells, *Water Resources Research* , vol. 30, no. 11, pp. 2945-2957.

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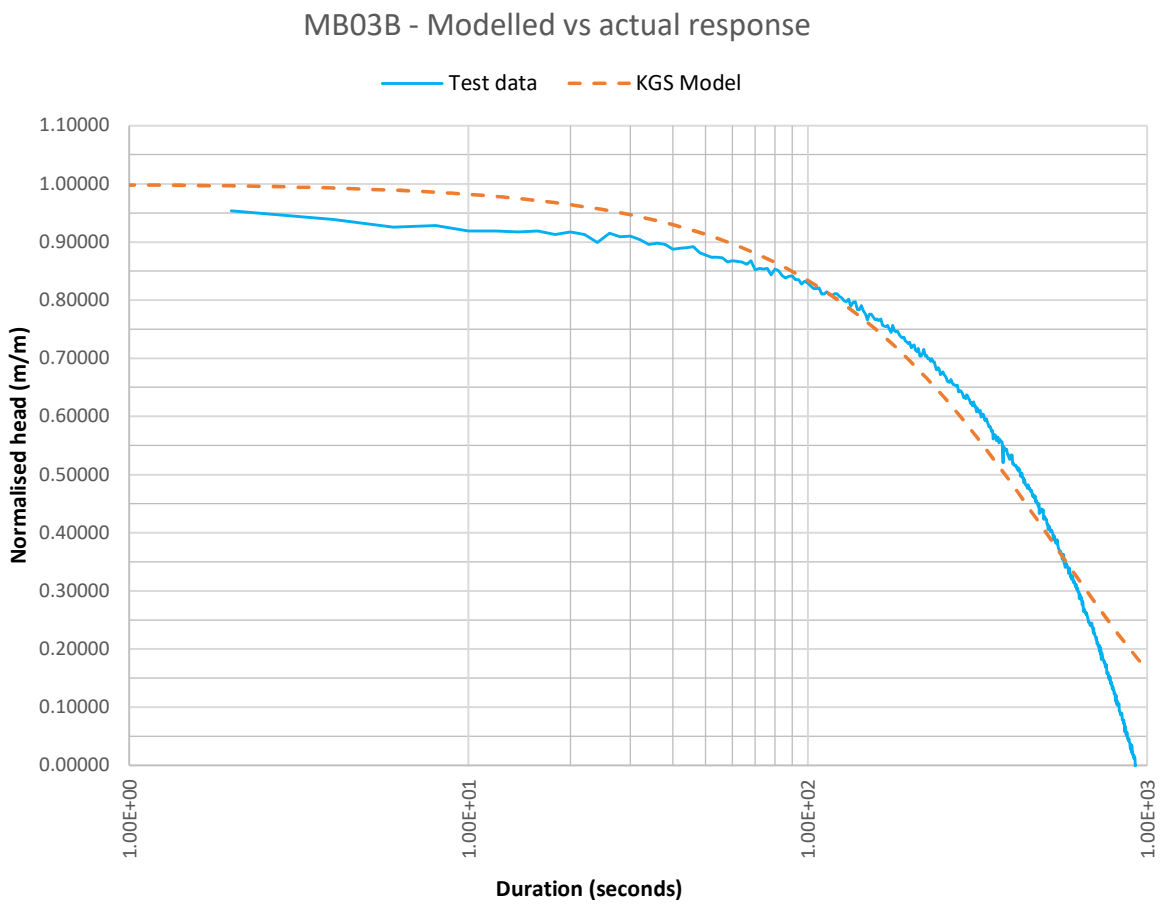
Permeability assessment

ID: MB03B

Client:	SMEC Australia Pty Limited	**Test type:**	Rising head test
Site:	Oven Mountain, Carrai NSW	**Equipment:**	Pneumatic apparatus
Project:	Oven Mountain Pumped Hydro	**Test start:**	21 April 2022; 10:10
Reference:	E210769	**Test finish:**	21 April 2022; 10:25
Field personnel:	AB	**Duration:**	15 minutes
Analysed by:	AB	**Data method:**	Automated (transducer)

Testing stratigraphy:	Triassic Carrai Granodiorite	**Aquifer type:**	Unconfined
General description:	Granodiorite, fresh to slightly weathered	**Bore construction:**	Partial penetration
Drill method:	152.4 mm diameter air hammer	**Analytical model:**	KGS (Hyder et al. 1994)

Well type:	PVC monitoring well	**Logger depth:**	29.61 m
Screen top depth:	86 m	**Initial water depth:**	1.85 m
Screen bottom depth:	98 m	**Final water depth:**	1.85 m
Screen length:	12 m	**Approximate recovery:**	100%
Casing radius:	25 mm	**Induced displacement:**	0.1 m
Well radius:	67.2 mm	**Water column height:**	96.15 m
Well skin radius:	- Note 1	**Saturated thickness:**	96.15 m Note 2



K = 1.7 x 10^{-7} m/s

Notes;

Note 1 well skin radius not accounted for in the referenced analytical model;

Note 2 saturated thickness assumed to be from base of alluvium observed to measured water depth;

Reference (as accessed through Hydrosolve Inc - Aqtesolv software)

Hyder, Z, Butler, J, McElwee, C & Liu, W 1994. Slug tests in partially penetrating wells, *Water Resources Research* , vol. 30, no. 11, pp. 2945-2957.

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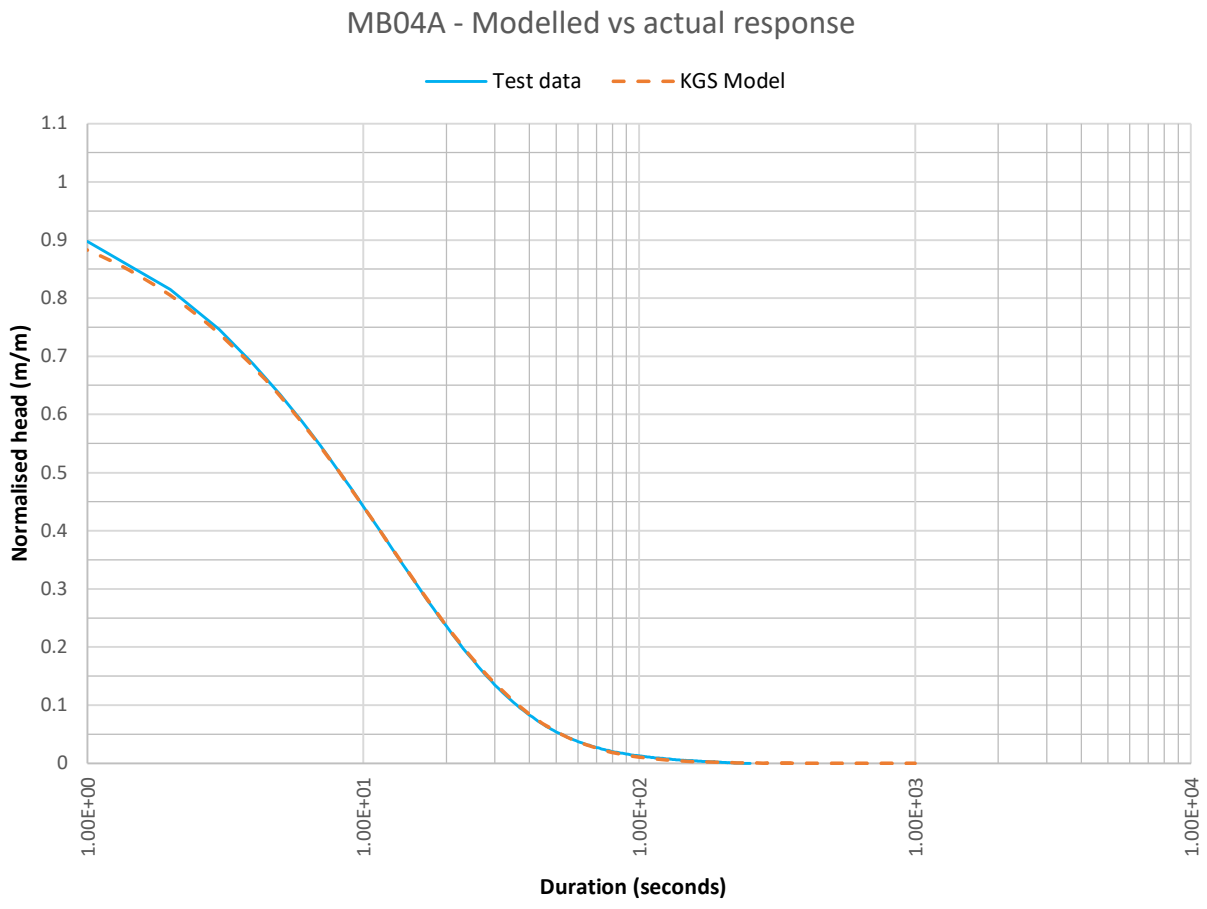
Permeability assessment

ID: MB04A

Client:	SMEC Australia Pty Limited	**Test type:**	Rising head test
Site:	Oven Mountain, Carrai NSW	**Equipment:**	Pneumatic apparatus
Project:	Oven Mountain Pumped Hydro	**Test start:**	17 February 2022; 10:25
Reference:	E210769	**Test finish:**	17 February 2022; 10:29
Field personnel:	AB	**Duration:**	4 minutes
Analysed by:	HJN	**Data method:**	Automated (transducer)

Testing stratigraphy:	Triassic Carrai Granodiorite	**Aquifer type:**	Unconfined
General description:	Granodiorite, fresh to slightly weathered	**Bore construction:**	Partial penetration
Drill method:	125 mm diameter air hammer	**Analytical model:**	KGS (Hyder et al. 1994)

Well type:	PVC monitoring well	**Logger depth:**	5.15 m
Screen top depth:	6.35 m	**Initial water depth:**	0.34 m
Screen bottom depth:	9.35 m	**Final water depth:**	0.34 m
Screen length:	3 m	**Approximate recovery:**	100%
Casing radius:	25 mm	**Induced displacement:**	2.83 m
Well radius:	62.5 mm	**Water column height:**	9.01 m
Well skin radius:	- Note 1	**Saturated thickness:**	9.01 m Note 2



K = 2.8 x 10^{-5} m/s

Notes;

Note 1 well skin radius not accounted for in the referenced analytical model;

Note 2 saturated thickness assumed to be from base of alluvium observed to measured water depth;

Reference (as accessed through Hydrosolve Inc - Aqtesolv software)

Hyder, Z, Butler, J, McElwee, C & Liu, W 1994. Slug tests in partially penetrating wells, *Water Resources Research* , vol. 30, no. 11, pp. 2945-2957.

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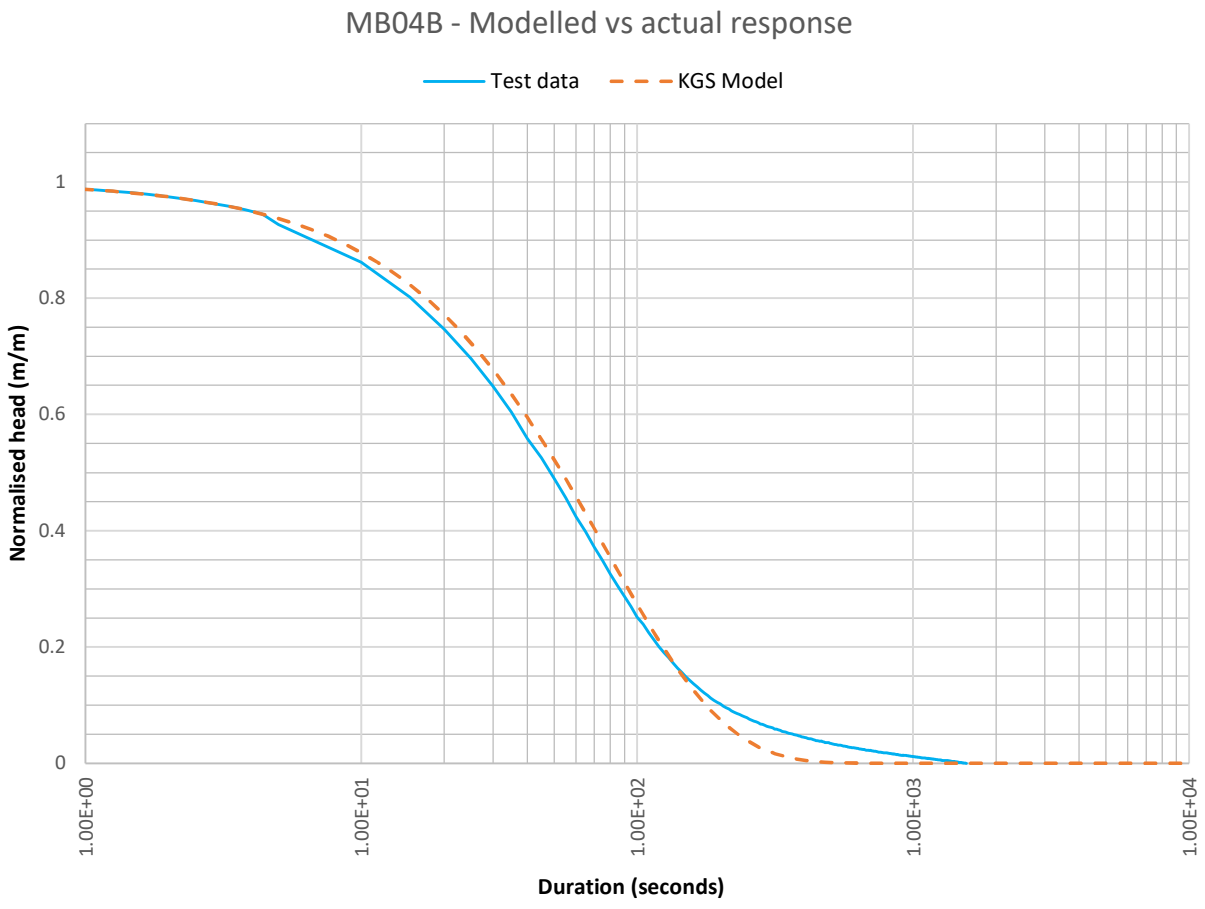
Permeability assessment

ID: MB04B

Client:	SMEC Australia Pty Limited	**Test type:**	Rising head test
Site:	Oven Mountain, Carrai NSW	**Equipment:**	Pneumatic apparatus
Project:	Oven Mountain Pumped Hydro	**Test start:**	17 February 2022; 09:05
Reference:	E210769	**Test finish:**	17 February 2022; 09:31
Field personnel:	AB	**Duration:**	26 minutes
Analysed by:	HJN	**Data method:**	Automated (transducer)

Testing stratigraphy:	Triassic Carrai Granodiorite	**Aquifer type:**	Unconfined
General description:	Granodiorite, fresh to slightly weathered	**Bore construction:**	Partial penetration
Drill method:	125 mm diameter air hammer	**Analytical model:**	Springer and Gehlar (1991)

Well type:	PVC monitoring well	**Logger depth:**	22.16 m
Screen top depth:	52.7 m	**Initial water depth:**	2.09 m
Screen bottom depth:	58.7 m	**Final water depth:**	2.11 m
Screen length:	6 m	**Approximate recovery:**	98%
Casing radius:	25 mm	**Induced displacement:**	2.87 m
Well radius:	62.5 mm	**Water column height:**	56.61 m
Well skin radius:	- Note 1	**Saturated thickness:**	56.61 m Note 2



K = 3.3 x 10^{-6} m/s

Notes;

Note 1 well skin radius not accounted for in the referenced analytical model;

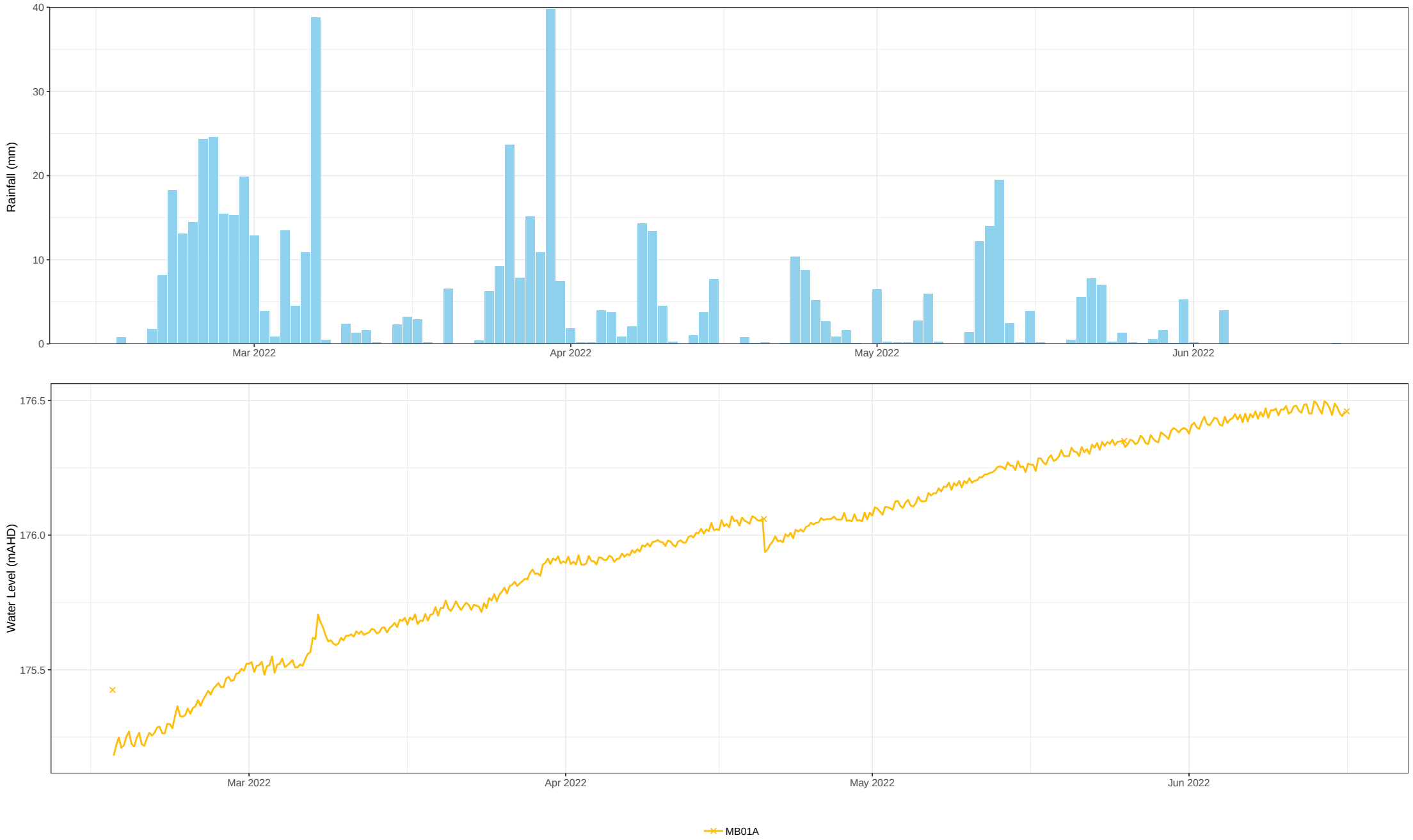
Note 2 saturated thickness assumed to be from base of alluvium observed to measured water depth;

Reference (as accessed through Hydrosolve Inc - Aqtesolv software)

Springer, R.K. and L.W. Gelhar, 1991. Characterization of large-scale aquifer heterogeneity in glacial outwash by analysis of slug tests with oscillatory response, Cape Cod, Massachusetts, U.S. Geol. Surv. Water Res. Invest. Rep. 91-4034, pp. 36-40

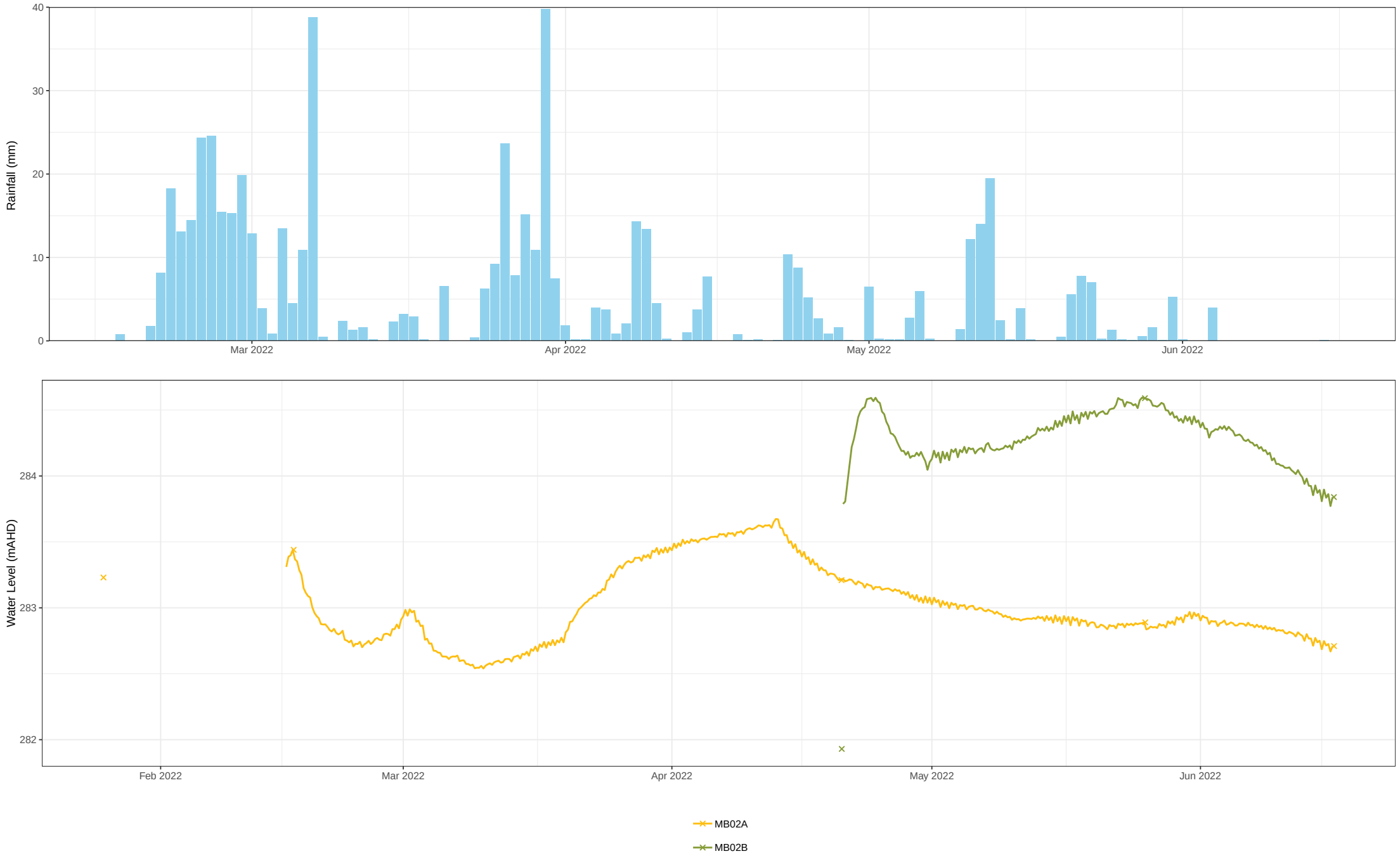
Appendix E
Groundwater level hydrographs

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Notes
Rainfall measured at East Kunderang, Kenebree (station 57013)
http://www.longpaddock.qld.gov.au/silo

Groundwater level times series data − MB01A
Oven Mountain Pumped Hydro Energy Storage − SMEC Australia Pty Limited
Stage one hydrogeological drilling and testing
Appendix E.1



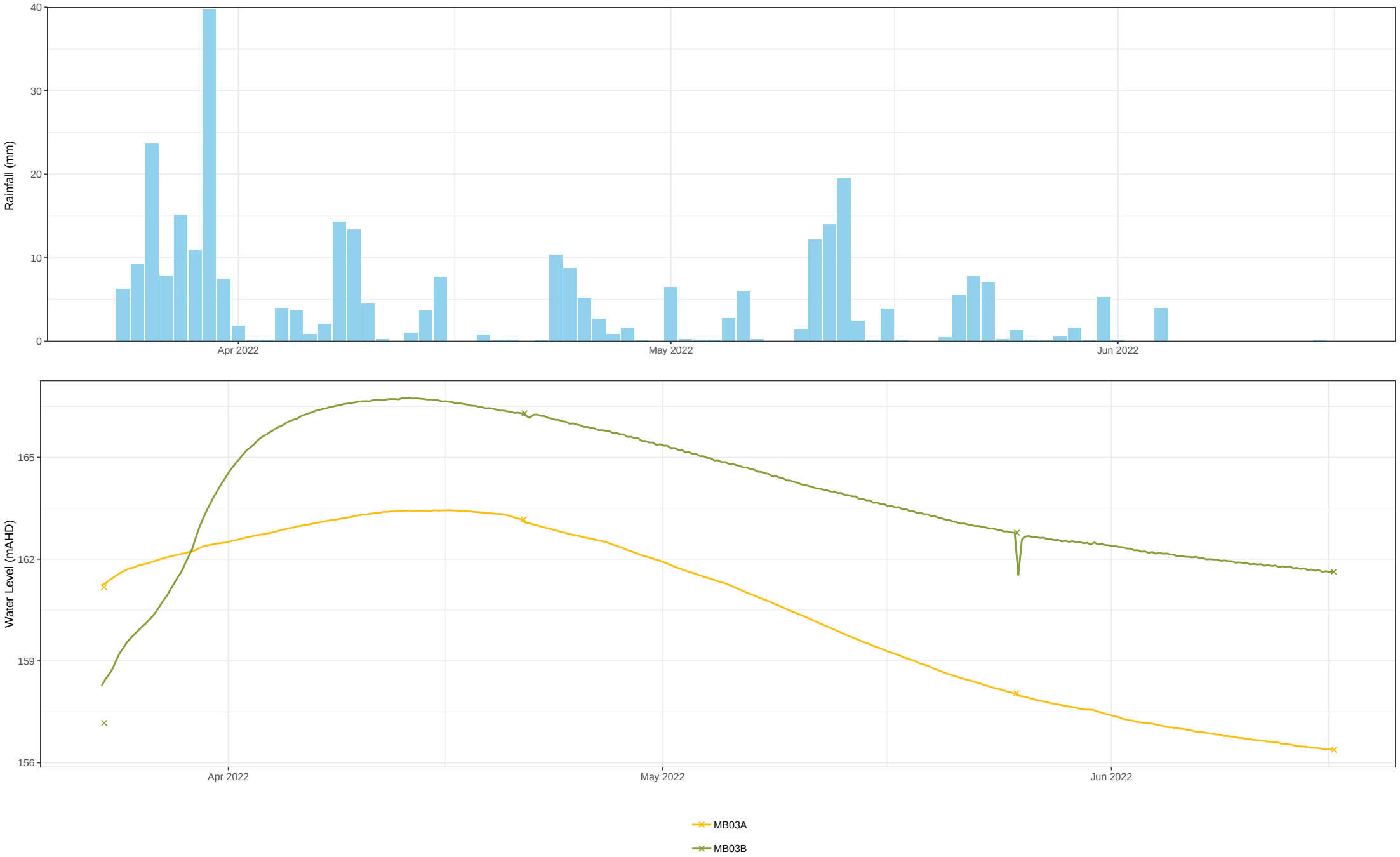
Notes
Rainfall measured at East Kunderang, Kenebree (station 57013)
http://www.longpaddock.qld.gov.au/silo

Groundwater level times series data − MB02A/B

Oven Mountain Pumped Hydro Energy Storage − SMEC Australia Pty Limited

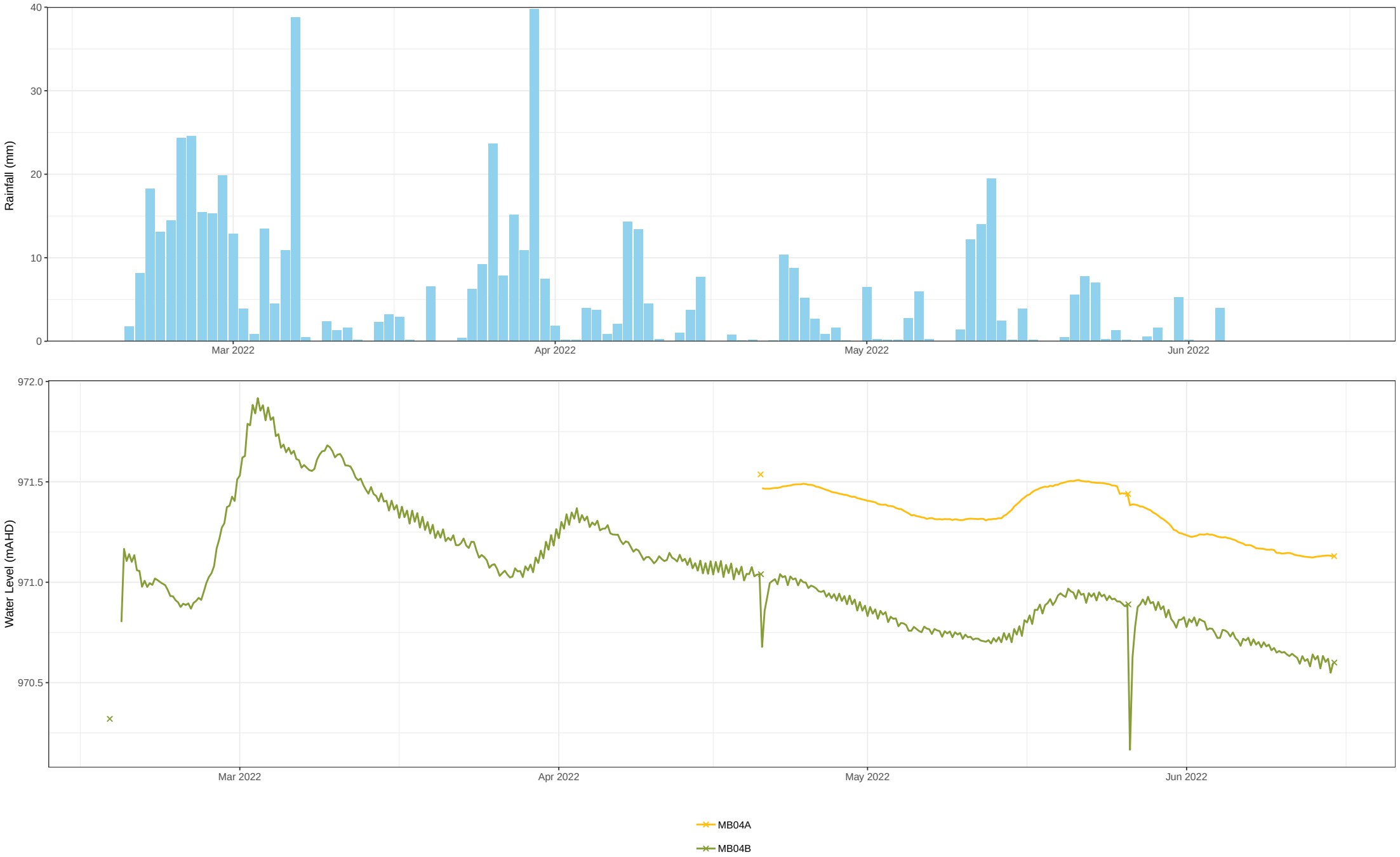
Stage one hydrogeological drilling and testing

Appendix E.2



Notes
Rainfall measured at East Kunderang, Kenebree (station 57013)
http://www.longpaddock.qld.gov.au/silo

Groundwater level times series data − MB03A/B
Oven Mountain Pumped Hydro Energy Storage − SMEC Australia Pty Limited
Stage one hydrogeological drilling and testing
Appendix E.3



Notes
Rainfall measured at East Kunderang, Kenebree (station 57013)
http://www.longpaddock.qld.gov.au/silo

Groundwater level times series data − MB04A/B
Oven Mountain Pumped Hydro Energy Storage − SMEC Australia Pty Limited
Stage one hydrogeological drilling and testing
Appendix E.4

Australia

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Toronto ON M4P 2E5

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60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1

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Appendix I Packer Test Results

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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4A

Client:	OMPS	**Date of Test:**	28/06/2022
Project:	OMPHES	**Driller:**	John Mulligan
Project No:	30018018	**Tested By:**	Luis Santos
Location:	Carrai NSW	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	17.13	**m**	23.23	**m**	6.1	**m**

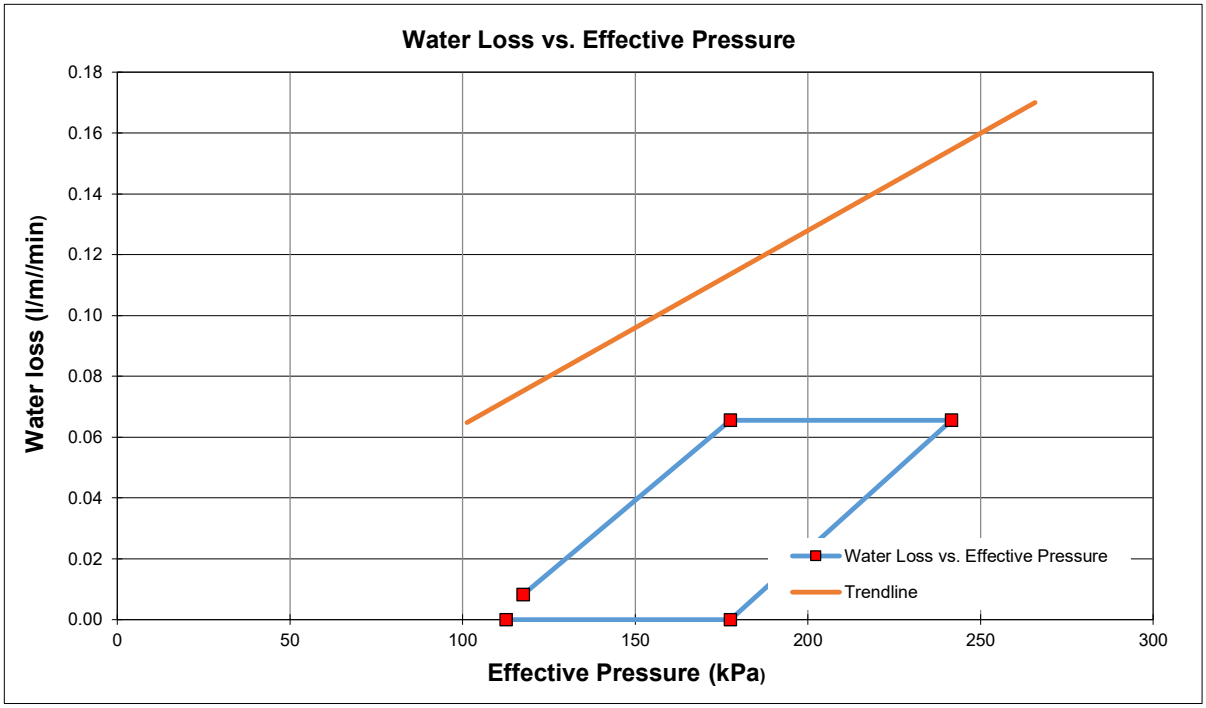
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	17.13	m
Inferred Groundwater Level:	4.35	m bgl			
Gauge Height:	0.5	m	Water Meter No:	5431278	
Hydrostatic Head:	47.6	kPa	Pump No:	G10591	

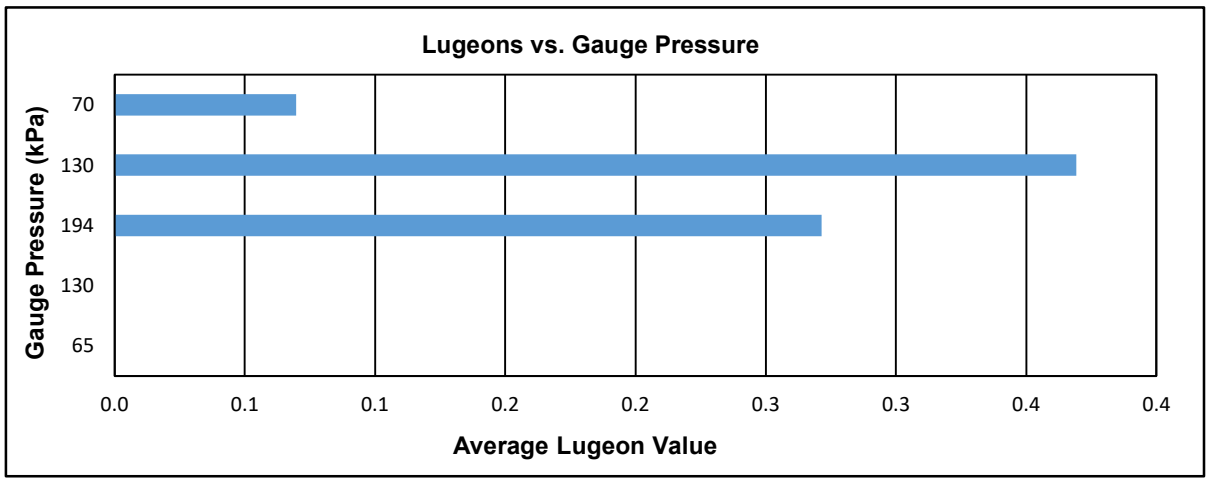
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
5	70	0	117.58	33.0	33.0	0	0	0.000	0.00
5	70	0	117.58	33.0	34.0	1	0	0.033	0.28
5	70	0	117.58	34.0	34.0	0	0	0.000	0.00
5	70	0	117.58	34.0	34.0	0	0	0.000	0.00
5	130	0	177.58	34.0	41.0	7	0	0.230	1.29
5	130	0	177.58	41.0	42.0	1	0	0.033	0.18
5	130	0	177.58	42.0	42.0	0	0	0.000	0.00
5	130	0	177.58	42.0	42.0	0	0	0.000	0.00
5	194	0	241.58	42.0	47.0	5	0	0.164	0.68
5	194	0	241.58	47.0	50.0	3	0	0.098	0.41
5	194	0	241.58	50.0	50.0	0	0	0.000	0.00
5	194	0	241.58	50.0	50.0	0	0	0.000	0.00
5	130	0	177.58	50.0	50.0	0	0	0.000	0.00
5	130	0	177.58	50.0	50.0	0	0	0.000	0.00
5	130	0	177.58	50.0	50.0	0	0	0.000	0.00
5	130	0	177.58	50.0	50.0	0	0	0.000	0.00
5	65	0	112.58	46.0	46.0	0	0	0.000	0.00
5	65	0	112.58	46.0	46.0	0	0	0.000	0.00
5	65	0	112.58	46.0	46.0	0	0	0.000	0.00
5	65	0	112.58	46.0	46.0	0	0	0.000	0.00

Comments:

-

BOREHOLE: BH4A





Lugeon Value: 0.6 (Burgess 1983)

SMEC
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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4A

Client:	OMPS	**Date of Test:**	28/06/2022
Project:	OMPHES	**Driller:**	John Mulligan
Project No:	30018018	**Tested By:**	Luis Santos
Location:	Carrai NSW	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	23.15	**m**	29.32	**m**	6.17	**m**

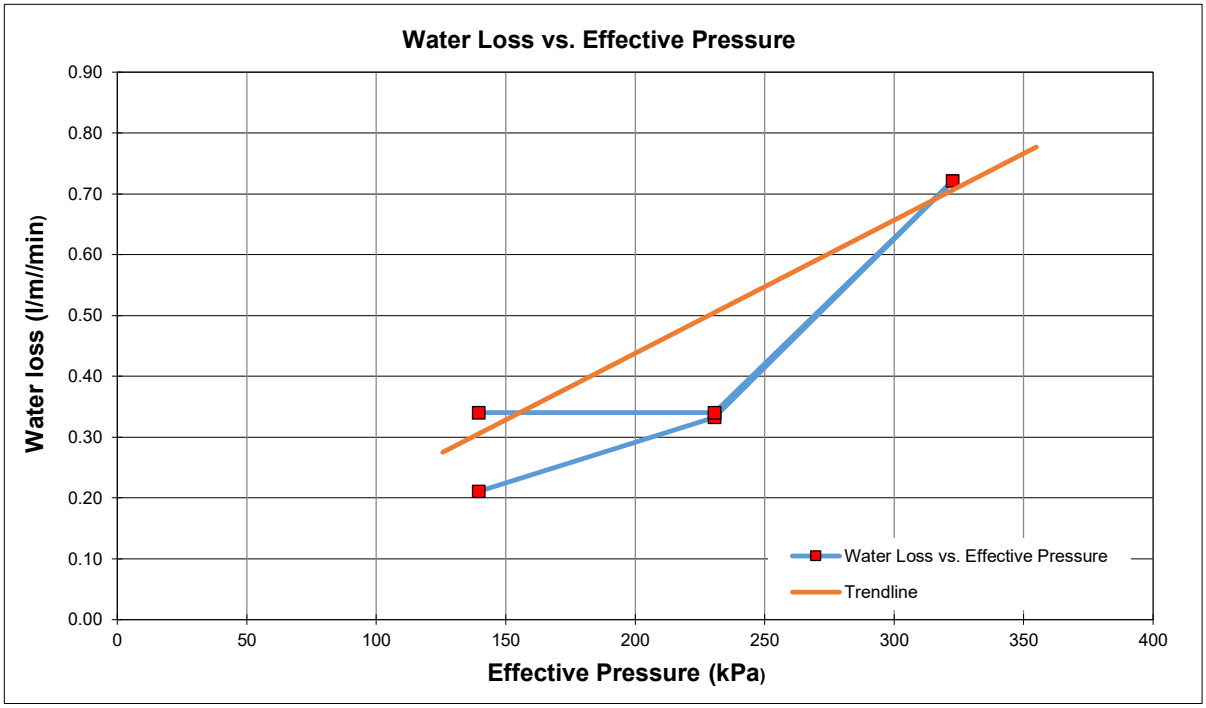
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	23.15	m
Inferred Groundwater Level:	4.35	m bgl			
Gauge Height:	0.5	m	Water Meter No:	5431278	
Hydrostatic Head:	47.6	kPa	Pump No:	G10591	

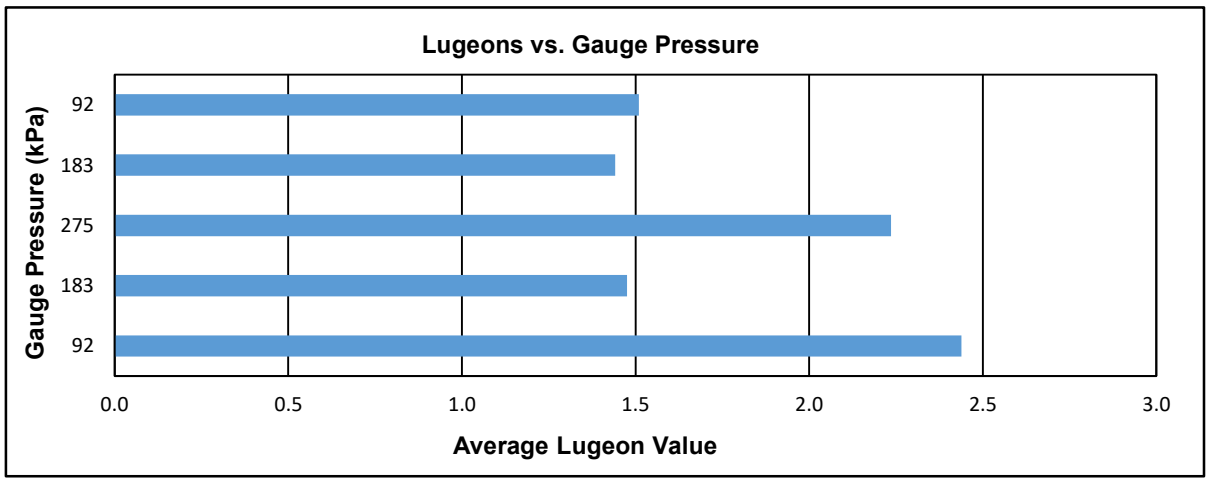
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
5	92	0	139.58	0.0	9.0	9	0	0.292	2.09
5	92	0	139.58	9.0	14.0	5	0	0.162	1.16
5	92	0	139.58	14.0	20.0	6	0	0.194	1.39
5	92	0	139.58	20.0	26.0	6	0	0.194	1.39
5	183	0	230.58	26.0	37.0	11	0	0.357	1.55
5	183	0	230.58	38.0	48.0	10	0	0.324	1.41
5	183	0	230.58	48.0	58.0	10	0	0.324	1.41
5	183	0	230.58	58.0	68.0	10	0	0.324	1.41
5	275	0	322.58	68.0	99.0	31	0	1.005	3.12
5	275	0	322.58	99.0	120.0	21	0	0.681	2.11
5	275	0	322.58	120.0	139.0	19	0	0.616	1.91
5	275	0	322.58	139.0	157.0	18	0	0.583	1.81
5	183	0	230.58	157.0	164.0	7	0	0.227	0.98
5	183	0	230.58	164.0	175.0	11	0	0.357	1.55
5	183	0	230.58	175.0	187.0	12	0	0.389	1.69
5	183	0	230.58	187.0	199.0	12	0	0.389	1.69
5	92	0	139.58	199.0	210.0	11	0	0.357	2.55
5	92	0	139.58	227.0	238.0	11	0	0.357	2.55
5	92	0	139.58	238.0	248.0	10	0	0.324	2.32
5	92	0	139.58	248.0	258.0	10	0	0.324	2.32

Comments:

-

BOREHOLE: BH4A





Lugeon Value: 2.19 (Burgess 1983)

SMEC
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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4A

Client:	OMPS	**Date of Test:**	30/06/2022
Project:	OMPHES	**Driller:**	John Mulligan
Project No:	30018018	**Tested By:**	Luis Santos
Location:	Carrai NSW	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	29.32	**m**	35.32	**m**	6	**m**

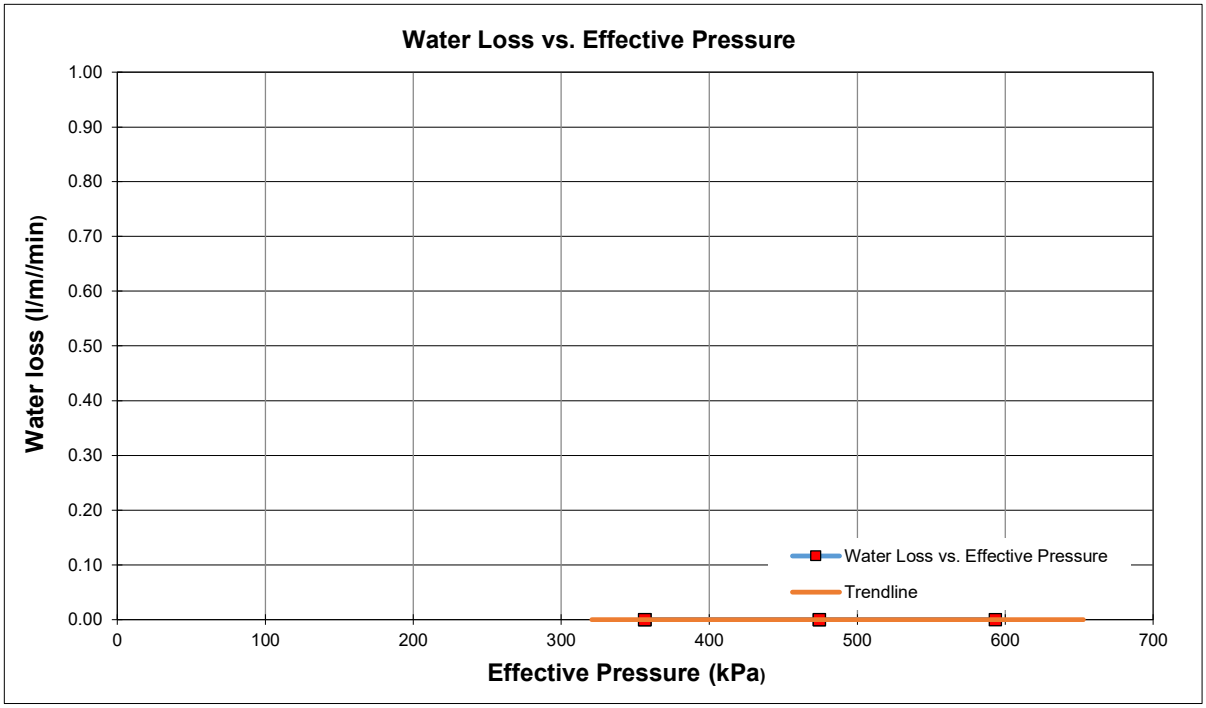
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	29.32	m
Inferred Groundwater Level:	24.20	m bgl			
Gauge Height:	0.1	m	Water Meter No:	5431278	
Hydrostatic Head:	238.4	kPa	Pump No:	G10591	

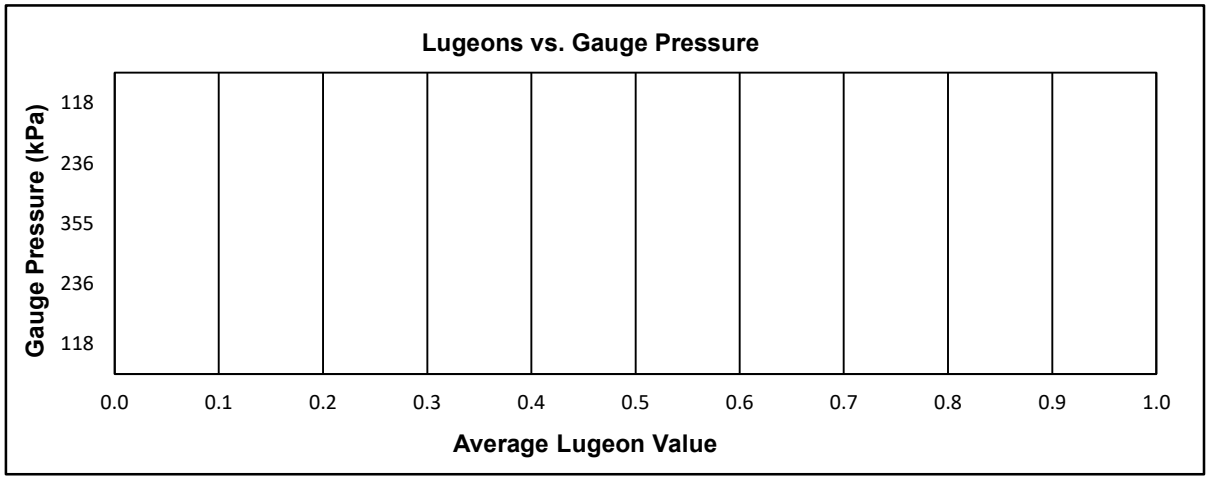
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
0	118	0	356.38	792.0	795.0	3	0	0	0.00
5	118	0	356.38	795.0	795.0	0	0	0.000	0.00
10	118	0	356.38	796.0	796.0	0	0	0.000	0.00
15	118	0	356.38	796.0	796.0	0	0	0.000	0.00
0	236	0	474.38	796.0	796.0	0	0	0	0.00
5	236	0	474.38	796.0	796.0	0	0	0.000	0.00
10	236	0	474.38	796.0	796.0	0	0	0.000	0.00
15	236	0	474.38	796.0	796.0	0	0	0.000	0.00
0	355	0	593.38	796.0	800.0	4	0	0	0.00
5	355	0	593.38	800.0	800.0	0	0	0.000	0.00
10	355	0	593.38	800.0	800.0	0	0	0.000	0.00
15	355	0	593.38	800.0	800.0	0	0	0.000	0.00
0	236	0	474.38	800.0	800.0	0	0	0	0.00
5	236	0	474.38	800.0	800.0	0	0	0.000	0.00
10	236	0	474.38	800.0	800.0	0	0	0.000	0.00
15	236	0	474.38	800.0	800.0	0	0	0.000	0.00
0	118	0	356.38	800.0	800.0	0	0	0	0.00
5	118	0	356.38	800.0	800.0	0	0	0.000	0.00
10	118	0	356.38	800.0	800.0	0	0	0.000	0.00
15	118	0	356.38	800.0	800.0	0	0	0.000	0.00

Comments:

-

BOREHOLE: BH4A





Lugeon Value: <0.1 **(Burgess 1983)**

SMEC
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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4A

Client:	OMPS	**Date of Test:**	1/07/2022
Project:	OMPHES	**Driller:**	John Mulligan
Project No:	30018018	**Tested By:**	Luis Santos
Location:	Carrai NSW	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	35.32	m	44.39	m	9.07	m

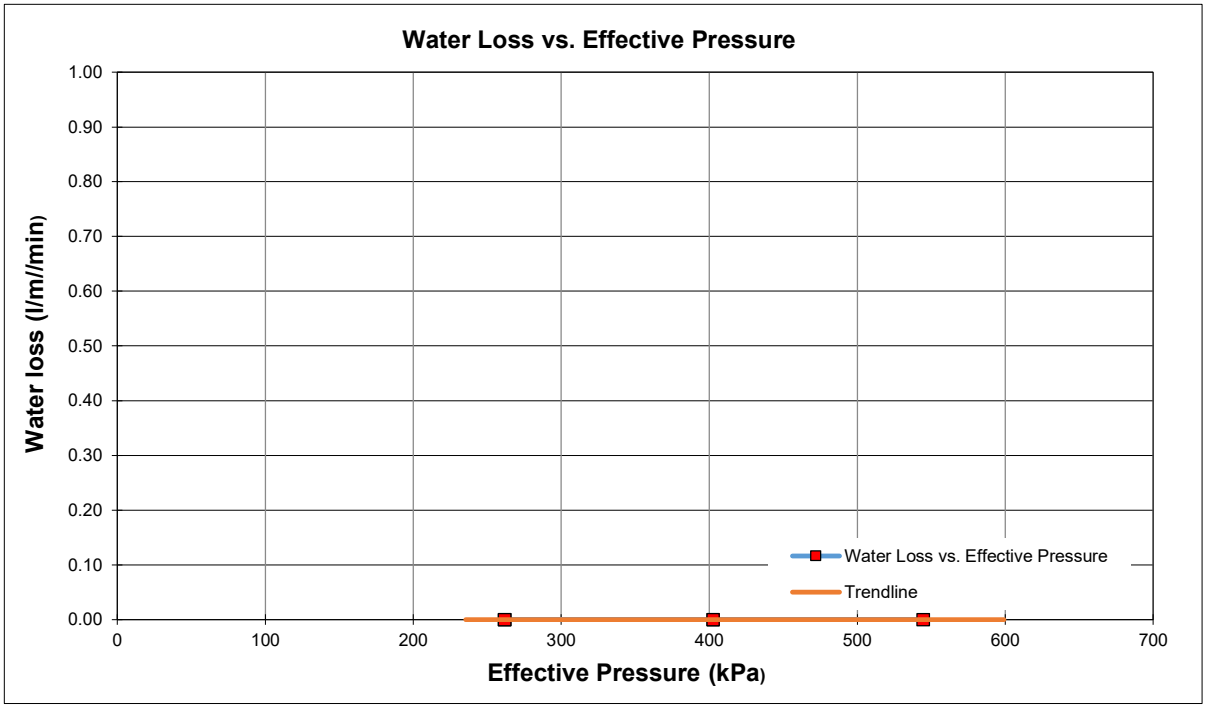
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	35.32	m
Inferred Groundwater Level:	12.10	m bgl			
Gauge Height:	0.1	m	Water Meter No:	5431278	
Hydrostatic Head:	119.7	kPa	Pump No:	G10591	

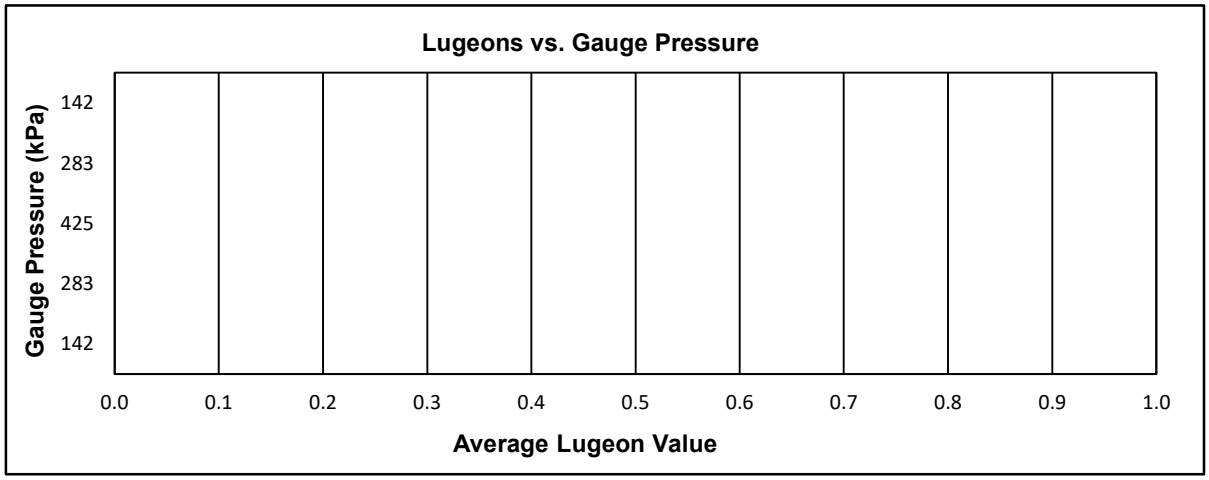
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
0	142	0	261.68	805.0	806.0	1	0	0	0.00
5	142	0	261.68	806.0	806.0	0	0	0.000	0.00
10	142	0	261.68	806.0	806.0	0	0	0.000	0.00
15	142	0	261.68	806.0	806.0	0	0	0.000	0.00
0	283	0	402.68	806.0	806.0	0	0	0	0.00
5	283	0	402.68	806.0	806.0	0	0	0.000	0.00
10	283	0	402.68	806.0	806.0	0	0	0.000	0.00
15	283	0	402.68	806.0	806.0	0	0	0.000	0.00
0	425	0	544.68	806.0	807.0	1	0	0	0.00
5	425	0	544.68	807.0	807.0	0	0	0.000	0.00
10	425	0	544.68	807.0	807.0	0	0	0.000	0.00
15	425	0	544.68	807.0	807.0	0	0	0.000	0.00
0	283	0	402.68	807.0	807.0	0	0	0	0.00
5	283	0	402.68	807.0	807.0	0	0	0.000	0.00
10	283	0	402.68	807.0	807.0	0	0	0.000	0.00
15	283	0	402.68	807.0	807.0	0	0	0.000	0.00
0	142	0	261.68	807.0	807.0	0	0	0	0.00
5	142	0	261.68	807.0	807.0	0	0	0.000	0.00
10	142	0	261.68	807.0	807.0	0	0	0.000	0.00
15	142	0	261.68	807.0	807.0	0	0	0.000	0.00

Comments:

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BOREHOLE: BH4A





Lugeon Value: <0.1 **(Burgess 1983)**

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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4A

Client:	OMPS	**Date of Test:**	1/07/2022
Project:	OMPHES	**Driller:**	John Mulligan
Project No:	30018018	**Tested By:**	Luis Santos
Location:	Carrai NSW	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	44.39	**m**	53.7	**m**	9.31	**m**

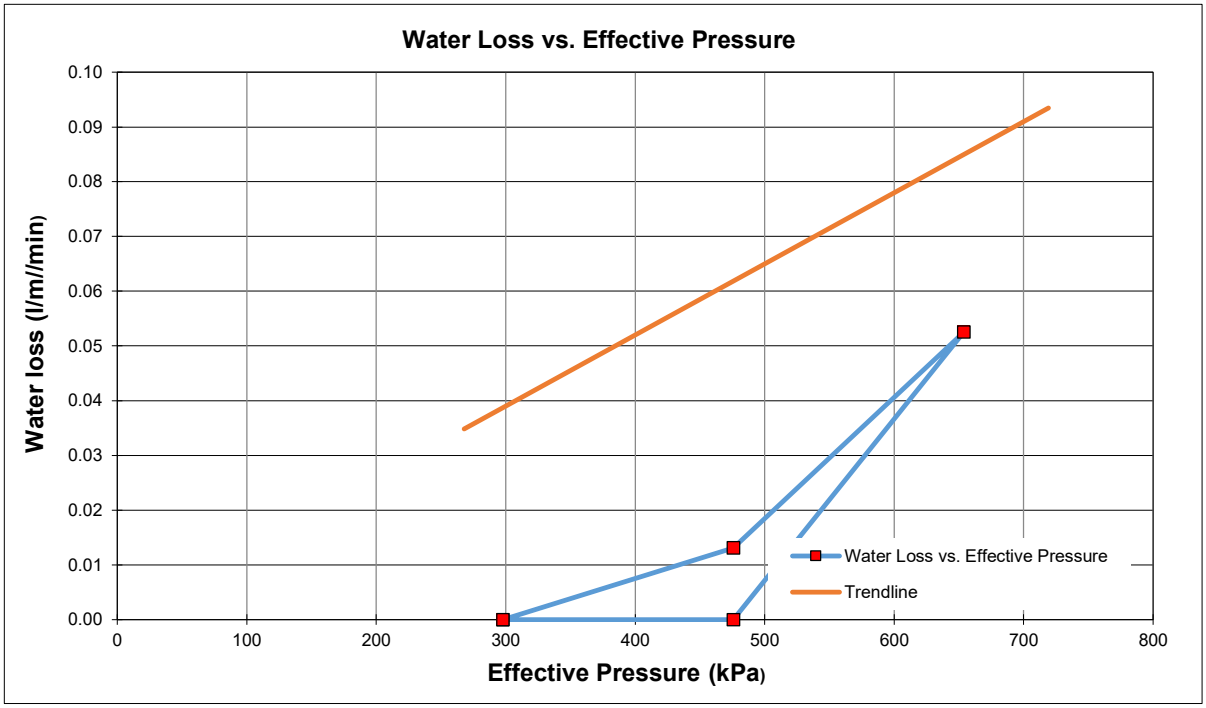
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	44.39	m
Inferred Groundwater Level:	12.10	m bgl			
Gauge Height:	0.1	m	Water Meter No:	5431278	
Hydrostatic Head:	119.7	kPa	Pump No:	G10591	

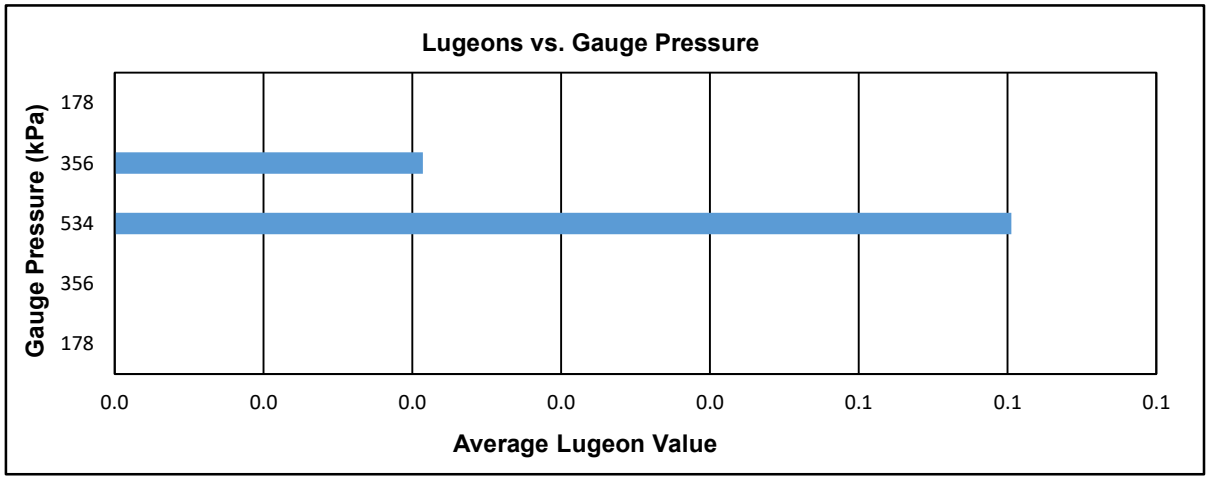
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
0	178	0	297.68	812.0	813.0	1	0	0	0.00
5	178	0	297.68	813.0	813.0	0	0	0.000	0.00
10	178	0	297.68	813.0	813.0	0	0	0.000	0.00
15	178	0	297.68	813.0	813.0	0	0	0.000	0.00
0	356	0	475.68	813.0	814.0	1	0	0	0.00
5	356	0	475.68	814.0	815.0	1	0	0.021	0.05
10	356	0	475.68	815.0	816.0	1	0	0.011	0.02
15	356	0	475.68	816.0	817.0	1	0	0.007	0.02
0	534	0	653.68	817.0	826.0	9	0	0	0.00
5	534	0	653.68	826.0	830.0	4	0	0.086	0.13
10	534	0	653.68	831.0	835.0	4	0	0.043	0.07
15	534	0	653.68	835.0	839.0	4	0	0.029	0.04
0	356	0	475.68	839.0	840.0	1	0	0	0.00
5	356	0	475.68	840.0	840.0	0	0	0.000	0.00
10	356	0	475.68	840.0	840.0	0	0	0.000	0.00
15	356	0	475.68	840.0	840.0	0	0	0.000	0.00
0	178	0	297.68	840.0	840.0	0	0	0	0.00
5	178	0	297.68	840.0	840.0	0	0	0.000	0.00
10	178	0	297.68	840.0	840.0	0	0	0.000	0.00
15	178	0	297.68	840.0	840.0	0	0	0.000	0.00

Comments:

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BOREHOLE: BH4A





Lugeon Value: 0.1 (Burgess 1983)

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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4B

Client:	OMPS	**Date of Test:**	5/07/2022
Project:	Oven mountain pumped hydro	**Driller:**	Mulligan
Project No:	30018018	**Tested By:**	LJ
Location:	Site 4	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	53.7	m	62.7	m	9	m

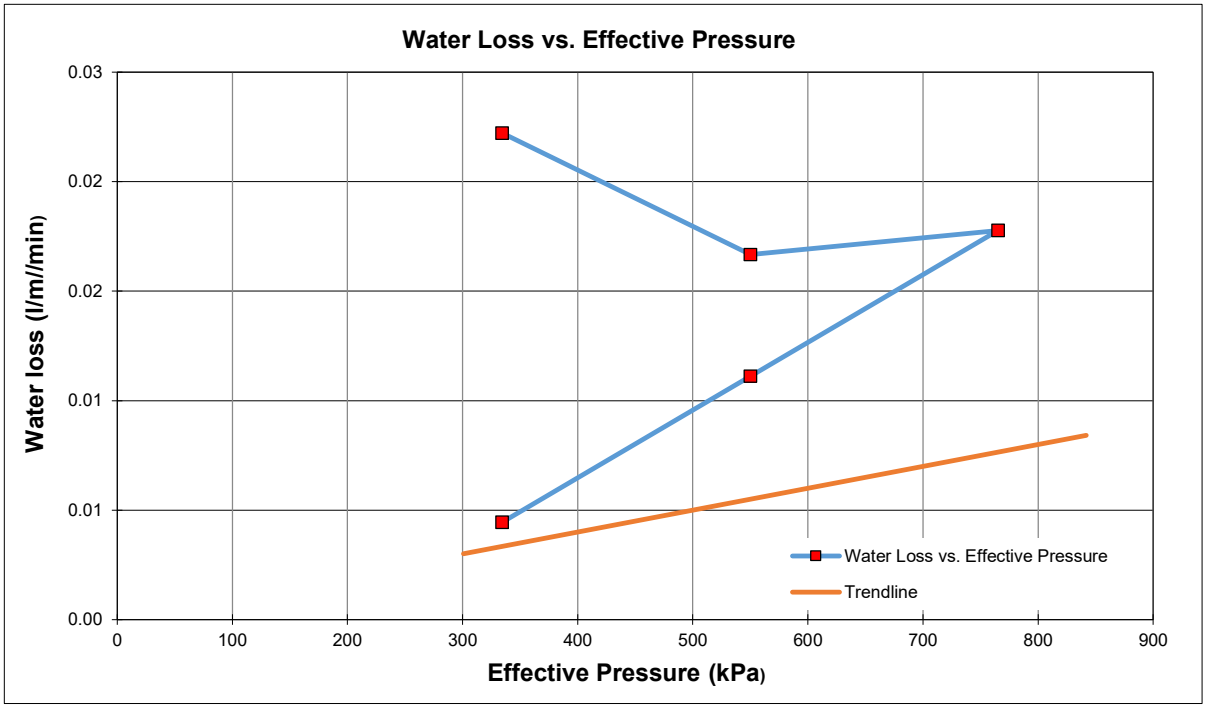
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	53.70	m
Inferred Groundwater Level:	12.15	m bgl			
Gauge Height:	0	m	Water Meter No:	160130064	
Hydrostatic Head:	119.2	kPa	Pump No:	GCAFT-2508818	

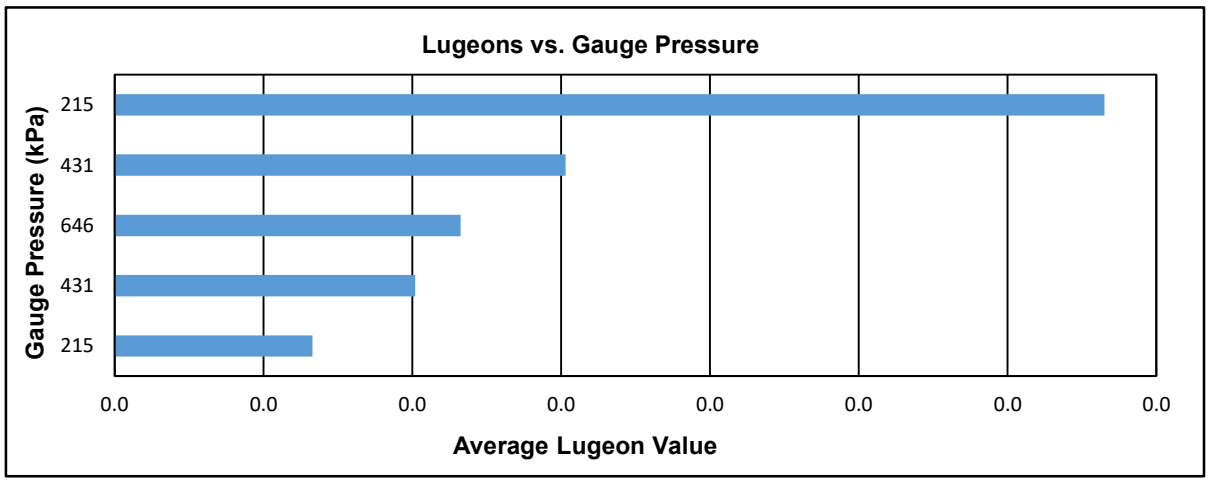
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
0	215	0	334.19	802.0	803.0	1	0	0	0.00
5	215	0	334.19	803.0	804.0	1	0	0.022	0.07
0	431	0	550.19	804.0	804.8	0.75	0	0	0.00
5	431	0	550.19	804.8	805.5	0.75	0	0.017	0.03
0	646	0	765.19	806.0	806.8	0.8	0	0	0.00
5	646	0	765.19	806.8	807.6	0.8	0	0.018	0.02
0	431	0	550.19	809.0	809.5	0.5	0	0	0.00
5	431	0	550.19	809.5	810.0	0.5	0	0.011	0.02
0	215	0	334.19	809.8	810.0	0.2	0	0	0.00
5	215	0	334.19	810.0	810.2	0.2	0	0.004	0.01

Comments:

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BOREHOLE: BH4B





Lugeon Value: <0.1 **(Burgess 1983)**

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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4B

Client:	OMPS	**Date of Test:**	4/07/2022
Project:	Oven mountain pumped hydro	**Driller:**	Mulligan
Project No:	30018018	**Tested By:**	LJ
Location:	Site 4	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	60	m	71.7	m	11.7	m

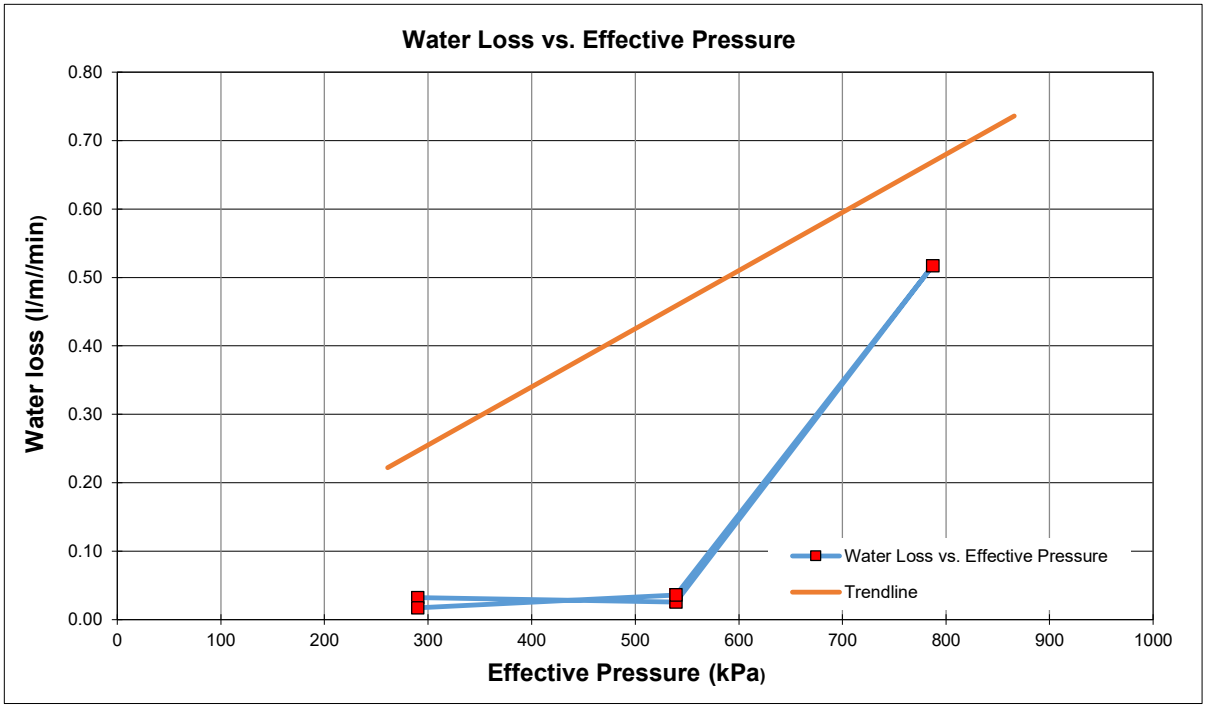
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	60.00	m
Inferred Groundwater Level:	2.60	m bgl			
Gauge Height:	1.7	m	Water Meter No:	160130064	
Hydrostatic Head:	42.2	kPa	Pump No:	GCAFT-2508818	

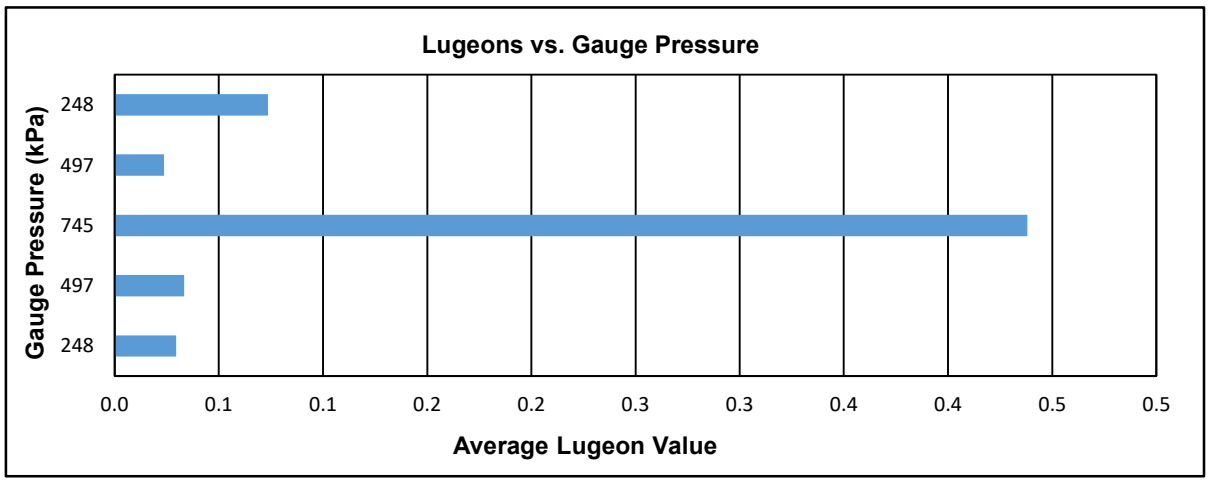
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
0	248	0	290.18	811.0	812.5	1.5	0	0	0.00
5	248	0	290.18	812.5	815.0	2.5	0	0.043	0.15
10	248	0	290.18	815.0	817.5	2.5	0	0.021	0.07
0	497	0	539.18	817.2	818.8	1.6	0	0	0.00
5	497	0	539.18	818.8	820.3	1.5	0	0.026	0.05
0	745	0	787.18	824.0	870.0	46	0	0	0.00
5	745	0	787.18	873.0	914.0	41	0	0.701	0.89
10	745	0	787.18	917.0	956.0	39	0	0.333	0.42
0	497	0	539.18	955.5	957.5	2	0	0	0.00
5	497	0	539.18	957.7	959.8	2.1	0	0.036	0.07
0	248	0	290.18	959.9	960.9	1	0	0	0.00
5	248	0	290.18	960.9	961.9	1	0	0.017	0.06

Comments:

Initial test stopped to reseat Packer at 60m due to water loss. Max pressure achieved in first test 240kPa.

BOREHOLE: BH4B





Lugeon Value: 0.9 (Burgess 1983)

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BOREHOLE WATER PRESSURE TEST RESULTS

BOREHOLE: BH4B

Client:	OMPS	**Date of Test:**	8/07/2022
Project:	Oven mountain pumped hydro	**Driller:**	Mulligan
Project No:	30018018	**Tested By:**	LJ
Location:	Site 4	**Checked By:**	Demetrius Cooper

Test Section (along BH axis)	**From**		**To**		**Length**	
	23	m	28.5	m	5.5	m

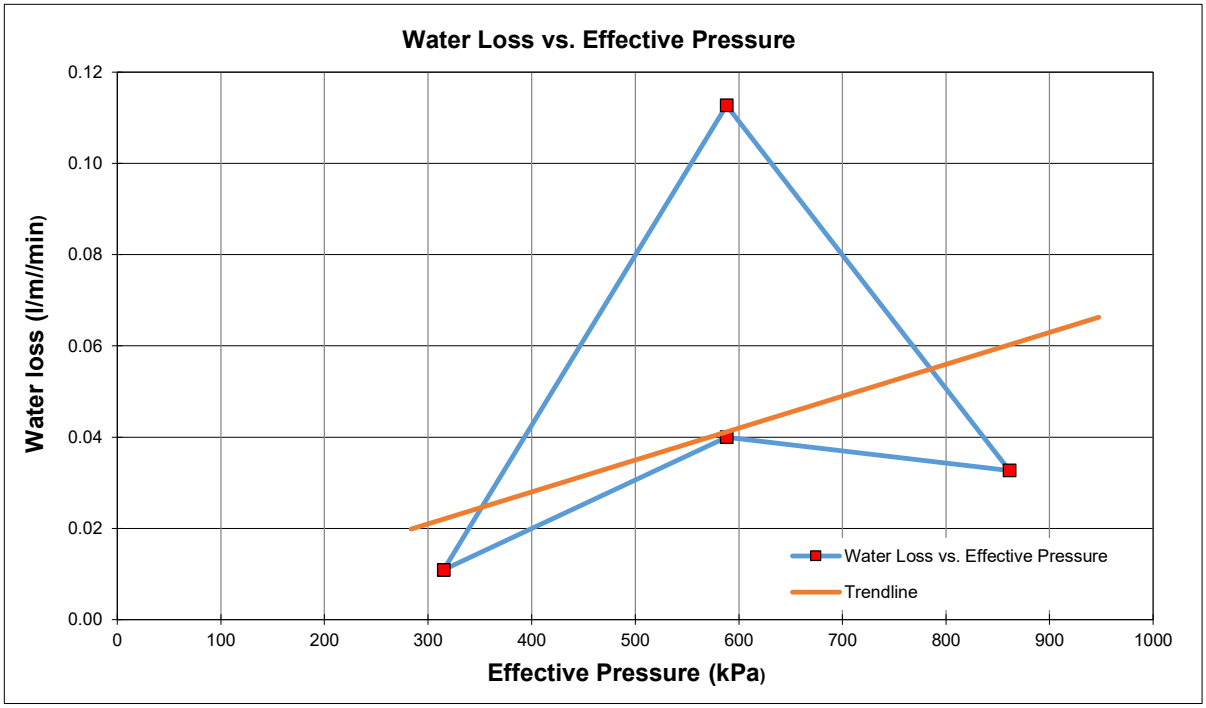
Surface Level:	0	m RL	Hole Diameter:	PQ	
Inclination of Borehole:	90	degrees	Vertical Depth of Test:	23.00	m
Inferred Groundwater Level:	2.60	m bgl			
Gauge Height:	1.7	m	Water Meter No:	160130064	
Hydrostatic Head:	42.2	kPa	Pump No:	GCAFT-2508818	

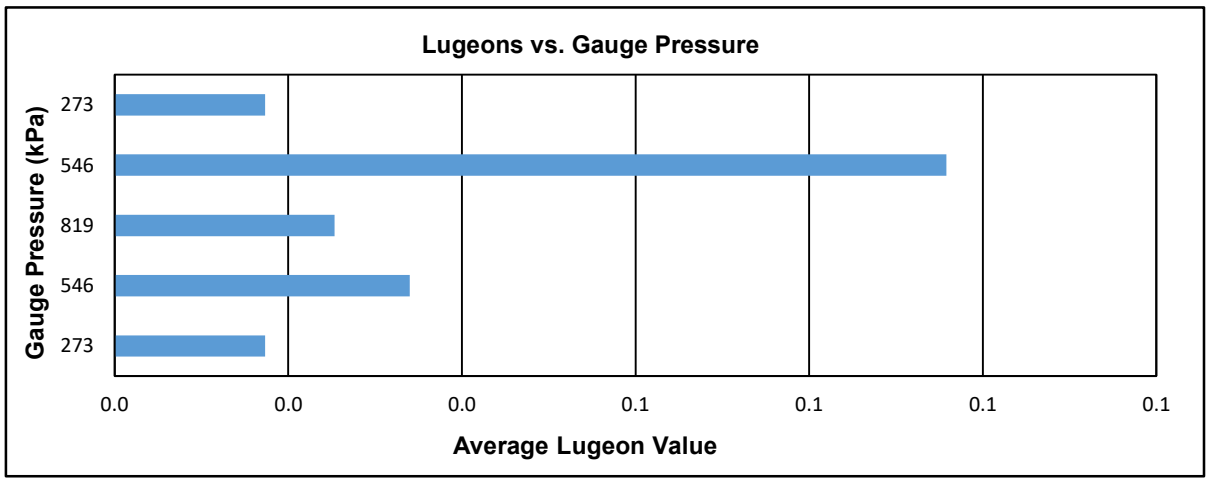
Test Duration (min)	Gauge Pressure (kPa)	Friction loss (kPa)	Effective Pressure (kPa)	Meter Start (L)	Meter End (L)	Water Loss (Gauge) (L)	Leakage (L/m/min)	Water Loss (L/m/min)	Lugeons
0	273	0	315.18	962.5	962.8	0.3	0	0	0.00
5	273	0	315.18	962.8	963.1	0.3	0	0.011	0.03
0	546	0	588.18	963.5	966.9	3.4	0	0	0.00
5	546	0	588.18	966.9	970.0	3.1	0	0.113	0.19
0	819	0	861.18	1045.5	1049.5	4	0	0	0.00
5	819	0	861.18	1049.5	1050.7	1.2	0	0.044	0.05
10	819	0	861.18	1050.7	1051.9	1.2	0	0.022	0.03
0	546	0	588.18	1049.8	1051.0	1.2	0	0	0.00
5	546	0	588.18	1051.0	1052.1	1.1	0	0.040	0.07
0	273	0	315.18	1051.7	1052.0	0.3	0	0	0.00
5	273	0	315.18	1052.0	1052.3	0.3	0	0.011	0.03

Comments:

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BOREHOLE: BH4B





Lugeon Value: <0.1 **(Burgess 1983)**

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Attachment B

Results and guideline comparisons

EMM
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Table A - Waste Classification (solids)

					Location	BH4B	BH4B	BH4B	BH4B	MB02B	MB02B	MB03B
					Field ID	BH4B_126.27-126.37	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_388.0-388.13	MB02B_0-9	MB02B_178-187	MB03B_7-20
					Sample Depth	126.27-126.37	2.39-2.51	22.05-22.3	388-388.13	0-9	178-187	7-20
					Sample Date	25/08/2022	25/08/2022	25/08/2022	25/08/2022	12/09/2022		12/09/2022
					Lab Report Number	ES2230654	ES2230654	ES2230654	ES2230654	ES2233009	ES2233009	ES2233009
				NSW 2014 General Solid Waste CT1 (No Leaching)	NSW 2014 General Solid Waste SCC1 (with leached)							
Chemical Group	**Chemical Name**	**Units**	**LOR**									
Inorganics	Fluoride	mg/kg	40	*3000*	**10000**	490	500	770	360	320	250	330
	pH (Final)	-	0.1			9.4	8.9	9.6	9.3	7.2	8.8	7.4
	pH of Leaching Fluid	-	0.1			9.4	8.9	9.6	9.3	7.2	8.8	7.4
	Moisture Content	%	0.1			<1	<1	<1	<1	0.3	0.6	2
Metals	Arsenic	mg/kg	5	*100*	**500**	<5	6	<5	<5	<5	<5	<5
	Beryllium	mg/kg	1	*20*	**100**	<1	<1	<1	<1	<1	<1	<1
	Chromium (hexavalent)	mg/kg	0.5	*100*	**1900**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Cadmium	mg/kg	1	*20*	**100**	<1	<1	<1	<1	<1	<1	<1
	Molybdenum	mg/kg	2	*100*	**1000**	<2	<2	<2	<2	<2	<2	<2
	Lead	mg/kg	5	*100*	**1500**	<5	<5	19	<5	<5	<5	<5
	Mercury	mg/kg	0.1	*4*	**50**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Nickel	mg/kg	2	*40*	**1050**	<2	3	<2	2	3	3	4
	Selenium	mg/kg	5	*20*	**50**	<5	<5	<5	<5	<5	<5	<5
	Silver	mg/kg	2	*100*	**180**	<2	<2	<2	<2	<2	<2	<2
Cyanides	Cyanide (WAD)	mg/kg	1			<1	<1	<1	<1	<1	<1	<1
	Cyanide Total	mg/kg	1	*320*	**5900**	<1	<1	<1	<1	<1	<1	<1
SVOCs	Hexachlorophene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TRH	C6-C10	mg/kg	10			<10	<10	<10	<10	<10	<10	<10
TRH - (Silica Gel Cleanup)	>C10 - C40 Fraction (sum) (SG)	mg/kg	50			<50	<50	<50	<50	<50	<50	<50
	TRH >C10-C16 (after silica gel clean-up)	mg/kg	50			<50	<50	<50	<50	<50	<50	<50
	TRH >C16-C34 (after silica gel clean-up)	mg/kg	100			<100	<100	<100	<100	<100	<100	<100
	TRH >C34-C40 (after silica gel clean-up)	mg/kg	100			<100	<100	<100	<100	<100	<100	<100
	TRH C10-C36 (Total) (after silica gel clean-up)	mg/kg	50			<50	<50	<50	<50	<50	<50	<50
TPH	C6-C9	mg/kg	10	*650*	**650**	<10	<10	<10	<10	<10	<10	<10
TPH - (Silica Gel Cleanup)	TPH C10-C14 Fraction after Silica Cleanup	mg/kg	50			<50	<50	<50	<50	<50	<50	<50
	TPH C15-C28 Fraction after Silica Cleanup	mg/kg	100			<100	<100	<100	<100	<100	<100	<100
	TPH C29-C36 Fraction after Silica Cleanup	mg/kg	100			<100	<100	<100	<100	<100	<100	<100
BTEX	Benzene	mg/kg	0.2	*10*	**18**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.5	*600*	**1080**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Toluene	mg/kg	0.5	*288*	**518**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Xylene (m & p)	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Xylene (o)	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PAH	Naphthalene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Acenaphthene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Anthracene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benz(a)anthracene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a) pyrene	mg/kg	0.5	*0.8*	**10**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(b+j+k)fluoranthene	mg/kg	1			<1	<1	<1	<1	<1	<1	<1
	Benzo(g,h,i)perylene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chrysene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Fluoranthene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Fluorene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	PAHs (Sum of total)	mg/kg	0.5	*200*	**200**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Phenanthrene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Pyrene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorinated Hydrocarbons	Dichloromethane	mg/kg	0.5	*172*	**310**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,1,1,2-tetrachloroethane	mg/kg	0.5	*200*	**360**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,1,1-trichloroethane	mg/kg	0.5	*600*	**1080**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,1,2,2-tetrachloroethane	mg/kg	0.5	*26*	**46.8**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,1,2-trichloroethane	mg/kg	0.5	*24*	**43.2**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,1-dichloroethene	mg/kg	0.5	*14*	**25**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,2-dichloroethane	mg/kg	0.5	*10*	**18**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Carbon tetrachloride	mg/kg	0.5	*10*	**18**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chloroform	mg/kg	0.5	*120*	**216**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Tetrachloroethene	mg/kg	0.5	*14*	**25.2**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Trichloroethene	mg/kg	0.5	*10*	**18**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Vinyl chloride	mg/kg	0.2	*4*	**7.2**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
MAH	Styrene	mg/kg	0.5	*60*	**108**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table A - Waste Classification (solids)

					Location	BH4B	BH4B	BH4B	BH4B	MB02B	MB02B	MB03B
					Field ID	BH4B_126.27-126.37	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_388.0-388.13	MB02B_0-9	MB02B_178-187	MB03B_7-20
					Sample Depth	126.27-126.37	2.39-2.51	22.05-22.3	388-388.13	0-9	178-187	7-20
					Sample Date	25/08/2022	25/08/2022	25/08/2022	25/08/2022	12/09/2022		12/09/2022
					Lab Report Number	ES2230654	ES2230654	ES2230654	ES2230654	ES2233009	ES2233009	ES2233009
				NSW 2014 General Solid Waste CT1 (No Leaching)	NSW 2014 General Solid Waste SCC1 (with leached)							
Chemical Group	**Chemical Name**	**Units**	**LOR**									
Phenols	Picloram	mg/kg	0.02	*60*	**110**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	2,4,5-Trichlorophenol	mg/kg	0.5	*8000*	**14400**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	2,4,6-Trichlorophenol	mg/kg	0.5	*40*	**72**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	2-Methylphenol	mg/kg	0.5	*4000*	**7200**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	3&4-Methylphenol (m&p-cresol)	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Pentachlorophenol	mg/kg	1			<1	<1	<1	<1	<1	<1	<1
	4-chloro-3-methylphenol	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Phenol	mg/kg	0.5		**518**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	2,3,4,6-Tetrachlorophenol	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Halogenated Benzenes	1,2,3,4-tetrachlorobenzene	mg/kg	0.5	*10*	**18**	<1.5[#1]	<1.5[#1]	<1.5[#1]	<1.5[#1]	<0.5	<0.5	<0.5
	1,2,4,5-tetrachlorobenzene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Hexachlorobenzene	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Pentachlorobenzene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,2,4-trichlorobenzene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,2-dichlorobenzene	mg/kg	0.5	*86*	**155**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	1,4-dichlorobenzene	mg/kg	0.5	*150*	**270**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chlorobenzene	mg/kg	0.5	*2000*	**3600**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Herbicides	2,4,5-TP (Silvex)	mg/kg	0.02			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	2,4,5-Trichlorophenoxy Acetic Acid	mg/kg	0.02			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Fluroxypyr	mg/kg	0.02	*40*	**75**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Hedonal	mg/kg	0.02	*200*	**10**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Triclopyr	mg/kg	0.02	*40*	**75**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Organochlorine Pesticides	a-BHC	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	4,4-DDE	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Aldrin	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	b-BHC	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Chlordane (cis)	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Chlordane (trans)	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	d-BHC	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	DDD	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	DDT	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Dieldrin	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Endosulfan I	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Endosulfan II	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Endrin	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Endosulfan sulphate	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Endrin aldehyde	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	g-BHC (Lindane)	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Heptachlor	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Heptachlor epoxide	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	chlordane	mg/kg	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Sum of Endosulfans (inc. sulfate)	mg/kg	0.05		**108**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Organophosphorous Pesticides	Chlorpyrifos	mg/kg	0.05	*4*	**7.5**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCBs	PCBs (Sum of total)	mg/kg	0.1	*50*	**50**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pesticides	Isodrin	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitroaromatics	Pentachloronitrobenzene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phthalates	Bis(2-ethylhexyl) phthalate	mg/kg	5			<5	<5	<5	<5	<5	<5	<5
Solvents	Methyl Ethyl Ketone	mg/kg	5	*4000*	**7200**	<5	<5	<5	<5	<5	<5	<5
Explosives	2,4-Dinitrotoluene	mg/kg	1	*2.6*	**4.68**	<1	<1	<1	<1	<1	<1	<1
	Nitrobenzene	mg/kg	0.5	*40*	**72**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Di(2-ethylhexyl)adipate	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Other	Sum of plasticisers	mg/kg	0.5		**600**	<5[#1]	<5[#1]	<5[#1]	<5[#1]	<5[#1]	<5[#1]	<5[#1]
	Sum of Scheduled Chemicals	mg/kg	0.05		**50**	<10[#1]	<10[#1]	<10[#1]	<10[#1]	<10[#1]	<10[#1]	<10[#1]

Notes

#1 Reported Analyte LOR is higher than Requested Analyte LOR

				Location	BH4B	BH4B	BH4B	BH4B	MB02B	MB02B	MB03B
				Field ID	BH4B_126.27-126.37	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_388.0-388.13	MB02B_0-9	MB02B_178-187	MB03B_7-20
				Sample Depth (mbgl)	126.27-126.37	2.39-2.51	22.05-22.3	388-388.13	0-9	178-187	7-20
				Sampled Date	25/08/2022	25/08/2022	25/08/2022	25/08/2022	12/09/2022	12/09/2022	12/09/2022
				Lab Report Number	ES2230654	ES2230654	ES2230654	ES2230654	ES2233009	ES2233009	ES2233009
				NSW 2014 General Solid Waste TCLP1 (leached)							
Chemical Group	**Chemical Name**	**Units**	**LOR**								
Cyanides	Cyanide (WAD)	mg/L	0.004		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Analytical – general	pH (Lab)	-	0.01		7.53	7.21	7.62	7.62	6.73	7.03	6.52
	Electrical Conductivity (Lab)	µS/cm	1		31	19	37	27	19	27	25
Analytical – alkalinity	Alkalinity (Bicarbonate as $CaCO_3$)	mg/L	1		16	7	14	15	4	11	6
	Alkalinity (Carbonate as $CaCO_3$)	mg/L	1		<1	<1	<1	<1	<1	<1	<1
	Alkalinity (Hydroxide) as $CaCO_3$	mg/L	1		<1	<1	<1	<1	<1	<1	<1
	Alkalinity (total) as $CaCO_3$	mg/L	1		16	7	14	15	4	11	6
Inorganics	Cyanide Total	mg/L	0.004	**16**	<0.004	<0.004	<0.004	0.024	<0.004	<0.004	<0.004
	Chloride	mg/L	1		<1	<1	<1	<1	2	2	2
	Fluoride	mg/L	0.1	**150**	0.1	<0.1	0.1	<0.1	0.2	<0.1	0.1
	Sulfate as SO_4 - Turbidimetric	mg/L	1		<1	<1	<1	<1	<1	<1	4
Metals	Aluminium	mg/L	0.1		4	4.1	3.1	4.2	3.9	3	2.4
	Arsenic	mg/L	0.1	**5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Beryllium	mg/L	0.05	**1**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Boron	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Antimony	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chromium (hexavalent)	mg/L	0.01	**5**	<0.01	<0.1[#1]	<0.01	<0.01	<0.01	<0.01	<0.01
	Cadmium	mg/L	0.05	**1**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Molybdenum	mg/L	0.1	**5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chromium (III+VI)	mg/L	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Iron	mg/L	0.1		4.2	2.6	1	4.3	5.9	4.8	2.1
	Lead	mg/L	0.1	**5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Manganese	mg/L	0.1		<0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1
	Mercury	mg/L	0.001	**0.2**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Nickel	mg/L	0.1	**2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Selenium	mg/L	0.05	**1**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Silver	mg/L	0.1	**5**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BTEX	Naphthalene (VOC)	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Benzene	µg/L	1	**500**	<1	<1	<1	<1	<1	<1	<1
	Ethylbenzene	µg/L	2	**30000**	<2	<2	<2	<2	<2	<2	<2
	Toluene	µg/L	2	**14400**	<2	<2	<2	<2	<2	<2	<2
	Xylene (m & p)	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Xylene (o)	µg/L	2		<2	<2	<2	<2	<2	<2	<2
Phenols	2,4,5-Trichlorophenol	µg/L	2	**400000**	<2	<2	<2	<2	<2	<2	<2
	2,4,6-Trichlorophenol	µg/L	2	**2000**	<2	<2	<2	<2	<2	<2	<2
	2,4-Dichlorophenol	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2,4-Dimethylphenol	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2,6-Dichlorophenol	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2-Chlorophenol	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2-Nitrophenol	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2-Methylphenol	µg/L	2	**200000**	<2	<2	<2	<2	<2	<2	<2
	3&4-Methylphenol (m&p-cresol)	µg/L	4		<4	<4	<4	<4	<4	<4	<4
	Pentachlorophenol	µg/L	4		<4	<4	<4	<4	<4	<4	<4
	4-chloro-3-methylphenol	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Phenol	µg/L	2	**14400**	<2	<2	<2	<2	<2	<2	<2
	2,3,4,6-Tetrachlorophenol	µg/L	2		<2	<2	<2	<2	<2	<2	<2
Amino Aliphatics	N-nitrosodiethylamine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	N-nitrosodi-n-butylamine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	N-nitrosodi-n-propylamine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	N-Nitrosomethylethylamine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
Amino Aromatics	1-naphthylamine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	N-Nitrosodiphenyl & Diphenylamine	µg/L	4		<4	<4	<4	<4	<4	<4	<4
Anilines	2-methyl-5-nitroaniline	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2-nitroaniline	µg/L	4		<4	<4	<4	<4	<4	<4	<4
	3-nitroaniline	µg/L	4		<4	<4	<4	<4	<4	<4	<4
	4-chloroaniline	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	4-nitroaniline	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Aniline	µg/L	2		<2	<2	<2	<2	<2	<2	<2
Chlorinated Hydrocarbons	Dichloromethane	µg/L	5	**8600**	<5	<5	<5	<5	<5	<5	<5
	Hexachlorocyclopentadiene	µg/L	10		<10	<10	<10	<10	<10	<10	<10
	Hexachloroethane	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	1,1,1,2-tetrachloroethane	µg/L	5	**10000**	<5	<5	<5	<5	<5	<5	<5
	1,1,1-trichloroethane	µg/L	5	**30000**	<5	<5	<5	<5	<5	<5	<5
	1,1,2,2-tetrachloroethane	µg/L	5	**1300**	<5	<5	<5	<5	<5	<5	<5
	1,1,2-trichloroethane	µg/L	5	**1200**	<5	<5	<5	<5	<5	<5	<5
	1,1-dichloroethane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	1,1-dichloroethene	µg/L	5	**700**	<5	<5	<5	<5	<5	<5	<5
	1,1-dichloropropene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	1,2,3-trichloropropane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	1,2-dibromo-3-chloropropane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	1,2-dichloroethane	µg/L	5	**500**	<5	<5	<5	<5	<5	<5	<5
	1,2-dichloropropane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	1,3-dichloropropane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	2,2-dichloropropane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Bromodichloromethane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Bromoform	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Carbon tetrachloride	µg/L	5	**500**	<5	<5	<5	<5	<5	<5	<5
	Chlorodibromomethane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Chloroethane	µg/L	50		<50	<50	<50	<50	<50	<50	<50
	Chloroform	µg/L	5	**6000**	<5	<5	<5	<5	<5	<5	<5
	Chloromethane	µg/L	50		<50	<50	<50	<50	<50	<50	<50
	cis-1,2-dichloroethene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	cis-1,3-dichloropropene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Dibromomethane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Hexachlorobutadiene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Tetrachloroethene	µg/L	5	**700**	<5	<5	<5	<5	<5	<5	<5
	trans-1,2-dichloroethene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	trans-1,3-dichloropropene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Trichloroethene	µg/L	5	**500**	<5	<5	<5	<5	<5	<5	<5
	Vinyl chloride	µg/L	50	**200**	<50	<50	<50	<50	<50	<50	<50
Explosives	1,3,5-Trinitrobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2,4-Dinitrotoluene	µg/L	4	**130**	<4	<4	<4	<4	<4	<4	<4
	2,6-dinitrotoluene	µg/L	4		<4	<4	<4	<4	<4	<4	<4
	Nitrobenzene	µg/L	2	**2000**	<2	<2	<2	<2	<2	<2	<2
Halogenated Benzenes	1,2,4,5-tetrachlorobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	1,3,5-Trichlorobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Hexachlorobenzene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Pentachlorobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	1,2,3-trichlorobenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	1,2,4-trichlorobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	1,2-dichlorobenzene	µg/L	2	**4300**	<2	<2	<2	<2	<2	<2	<2
	1,3-dichlorobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	1,4-dichlorobenzene	µg/L	2	**7500**	<2	<2	<2	<2	<2	<2	<2
	2-chlorotoluene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	4-chlorotoluene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Bromobenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Chlorobenzene	µg/L	5	**100000**	<5	<5	<5	<5	<5	<5	<5
Halogenated Hydrocarbons	1,2-dibromoethane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Bromomethane	µg/L	50		<50	<50	<50	<50	<50	<50	<50
	Dichlorodifluoromethane	µg/L	50		<50	<50	<50	<50	<50	<50	<50
	Iodomethane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Trichlorofluoromethane	µg/L	50		<50	<50	<50	<50	<50	<50	<50
Herbicides	Diallate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Atrazine	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Simazine	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Pronamide	µg/L	2		<2	<2	<2	<2	<2	<2	<2
MAH	1,2,4-trimethylbenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	1,3,5-trimethylbenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5

				Location	BH4B	BH4B	BH4B	BH4B	MB02B	MB02B	MB03B
				Field ID	BH4B_126.27-126.37	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_388.0-388.13	MB02B_0-9	MB02B_178-187	MB03B_7-20
				Sample Depth (mbgl)	126.27-126.37	2.39-2.51	22.05-22.3	388-388.13	0-9	178-187	7-20
				Sampled Date	25/08/2022	25/08/2022	25/08/2022	25/08/2022	12/09/2022	12/09/2022	12/09/2022
				Lab Report Number	ES2230654	ES2230654	ES2230654	ES2230654	ES2233009	ES2233009	ES2233009
				NSW 2014 General Solid Waste TCLP1 (leached)							
Chemical Group	**Chemical Name**	**Units**	**LOR**								
MAH	Isopropylbenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	n-butylbenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	n-propylbenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	p-isopropyltoluene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	sec-butylbenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Styrene	µg/L	5	**3000**	<5	<5	<5	<5	<5	<5	<5
	tert-butylbenzene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
Nitroaromatics	2-Picoline	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	4-aminobiphenyl	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Pentachloronitrobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
Organochlorine Pesticides	a-BHC	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	4,4-DDE	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Aldrin	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	b-BHC	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chlordane (cis)	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chlordane (trans)	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	d-BHC	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	DDD	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	DDT	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	DDT+DDE+DDD	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Dieldrin	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Endosulfan I	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Endosulfan II	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Endrin	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Endosulfan sulphate	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Endrin aldehyde	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Endrin ketone	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	g-BHC (Lindane)	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Heptachlor	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Heptachlor epoxide	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Methoxychlor	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Aldrin + Dieldrin	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	chlordane	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Organophosphorous Pesticides	Isosafrole (cis)	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Isosafrole (trans)	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Methyl methanesulfonate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Safrole	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Azinophos methyl	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Bromophos-ethyl	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chlorpyrifos	µg/L	0.5	**200**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chlorpyrifos-methyl	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Diazinon	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Dichlorvos	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Dimethoate	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Ethion	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Malathion	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Carbophenothion	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Chlorfenvinphos	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Fenthion	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Methyl parathion	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Monocrotophos	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Prothiofos	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Other	Acetophenone	µg/L	2		<2	<2	<2	<2	<2	<2	<2
PAH	Naphthalene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2-chloronaphthalene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	3-methylcholanthrene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	7,12-dimethylbenz(a)anthracene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2-methylnaphthalene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Acenaphthene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Acenaphthylene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Anthracene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Benz(a)anthracene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Benzo(a) pyrene	µg/L	2	**40**	<2	<2	<2	<2	<2	<2	<2
	Benzo(a)pyrene TEQ calc (Zero)	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Benzo(b+j+k)fluoranthene	µg/L	4		<4	<4	<4	<4	<4	<4	<4
	Benzo(g,h,i)perylene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Chrysene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Dibenz(a,h)anthracene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Fluoranthene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Fluorene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	PAHs (Sum of total)	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Indeno(1,2,3-c,d)pyrene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Phenanthrene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Pyrene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
Pesticides	Cypermethrins(total)	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Methoprene	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Carbazole	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Chlorobenzilate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Parathion	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Demeton-S-methyl	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Fenamiphos	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Pirimphos-ethyl	µg/L	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phthalates	Bis(2-ethylhexyl) phthalate	µg/L	10		<10	<10	<10	<10	<10	<10	<10
	Butyl benzyl phthalate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Diethylphthalate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Dimethyl phthalate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Di-n-butyl phthalate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Di-n-octyl phthalate	µg/L	2		<2	<2	<2	<2	<2	<2	<2
Solvents	Acetone	µg/L	50		<50	<50	<50	<50	<50	<50	<50
	Isophorone	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	2-hexanone (MBK)	µg/L	50		<50	<50	<50	<50	<50	<50	<50
	4-Methyl-2-pentanone	µg/L	50		<50	<50	<50	<50	<50	<50	<50
	Carbon disulfide	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Methyl Ethyl Ketone	µg/L	50	**200000**	<50	<50	<50	<50	<50	<50	<50
	Vinyl acetate	µg/L	50		<50	<50	<50	<50	<50	<50	<50
SVOCs	2-(acetylamino) fluorene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	3,3-Dichlorobenzidine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	4-(dimethylamino) azobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	4-bromophenyl phenyl ether	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	4-chlorophenyl phenyl ether	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	4-Nitroquinoline-N-oxide	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Azobenzene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Bis(2-chloroethoxy) methane	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Bis(2-chloroethyl)ether	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Dibenzofuran	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Hexachloropropene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	Methapyrilene	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	N-nitrosomorpholine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	N-nitrosopiperidine	µg/L	2		<2	<2	<2	<2	<2	<2	<2
	N-nitrosopyrrolidine	µg/L	4		<4	<4	<4	<4	<4	<4	<4
	Phenacetin	µg/L	2		<2	<2	<2	<2	<2	<2	<2
VOCs	cis-1,4-Dichloro-2-butene	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	Pentachloroethane	µg/L	5		<5	<5	<5	<5	<5	<5	<5
	trans-1,4-Dichloro-2-butene	µg/L	5		<5	<5	<5	<5	<5	<5	<5

#1 Reported Analyte LOR is higher than Requested Analyte LOR

Table C - Acid Base Accounting Results

Location	BH4B	BH4B	BH4B	BH4B	BH4B	MB01A	MB03B
Field ID	BH4B_6.40-6.52	BH4B_39.74-39.91	BH4B_71.0-71.20	BH4B_148.17-148.36	BH4B_419.0-419.14	MB01A_26-36.5	MB03B_21-29
Sample Depth	6.4-6.52	39.74-39.91	71-71.2	148.17-148.36	419-419.14	26-36.5	21-29
Sample Date	25/08/2022	25/08/2022	25/08/2022	25/08/2022	25/08/2022	12/09/2022	12/09/2022
Lab Report Number	ES2230654	ES2230654	ES2230654	ES2230654	ES2230654	ES2233009	ES2233009

Chemical Group	Chemical Name	Units	LOR							
Field	pH (field)	pH	0.1	8.5	8.1	7	9.3	9.4	8.5	9.3
	Field pH of Peroxide extract	pH	0.1	4.9	3.4	2.9	3	5.3	6.2	5.7
Net Acid Generation	NAG (pH 4.5)	kg H2SO4/t	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	NAG (pH 7.0)	kg H2SO4/t	0.1	<0.1	0.5	3.5	<0.1	1.9	<0.1	1.2
	pH (Ox)	pH	0.1	7.1	6.9	4.6	10.8	6.7	9.8	5.9
Acid neutralising capacity	ANC as CaCO3	% CaCO3	0.1	1.8	1	1.5	6	0.7	4.4	1.9
	ANC as H2SO4	kg H2SO4 eq/t	0.5	17.8	9.5	14.8	59	7.2	43.3	18.7
	Maximum potential acidity[1]	kg H2SO4 eq/t		0.918	1.53	5.508	27.846	0.153	0.918	4.896
	Net Acid Production Potential[2]	kg H2SO4 eq/t		-16.882	-7.97	-9.292	-31.154	-7.047	-42.382	-13.804
	Fizz Rating	Fizz Unit	0	1	0	1	2	0	2	1
	Reaction Rate	Reaction unit	1	2	2	2	2	2	1	1
Sulfur and carbon	TOC	mg/kg	200	200	3800	600	<200	<200	<200	200
	TOC	%	0	0.02	0.38	0.06	<0.02	<0.02	<0.02	0.02
	Sulfur - Total as S (LECO)	mg/kg	100	300	500	1800	9100	<100	300	1600
	Sulfur - Total as S (LECO)	%	0	0.03	0.05	0.18	0.91	<0.01	0.03	0.16

Notes

[1] Maximum potential acidity calculated by Sulfur - Total as S * 30.6

[2] Net Acid Production Potential - Maximum potential acidity - Net Acid Production Potential

Table D - Rock leachable metals concentrations

								Location	BH4B	BH4B	BH4B	BH4B	BH4B	MB01A	MB03B
								Field ID	BH4B_148.17-148.36	BH4B_39.74-39.91	BH4B_419.0-419.14	BH4B_6.40-6.52	BH4B_71.0-71.20	MB01A_26-36.5	MB03B_7-20
								Sample Depth	148.17-148.36	39.74-39.91	419-419.14	6.4-6.52	71-71.2	26-36.5	7-20
								Sample Date	25-08-22	25-08-22	25-08-22	25-08-22	25-08-22	12-09-22	12-09-22
								Lab Report Number	ES2239415	ES2239415	ES2239415	ES2239415	ES2239415	ES2239415	ES2239415
				ANZG 2018 Freshwater 95% Toxicant DGV	ADWG 2011 Health	NSW 2014 General Solid Waste TCLP1 (leached)	ADWG 2011 Aesthetic	Baseline groundwater median concentration	Baseline groundwater 95th percentile							
Chemical Group	**Chemical Name**	**Units**	**LOR**													
Metals	Aluminium	mg/L	0.01	*0.055*			0.2	**0.1**	0.22	***0.79***	***3.82***	***3.38***	***4.88***	***4.3***	***2.39***	***3.97***
	Arsenic	mg/L	0.001	*0.013*	0.01	5		**0.01**	0.05	0.005	0.004	<0.001	0.008	0.008	***0.019***	0.003
	Barium	mg/L	0.001		2					0.002	0.026	0.033	0.032	0.025	0.015	0.024
	Boron	mg/L	0.05	*0.94*	4					<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Thallium	mg/L	0.001	*0.00003*						*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
	Uranium	mg/L	0.001	*0.0005*	0.02					***0.001***	*<0.001*	***0.002***	*<0.001*	*<0.001*	*<0.001*	*<0.001*
	Antimony	mg/L	0.001	*0.009*	0.003			**0.01**	0.011	<0.001	0.004	<0.001	<0.001	0.003	***0.016***	<0.001
	Tin	mg/L	0.001							<0.001	0.008	0.006	0.006	0.002	0.002	0.005
	Titanium	mg/L	0.01							<0.01	0.3	0.44	0.34	0.21	0.1	0.25
	Cadmium	mg/L	0.0001	*0.0002*	0.002	1		**0.005**	0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	*0.0003*	<0.0001
	Molybdenum	mg/L	0.001	*0.034*	0.05*	5				0.002	<0.001	<0.001	0.001	0.015	<0.001	<0.001
	Chromium (III+VI)	mg/L	0.001	*0.0033*	0.05			**0.01**	0.01	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
	Cobalt	mg/L	0.001	*0.001*						<0.001	*0.002*	*0.001*	*0.002*	*0.002*	*0.002*	*0.003*
	Copper	mg/L	0.001	*0.0014*	2		1	**0.01**	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Strontium	mg/L	0.001							0.021	0.008	0.005	0.015	0.025	0.016	0.028
	Iron	mg/L	0.05				0.3	**0.43**	2.864	0.38	**3.09**	**4.11**	**4.96**	**5.14**	**2.06**	**3.2**
	Lead	mg/L	0.001	*0.0034*	0.01	5		**0.01**	0.01	<0.001	<0.001	0.001	0.001	*0.005*	<0.001	<0.001
	Manganese	mg/L	0.001	*1.9*	0.5		0.1	**0.13**	1.9725	0.005	0.044	0.051	0.068	0.121	0.041	0.088
	Nickel	mg/L	0.001	*0.011*	0.02	2		**0.01**	0.01	<0.001	0.003	<0.001	0.004	0.005	0.001	0.006
	Selenium	mg/L	0.01	*0.005***	0.01	1				*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
	Silver	mg/L	0.001	*0.00005*	0.1	5				*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
	Vanadium	mg/L	0.01	*0.006*						*<0.01*	*<0.01*	*<0.01*	***0.01***	*<0.01*	*<0.01*	*<0.01*
	Zinc	mg/L	0.005	*0.008*			3	**0.01**	0.031	<0.005	<0.005	***0.011***	***0.016***	***0.029***	<0.005	***0.019***
	Gallium	mg/L	0.001							0.001	0.002	0.001	0.002	0.001	0.002	0.001
	Tungsten	mg/L	0.001							0.032	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
	Thorium	mg/L	0.001							<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001

*Conservatively adopted speciated chromium (VI)
**Adopted the 99% criteria due to bioaccumulation

Attachment C

Laboratory certificates of analysis

EMM
creating opportunities

CHAIN OF CUSTODY

ALS Laboratory **please tick →**

CLIENT: EMM CONSULTING	**TURNAROUND REQUIREMENTS :** ☒ Standard TAT (List due date):		**FOR LABORATORY USE ONLY (Circle)**
OFFICE: 20 Chandos Street, St Leonards	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		Custody Seal Intact? Yes No N/A
PROJECT: Oven Mountain Pumped Storage Project **PROJECT NO.:** J200698	**ALS QUOTE NO:** NA	**COC SEQUENCE NUMBER (Circle)**	Free ice / frozen ice bricks present upon receipt? Yes No N/A
PURCHASE ORDER: J200698	**COUNTRY OF ORIGIN:**	COC: ① 2 3 4 5 6 7	Random Sample Temperature on Receipt. °C
PROJECT MANAGER: Henry Noakes	**CONTACT PH:** 0448 772 835	OF: ① 2 3 4 5 6 7	Other comment:
SAMPLER: Henry Noakes	**SAMPLER MOBILE:** 0448 772 835	**RELINQUISHED BY:** HJN	**RECEIVED BY:** J GA
COC Emailed to ALS? (YES)	**EDD FORMAT (or default):** esdat		
Email Reports to: hnoakes@emmconsulting.com.au / ccassidy@emmconsulting.com.au / ebayer@emmconsulting.com.au / emmconsulting@esdat.net; rtruscott@emmconsulting.com.au; mskold@emmconsulting.com.au		DATE/TIME: 12/09/2022	DATE/TIME: 14/09/22 1515
Email Invoice to finance@emmconsulting.com.au / hnoakes@emmconsulting.com.au			

RELINQUISHED BY:	**RECEIVED BY:**
DATE/TIME	DATE/TIME

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS (MATRIX: Solid(S) Water(W))				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB: Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).									Additional Information
LAB ID	SAMPLE ID	DATE	TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL CONATAINERS	HOLD									
1	MB01A_26-36.5	12/09/2022	15:00	Solids	Glass jar	1	1									
2	MB02B_0-9	12/09/2022	15:00	Solids	Glass jar	1	1									
3	MB02B_178-187	12/09/2022	15:00	Solids	Glass jar	1	1									
4	MB03B_7-20	12/09/2022	15:00	Solids	Glass jar	1	1									
5	MB03B_54-63	12/09/2022	15:00	Solids	Glass jar	1	1									
					TOTAL	5	5	0	0	0	0	0	0	0	0	

Water Container Codes: P = Unpreserved Plastic, N = Nitric Preserved Plastic, ORC = Nitric Preserved ORC, SH = Sodium Hydroxide/Cd Preserved, S = Sodium Hydroxide Preserved Plastic, AG = Amber Glass Unpreserved, AP = Airfreight Unpreserved Plastic, V = VOA Vial HCl Preserved, VB = VOA Vial Sodium Bisulphate Preserved, VS = VOA Vial Sulfuric Preserved, AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass, H = HCl preserved Plastic, HS = HCl preserved Speciation bottle, SP = Sulfuric Preserved Plastic, F = Formaldehyde Preserved Glass, Z = Zinc Acetate Preserved Bottle, E = EDTA Preserved Bottles, ST = Sterile Bottle, ASG = Plastic Bag for Acid Sulphate Soils, B = Unpreserved Bag, U = Lugols Iodine Preserved Bottles, STT = Sterile Sodium Thiosulfate Preserved Bottles

Environmental Division
Sydney
Work Order Reference
ES2233009

Telephone : - 61-2-8784 8555

ES2233009

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Dursna Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GOLDSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 9600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 129 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgeemail@alsglobal.com

NEWCASTLE 0555 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-16 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

WOLLONGONG 1/10-21 Ralph Black Dr, North Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: EMM CONSULTING	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: 20 Chandos Street, St Leonards	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) X Non Standard or urgent TAT (List due date): FRIDAY - 16 December 2022		Custody Seal Intact? Yes No N/A
PROJECT: Oven Mountain Pumped Storage Project PROJECT NO.: J200506	ALS QUOTE NO: NA	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
PURCHASE ORDER: J200506	COUNTRY OF ORIGIN:	COC: ① 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Henry Nookes CONTACT PH: 0448 772 935		OF: ① 2 3 4 5 6 7	Other comments:

SAMPLER: KG SAMPLER MOBILE: 0401 881 447	RELINQUISHED BY: HJN	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY: Helen
COC Emailed to ALS? (YES) EDD FORMAT (or default): sadat				
Email Reports to: hnookes@emmconsulting.com.au / kmsady@emmconsulting.com.au / sbayer@emmconsulting.com.au / emmconsulting@eviadat.net; ntrusco@emmconsulting.com.au; mskold@emmconsulting.com.au	DATE/TIME: 16/9/2022	DATE/TIME:	DATE/TIME:	DATE/TIME: 16/9/22 12pm
Email Invoices to: finance@emmconsulting.com.au / hnookes@emmconsulting.com.au				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required)								Additional Information
LAB ID	SAMPLE ID	DATE	TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL	Waste classification (PxT/3 long)	Acid neutralising capacity	Total sulfur (S-IR08)	Metals and metalloids (ME M561m)	ASLP Suite (as per attached quote)	Rock analysis (as per attached quote)			
	BH4B_2.39-2.51	25/08/2022		Rock	BAG	1	1				1				
	BH4B_6.40-6.52	25/08/2022		Rock	BAG	1				1		1			
	BH4B_13.85-14.0	25/08/2022		Rock	BAG	1									
	BH4B_22.05-22.30	25/08/2022		Rock	BAG	1	1				1				
	BH4B_33.0-33.27	25/08/2022		Rock	BAG	1									
	BH4B_39.74-39.91	25/08/2022		Rock	BAG	1				1		1			
	BH4B_47.89-48.00	25/08/2022		Rock	BAG	1									
	BH4B_56.81-57.0	25/08/2022		Rock	BAG	1									
	BH4B_62.10-62.30	25/08/2022		Rock	BAG	1									
	BH4B_71.07-71.20	25/08/2022		Rock	BAG	1				1		1			
	BH4B_84.0-84.15	25/08/2022		Rock	BAG	1									
	BH4B_86.0-86.15	25/08/2022		Rock	BAG	1									
	BH4B_99.82-99.95	25/08/2022		Rock	BAG	1									
	BH4B_126.27-126.37	25/08/2022		Rock	BAG	1	1				1				
	BH4B_148.17-148.36	25/08/2022		Rock	BAG	1				1		1			
	BH4B_191.75-191.94	25/08/2022		Rock	BAG	1									
	BH4B_221.74-221.87	25/08/2022		Rock	BAG	1									
	BH4B_325.0-325.16	25/08/2022		Rock	BAG	1									
	BH4B_349.86-350.0	25/08/2022		Rock	BAG	1									
	BH4B_373.86-374.0	25/08/2022		Rock	BAG	1									
	BH4B_398.0-398.13	25/08/2022		Rock	BAG	1	1				1				
	BH4B_419.0-419.14	25/08/2022		Rock	BAG	1				1		1			
1	MB01A_26-36.5	12/09/2022	15:00	Solids	JAR	1				1		1			
2	MB02B_0-9	12/09/2022	15:00	Solids	JAR	1	1				1				
3	MB02B_178-187	12/09/2022	15:00	Solids	JAR	1	1				1				
4	MB03B_7-20	12/09/2022	15:00	Solids	JAR	1	1				1				

Updated COC

Environmental Division
Sydney
Work Order Reference
ES2233009

Telephone : +61-2-8784 8555

5	MB03B_21-29	12/09/2022	15:00	Solids	JAR	1										
6	MB03B_54-63	12/09/2022	15:00	Solids	JAR	1				1		1				
					TOTAL	28	7	9	0	7	7	7	0	0	0	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; HP = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass.
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASG = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottle, STT = Sterile Sodium Thiosulfate Preserved Bottles

S4/284/22

UPDATED COC

Rec 2 @ 14/09/22 1550

	BH4B_373.86-374.0	25/08/2022		Rock	BAG	1											
	BH4B_388.0-388.13	25/08/2022		Rock	BAG	1											
	BH4B_419.0-419.14	25/08/2022		Rock	BAG	1				1	1	1					
1	MB01A_26-36.5	12/09/2022	15:00	Solids	JAR	1				1	1	1					
2	MB02B_0-9	12/09/2022	15:00	Solids	JAR	1	1				1						
3	MB02B_178-187	12/09/2022	15:00	Solids	JAR	1											
4	MB03B_7-20	12/09/2022	15:00	Solids	JAR	1	1			1	1	1					
5	MB03B_54-63	12/09/2022	15:00	Solids	JAR	1											
Extra 6	MB03B_21-29	12/9			TOTAL	27	5	0	0	7	11	7	0	0	0		

Waste classification (CP-713 long)

Metals & Metalloids (ME-MS61m) ASLP suite (as per attached quote).

Leach analysis (as per attached quote). Table 3.

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

TAT

Subcon / Forward Lab / (Split WO) From 8522 30654

Lab / Analysis:

Organised By / Date:

Relinquished By / Date:

Connote / Courier:

WO No:

Attached By PO / Internal Sheet:

Environmental Division
Sydney
Work Order Reference
ES2233009

Telephone : +61-2-8784 8555

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2233009**	Page	: 1 of 21
Amendment	: **(Preliminary Report)**		
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 14-Sep-2022 15:15
Order number	: J200096	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: ----	Issue Date	: 11-Oct-2022 09:51
Sampler	: HENRY NOAKES		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 6		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Hez Weldermariam	Lab Technician	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

This report contains preliminary authorised results. The report may contain semi-quantitative results. Any result presented in this preliminary report may be subject to change in the final report.

- EP202: Poor matrix spike recoveries for Clopyralid due to matrix effects.
- EG048G: Poor spike recovery for Hexavalent Chromium by Alkaline Digestion due to matrix interferences.
- EP075: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- NSW-WCG: Where reported, Total Chlorinated Hydrocarbons is the sum of the reported concentrations of all Chlorinated Hydrocarbons at or above the LOR.
- EP074: Where reported, Total Trihalomethanes is the sum of the reported concentrations of all Trihalomethanes at or above the LOR.
- EP074: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP074: Where reported, Sum of chlorinated hydrocarbons includes carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichlorothene, trans-1,2-dichlorothene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, vinyl chloride, hexachlorobutadiene and methylene chloride.
- EP074: Where reported, Total Trimethylbenzenes is the sum of the reported concentrations of 1.2.3-Trimethylbenzene, 1.2.4-Trimethylbenzene and 1.3.5-Trimethylbenzene at or above the LOR.
- EG048G: Poor spike recovery for Alkaline Hexavalent Chromium due to matrix interferences
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.
- EP075: Where reported, 'Sum of PAH' is the sum of the USEPA 16 priority PAHs
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

- EP132: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit	ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
				Result	Result	Result	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.73**	**6.52**	**7.03**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**19**	**25**	**27**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**4**	**6**	**11**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**4**	**6**	**11**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	**4**	<1	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**2**	**2**	**2**	----	----
EG005(ED093)C: Leachable Metals by ICPAES								
Aluminium	7429-90-5	0.1	mg/L	**3.9**	**2.4**	**3.0**	----	----
Antimony	7440-36-0	0.1	mg/L	<0.1	<0.1	<0.1	----	----
Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	<0.1	----	----
Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	<0.05	----	----
Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	<0.05	----	----
Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	<0.1	----	----
Iron	7439-89-6	0.1	mg/L	**5.9**	**2.1**	**4.8**	----	----
Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	<0.1	----	----
Manganese	7439-96-5	0.1	mg/L	**0.1**	<0.1	<0.1	----	----
Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	<0.1	----	----
Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	<0.05	----	----
Silver	7440-22-4	0.1	mg/L	<0.1	<0.1	<0.1	----	----
Molybdenum	7439-98-7	0.1	mg/L	<0.1	<0.1	<0.1	----	----
EG035C: Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0010	mg/L	<0.0010	<0.0010	<0.0010	----	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.2**	**0.1**	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit		ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
					Result	Result	Result	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	<0.5	----	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	<0.5	----	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	<0.5	----	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	<0.5	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	----	----
4.4`-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
4.4`-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
4.4`-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	<2.0	----	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	<2.0	----	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	<0.5	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/L		<0.5	<0.5	<0.5	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	<2.0	----	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Parathion-methyl	298-00-0	2.0	µg/L		<2.0	<2.0	<2.0	----	----
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit	ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
				Result	Result	Result	----	----
EP068B: Organophosphorus Pesticides (OP) - Continued								
Chlorpyrifos	2921-88-2	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Parathion	56-38-2	2.0	µg/L	<2.0	<2.0	<2.0	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Chlorfenvinphos	470-90-6	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Fenamiphos	22224-92-6	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Prothiofos	34643-46-4	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Ethion	563-12-2	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Carbophenothion	786-19-6	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Azinphos Methyl	86-50-0	0.5	µg/L	<0.5	<0.5	<0.5	----	----
EP068C: Triazines								
Atrazine	1912-24-9	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Simazine	122-34-9	0.5	µg/L	<0.5	<0.5	<0.5	----	----
EP068D: Cypermethrins								
Cypermethrins	----	2.0	µg/L	<2.0	<2.0	<2.0	----	----
EP068E: Other Pesticides								
Methoprene	40596-69-8	0.5	µg/L	<0.5	<0.5	<0.5	----	----
EP075A: Phenolic Compounds								
Phenol	108-95-2	2	µg/L	<2	<2	<2	----	----
2-Chlorophenol	95-57-8	2	µg/L	<2	<2	<2	----	----
2-Methylphenol	95-48-7	2	µg/L	<2	<2	<2	----	----
3- & 4-Methylphenol	1319-77-3	4	µg/L	<4	<4	<4	----	----
2-Nitrophenol	88-75-5	2	µg/L	<2	<2	<2	----	----
2.4-Dimethylphenol	105-67-9	2	µg/L	<2	<2	<2	----	----
2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<2	<2	----	----
2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<2	<2	----	----
4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	<2	<2	----	----
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2	<2	----	----
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2	<2	----	----
Pentachlorophenol	87-86-5	4	µg/L	<4	<4	<4	----	----
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	2	µg/L	<2	<2	<2	----	----
2-Methylnaphthalene	91-57-6	2	µg/L	<2	<2	<2	----	----
2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2	<2	----	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit		ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
					Result	Result	Result	----	----
EP075B: Polynuclear Aromatic Hydrocarbons - Continued									
Acenaphthylene	208-96-8	2	µg/L		<2	<2	<2	----	----
Acenaphthene	83-32-9	2	µg/L		<2	<2	<2	----	----
Fluorene	86-73-7	2	µg/L		<2	<2	<2	----	----
Phenanthrene	85-01-8	2	µg/L		<2	<2	<2	----	----
Anthracene	120-12-7	2	µg/L		<2	<2	<2	----	----
Fluoranthene	206-44-0	2	µg/L		<2	<2	<2	----	----
Pyrene	129-00-0	2	µg/L		<2	<2	<2	----	----
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L		<2	<2	<2	----	----
Benz(a)anthracene	56-55-3	2	µg/L		<2	<2	<2	----	----
Chrysene	218-01-9	2	µg/L		<2	<2	<2	----	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L		<4	<4	<4	----	----
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L		<2	<2	<2	----	----
Benzo(a)pyrene	50-32-8	2	µg/L		<2	<2	<2	----	----
3-Methylcholanthrene	56-49-5	2	µg/L		<2	<2	<2	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L		<2	<2	<2	----	----
Dibenz(a.h)anthracene	53-70-3	2	µg/L		<2	<2	<2	----	----
Benzo(g.h.i)perylene	191-24-2	2	µg/L		<2	<2	<2	----	----
^ Sum of PAHs	----	2	µg/L		<2	<2	<2	----	----
^ Benzo(a)pyrene TEQ (zero)	----	2	µg/L		<2	<2	<2	----	----
EP075C: Phthalate Esters									
Dimethyl phthalate	131-11-3	2	µg/L		<2	<2	<2	----	----
Diethyl phthalate	84-66-2	2	µg/L		<2	<2	<2	----	----
Di-n-butyl phthalate	84-74-2	2	µg/L		<2	<2	<2	----	----
Butyl benzyl phthalate	85-68-7	2	µg/L		<2	<2	<2	----	----
bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L		<10	<10	<10	----	----
Di-n-octylphthalate	117-84-0	2	µg/L		<2	<2	<2	----	----
EP075D: Nitrosamines									
N-Nitrosomethylethylamine	10595-95-6	2	µg/L		<2	<2	<2	----	----
N-Nitrosodiethylamine	55-18-5	2	µg/L		<2	<2	<2	----	----
N-Nitrosopyrrolidine	930-55-2	4	µg/L		<4	<4	<4	----	----
N-Nitrosomorpholine	59-89-2	2	µg/L		<2	<2	<2	----	----
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L		<2	<2	<2	----	----
N-Nitrosopiperidine	100-75-4	2	µg/L		<2	<2	<2	----	----
N-Nitrosodibutylamine	924-16-3	2	µg/L		<2	<2	<2	----	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit	ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
				Result	Result	Result	----	----
EP075D: Nitrosamines - Continued								
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	<4	<4	----	----
Methapyrilene	91-80-5	2	µg/L	<2	<2	<2	----	----
EP075E: Nitroaromatics and Ketones								
2-Picoline	109-06-8	2	µg/L	<2	<2	<2	----	----
Acetophenone	98-86-2	2	µg/L	<2	<2	<2	----	----
Nitrobenzene	98-95-3	2	µg/L	<2	<2	<2	----	----
Isophorone	78-59-1	2	µg/L	<2	<2	<2	----	----
2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4	<4	----	----
2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4	<4	----	----
1-Naphthylamine	134-32-7	2	µg/L	<2	<2	<2	----	----
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2	<2	----	----
5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2	<2	----	----
Azobenzene	103-33-3	2	µg/L	<2	<2	<2	----	----
1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2	<2	----	----
Phenacetin	62-44-2	2	µg/L	<2	<2	<2	----	----
4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2	<2	----	----
Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2	<2	----	----
Pronamide	23950-58-5	2	µg/L	<2	<2	<2	----	----
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	<2	----	----
Chlorobenzilate	510-15-6	2	µg/L	<2	<2	<2	----	----
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	<2	----	----
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	<2	----	----
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	<2	----	----
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	<2	----	----
EP075G: Chlorinated Hydrocarbons								
1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	<2	----	----
1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	<2	----	----
1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	<2	----	----
Hexachloroethane	67-72-1	2	µg/L	<2	<2	<2	----	----
1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	<2	----	----
Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	<2	----	----
Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	<2	----	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit	ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
				Result	Result	Result	----	----
EP075G: Chlorinated Hydrocarbons - Continued								
Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<10	<10	----	----
Pentachlorobenzene	608-93-5	2	µg/L	<2	<2	<2	----	----
Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<4	<4	----	----
EP075H: Anilines and Benzidines								
Aniline	62-53-3	2	µg/L	<2	<2	<2	----	----
4-Chloroaniline	106-47-8	2	µg/L	<2	<2	<2	----	----
2-Nitroaniline	88-74-4	4	µg/L	<4	<4	<4	----	----
3-Nitroaniline	99-09-2	4	µg/L	<4	<4	<4	----	----
Dibenzofuran	132-64-9	2	µg/L	<2	<2	<2	----	----
4-Nitroaniline	100-01-6	2	µg/L	<2	<2	<2	----	----
Carbazole	86-74-8	2	µg/L	<2	<2	<2	----	----
3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	<2	<2	----	----
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	2	µg/L	<2	<2	<2	----	----
beta-BHC	319-85-7	2	µg/L	<2	<2	<2	----	----
gamma-BHC	58-89-9	2	µg/L	<2	<2	<2	----	----
delta-BHC	319-86-8	2	µg/L	<2	<2	<2	----	----
Heptachlor	76-44-8	2	µg/L	<2	<2	<2	----	----
Aldrin	309-00-2	2	µg/L	<2	<2	<2	----	----
Heptachlor epoxide	1024-57-3	2	µg/L	<2	<2	<2	----	----
alpha-Endosulfan	959-98-8	2	µg/L	<2	<2	<2	----	----
4.4`-DDE	72-55-9	2	µg/L	<2	<2	<2	----	----
Dieldrin	60-57-1	2	µg/L	<2	<2	<2	----	----
Endrin	72-20-8	2	µg/L	<2	<2	<2	----	----
beta-Endosulfan	33213-65-9	2	µg/L	<2	<2	<2	----	----
4.4`-DDD	72-54-8	2	µg/L	<2	<2	<2	----	----
Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2	<2	----	----
4.4`-DDT	50-29-3	4	µg/L	<4	<4	<4	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	<4	<4	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	4	µg/L	<4	<4	<4	----	----
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	2	µg/L	<2	<2	<2	----	----
Dimethoate	60-51-5	2	µg/L	<2	<2	<2	----	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit	ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
				Result	Result	Result	----	----
EP075J: Organophosphorus Pesticides - Continued								
Diazinon	333-41-5	2	µg/L	<2	<2	<2	----	----
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2	<2	----	----
Malathion	121-75-5	2	µg/L	<2	<2	<2	----	----
Fenthion	55-38-9	2	µg/L	<2	<2	<2	----	----
Chlorpyrifos	2921-88-2	2	µg/L	<2	<2	<2	----	----
Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2	<2	----	----
Chlorfenvinphos	470-90-6	2	µg/L	<2	<2	<2	----	----
Prothiofos	34643-46-4	2	µg/L	<2	<2	<2	----	----
Ethion	563-12-2	2	µg/L	<2	<2	<2	----	----
EP075K: Miscellaneous Compounds								
1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	<2	<2	----	----
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	<2	<2	----	----
Methanesulfonate methyl	66-27-3	2	µg/L	<2	<2	<2	----	----
cis-Isosafrole	17627-76-8	2	µg/L	<2	<2	<2	----	----
trans-Isosafrole	4043-71-4	2	µg/L	<2	<2	<2	----	----
Safrole	94-59-7	2	µg/L	<2	<2	<2	----	----
Diallate	2303-16-4	2	µg/L	<2	<2	<2	----	----
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	<2	<2	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.5	%	71.6	93.8	73.3	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.5	%	84.0	104	88.7	----	----
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	2	%	30.3	25.9	11.9	----	----
Phenol-d6	13127-88-3	2	%	25.7	26.3	23.3	----	----
2-Chlorophenol-D4	93951-73-6	2	%	50.1	48.7	30.3	----	----
2.4.6-Tribromophenol	118-79-6	2	%	42.9	31.5	10.9	----	----
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	2	%	57.5	62.7	61.1	----	----
1.2-Dichlorobenzene-D4	2199-69-1	2	%	53.3	58.6	56.1	----	----
2-Fluorobiphenyl	321-60-8	2	%	59.8	65.5	62.3	----	----
Anthracene-d10	1719-06-8	2	%	67.4	79.8	71.9	----	----
4-Terphenyl-d14	1718-51-0	2	%	70.1	85.5	74.2	----	----

Analytical Results

Sub-Matrix: DI WATER ZHE LEACHATE (Matrix: WATER)				Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit		ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
					Result	Result	Result	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser									
Weak Acid Dissociable Cyanide	----	0.004	mg/L		<0.004	<0.004	<0.004	----	----
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	1	µg/L		<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	----	----
Styrene	100-42-5	5	µg/L		<5	<5	<5	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	----	----
Isopropylbenzene	98-82-8	5	µg/L		<5	<5	<5	----	----
n-Propylbenzene	103-65-1	5	µg/L		<5	<5	<5	----	----
1.3.5-Trimethylbenzene	108-67-8	5	µg/L		<5	<5	<5	----	----
sec-Butylbenzene	135-98-8	5	µg/L		<5	<5	<5	----	----
1.2.4-Trimethylbenzene	95-63-6	5	µg/L		<5	<5	<5	----	----
tert-Butylbenzene	98-06-6	5	µg/L		<5	<5	<5	----	----
p-Isopropyltoluene	99-87-6	5	µg/L		<5	<5	<5	----	----
n-Butylbenzene	104-51-8	5	µg/L		<5	<5	<5	----	----
EP074B: Oxygenated Compounds									
2-Propanone (Acetone)	67-64-1	50	µg/L		<50	<50	<50	----	----
Vinyl Acetate	108-05-4	50	µg/L		<50	<50	<50	----	----
2-Butanone (MEK)	78-93-3	50	µg/L		<50	<50	<50	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L		<50	<50	<50	----	----
2-Hexanone (MBK)	591-78-6	50	µg/L		<50	<50	<50	----	----
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L		<5	<5	<5	----	----
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5	<5	----	----
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5	<5	----	----
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5	<5	----	----
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	<5	----	----
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	<5	----	----
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	<50	----	----

Analytical Results

Sub-Matrix: DI WATER ZHE LEACHATE (Matrix: WATER)				Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
Compound	CAS Number	LOR	Unit		ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
					Result	Result	Result	----	----
EP074E: Halogenated Aliphatic Compounds - Continued									
Chloromethane	74-87-3	50	µg/L		<50	<50	<50	----	----
Vinyl chloride	75-01-4	50	µg/L		<50	<50	<50	----	----
Bromomethane	74-83-9	50	µg/L		<50	<50	<50	----	----
Chloroethane	75-00-3	50	µg/L		<50	<50	<50	----	----
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	<50	----	----
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5	<5	----	----
Iodomethane	74-88-4	5	µg/L		<5	<5	<5	----	----
Methylene chloride	75-09-2	5	µg/L		<5	<5	<5	----	----
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5	<5	----	----
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5	<5	----	----
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5	<5	----	----
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5	<5	----	----
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	<5	----	----
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	<5	----	----
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5	<5	----	----
Trichloroethene	79-01-6	5	µg/L		<5	<5	<5	----	----
Dibromomethane	74-95-3	5	µg/L		<5	<5	<5	----	----
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5	<5	----	----
1.3-Dichloropropane	142-28-9	5	µg/L		<5	<5	<5	----	----
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	<5	----	----
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	<5	----	----
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	<5	----	----
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	<5	----	----
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	<5	----	----
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	<5	<5	----	----
Pentachloroethane	76-01-7	5	µg/L		<5	<5	<5	----	----
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	<5	----	----
Hexachlorobutadiene	87-68-3	5	µg/L		<5	<5	<5	----	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	<5	----	----
Bromobenzene	108-86-1	5	µg/L		<5	<5	<5	----	----
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5	<5	----	----
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5	<5	----	----
1.3-Dichlorobenzene	541-73-1	5	µg/L		<5	<5	<5	----	----
1.4-Dichlorobenzene	106-46-7	5	µg/L		<5	<5	<5	----	----

Analytical Results

Sub-Matrix: **DI WATER ZHE LEACHATE** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
					ES2233009-002	ES2233009-004	ES2233009-007	--------	--------
					Result	Result	Result	----	----
EP074F: Halogenated Aromatic Compounds - Continued									
1.2-Dichlorobenzene	95-50-1	5	µg/L		<5	<5	<5	----	----
1.2.4-Trichlorobenzene	120-82-1	5	µg/L		<5	<5	<5	----	----
1.2.3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5	<5	----	----
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5	<5	----	----
Bromodichloromethane	75-27-4	5	µg/L		<5	<5	<5	----	----
Dibromochloromethane	124-48-1	5	µg/L		<5	<5	<5	----	----
Bromoform	75-25-2	5	µg/L		<5	<5	<5	----	----
EP074H: Naphthalene									
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	5	%		**118**	**110**	**111**	----	----
Toluene-D8	2037-26-5	5	%		**117**	**106**	**109**	----	----
4-Bromofluorobenzene	460-00-4	5	%		**119**	**111**	**112**	----	----

Analytical Results

Sub-Matrix: SOLID (Matrix: SOIL)			Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 00:00	12-Sep-2022 15:00
Compound	CAS Number	LOR	Unit	ES2233009-001	ES2233009-002	ES2233009-004	ES2233009-006	ES2233009-007
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	8.5	----	----	9.3	----
pH (Fox)	----	0.1	pH Unit	6.2	----	----	5.7	----
Reaction Rate	----	1	Reaction Unit	1	----	----	1	----
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	9.8	----	----	5.9	----
NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	----	----	<0.1	----
NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	----	----	1.2	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	43.3	----	----	18.7	----
ANC as CaCO3	----	0.1	% CaCO3	4.4	----	----	1.9	----
Fizz Rating	----	0	Fizz Unit	2	----	----	1	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	----	0.3	2.0	----	0.6
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	----	----	0.16	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	<5	<5	----	<5
Beryllium	7440-41-7	1	mg/kg	----	<1	<1	----	<1
Cadmium	7440-43-9	1	mg/kg	----	<1	<1	----	<1
Lead	7439-92-1	5	mg/kg	----	<5	<5	----	<5
Molybdenum	7439-98-7	2	mg/kg	----	<2	<2	----	<2
Nickel	7440-02-0	2	mg/kg	----	3	4	----	3
Selenium	7782-49-2	5	mg/kg	----	<5	<5	----	<5
Silver	7440-22-4	2	mg/kg	----	<2	<2	----	<2
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	<0.1	<0.1	----	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)								
Hexavalent Chromium	18540-29-9	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	----	<1	<1	----	<1
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser								
Weak Acid Dissociable Cyanide	----	1	mg/kg	----	<1	<1	----	<1
EK040T: Fluoride Total								

Analytical Results

Sub-Matrix: SOLID (Matrix: SOIL)			Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 00:00	12-Sep-2022 15:00
Compound	CAS Number	LOR	Unit	ES2233009-001	ES2233009-002	ES2233009-004	ES2233009-006	ES2233009-007
				Result	Result	Result	Result	Result
EK040T: Fluoride Total - Continued								
Fluoride	16984-48-8	40	mg/kg	----	320	330	----	250
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)								
Final pH	----	0.1	pH Unit	----	7.2	7.4	----	8.8
EN60Z: ASLP Leachate - ZHE								
Extraction Fluid pH	----	0.1	pH Unit	----	7.2	7.4	----	8.8
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	<0.02	----	----	0.02	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	----	<0.1	<0.1	----	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
EP068B: Organophosphorus Pesticides (OP)								
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup								
>C10 - C16 Fraction	----	50	mg/kg	----	<50	<50	----	<50

Analytical Results

Sub-Matrix: SOLID (Matrix: SOIL)				Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 00:00	12-Sep-2022 15:00
Compound	CAS Number	LOR	Unit		ES2233009-001	ES2233009-002	ES2233009-004	ES2233009-006	ES2233009-007
					Result	Result	Result	Result	Result
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup - Continued									
>C16 - C34 Fraction	----	100	mg/kg		----	<100	<100	----	<100
>C34 - C40 Fraction	----	100	mg/kg		----	<100	<100	----	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		----	<50	<50	----	<50
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup									
C10 - C14 Fraction	----	50	mg/kg		----	<50	<50	----	<50
C15 - C28 Fraction	----	100	mg/kg		----	<100	<100	----	<100
C29 - C36 Fraction	----	100	mg/kg		----	<100	<100	----	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		----	<50	<50	----	<50
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	<0.2	----	<0.2
Toluene	108-88-3	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
Styrene	100-42-5	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
EP074B: Oxygenated Compounds									
2-Butanone (MEK)	78-93-3	5	mg/kg		----	<5	<5	----	<5
EP074E(SIM): Halogenated Aliphatic Compounds									
Vinyl chloride	75-01-4	0.2	mg/kg		----	<0.2	<0.2	----	<0.2
EP074E: Halogenated Aliphatic Compounds									
Vinyl chloride	75-01-4	4	mg/kg		----	<4	<4	----	<4
1.1-Dichloroethene	75-35-4	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
Methylene chloride	75-09-2	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
Carbon Tetrachloride	56-23-5	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
1.2-Dichloroethane	107-06-2	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
Trichloroethene	79-01-6	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
Tetrachloroethene	127-18-4	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	0.5	mg/kg		----	<0.5	<0.5	----	<0.5
EP074G: Trihalomethanes									

Analytical Results

Sub-Matrix: SOLID (Matrix: SOIL)			Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 00:00	12-Sep-2022 15:00
Compound	CAS Number	LOR	Unit	ES2233009-001	ES2233009-002	ES2233009-004	ES2233009-006	ES2233009-007
				Result	Result	Result	Result	Result
EP074G: Trihalomethanes - Continued								
Chloroform	67-66-3	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
EP075A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Pentachlorophenol	87-86-5	1	mg/kg	----	<1	<1	----	<1
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Fluorene	86-73-7	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Anthracene	120-12-7	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Pyrene	129-00-0	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Chrysene	218-01-9	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	----	<1	<1	----	<1
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
^ Sum of PAHs	----	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
EP075C: Phthalate Esters								
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg	----	<5.0	<5.0	----	<5.0
EP075E: Nitroaromatics and Ketones								
Nitrobenzene	98-95-3	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg	----	<1.0	<1.0	----	<1.0
Pentachloronitrobenzene	82-68-8	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
EP075G: Chlorinated Hydrocarbons								

Analytical Results

Sub-Matrix: SOLID (Matrix: SOIL)			Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 00:00	12-Sep-2022 15:00
Compound	CAS Number	LOR	Unit	ES2233009-001	ES2233009-002	ES2233009-004	ES2233009-006	ES2233009-007
				Result	Result	Result	Result	Result
EP075G: Chlorinated Hydrocarbons - Continued								
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Pentachlorobenzene	608-93-5	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
1.2.3.4-Tetrachlorobenzene	634-66-2	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
EP075K: Miscellaneous Compounds								
1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Isodrin	465-73-6	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
Di (2-ethylhexyl) adipate	103-23-1	0.5	mg/kg	----	<0.5	<0.5	----	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	<10	<10	----	<10
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	<10	<10	----	<10
EP132A: Phenolic Compounds								
Hexachlorophene	70-30-4	0.01	mg/kg	----	<0.01	<0.01	----	<0.01
EP202A: Phenoxyacetic Acid Herbicides by LCMS								
2.4-D	94-75-7	0.02	mg/kg	----	<0.02	<0.02	----	<0.02
Triclopyr	55335-06-3	0.02	mg/kg	----	<0.02	<0.02	----	<0.02
2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg	----	<0.02	<0.02	----	<0.02
2.4.5-T	93-76-5	0.02	mg/kg	----	<0.02	<0.02	----	<0.02
Picloram	1918-02-1	0.02	mg/kg	----	<0.02	<0.02	----	<0.02
Fluroxypyr	69377-81-7	0.02	mg/kg	----	<0.02	<0.02	----	<0.02
NSW-CWG: Aggregate Organics for Guideline Evaluation								
^ øSum of Endosulfans (inc. sulfate)	----	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
ø Sum of Scheduled Chemicals	----	0.05	mg/kg	----	<10.0	<10.0	----	<10.0
^ øSum of plasticisers	----	0.50	mg/kg	----	<5.00	<5.00	----	<5.00
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	**117**	**93.9**	----	**104**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	----	**89.9**	**83.6**	----	**70.0**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	----	**86.9**	**107**	----	**81.1**

Analytical Results

Sub-Matrix: SOLID (Matrix: SOIL)				Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 00:00	12-Sep-2022 15:00
Compound	CAS Number	LOR	Unit		ES2233009-001	ES2233009-002	ES2233009-004	ES2233009-006	ES2233009-007
					Result	Result	Result	Result	Result
EP074S(SIM) : VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		----	111	101	----	103
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		----	109	92.4	----	106
Toluene-D8	2037-26-5	0.5	%		----	116	102	----	98.1
4-Bromofluorobenzene	460-00-4	0.5	%		----	112	95.6	----	97.4
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	0.5	%		----	90.1	92.3	----	82.8
Phenol-d6	13127-88-3	0.5	%		----	73.6	77.2	----	72.8
2-Chlorophenol-D4	93951-73-6	0.5	%		----	90.0	90.6	----	86.6
2.4.6-Tribromophenol	118-79-6	0.5	%		----	49.2	48.8	----	38.7
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	0.5	%		----	88.9	96.8	----	88.1
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%		----	94.8	97.8	----	88.0
2-Fluorobiphenyl	321-60-8	0.5	%		----	98.0	102	----	95.0
Anthracene-d10	1719-06-8	0.5	%		----	92.2	91.2	----	77.7
4-Terphenyl-d14	1718-51-0	0.5	%		----	80.3	79.8	----	89.1
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	109	92.6	----	106
Toluene-D8	2037-26-5	0.2	%		----	125	107	----	102
4-Bromofluorobenzene	460-00-4	0.2	%		----	121	114	----	112
EP202S: Phenoxyacetic Acid Herbicide Surrogate									
2.4-Dichlorophenyl Acetic Acid	19719-28-9	0.02	%		----	91.1	78.4	----	91.0

Surrogate Control Limits

Sub-Matrix: DI WATER LEACHATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	10	117
Phenol-d6	13127-88-3	10	69
2-Chlorophenol-D4	93951-73-6	21	130
2.4.6-Tribromophenol	118-79-6	10	151
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	29	142
1.2-Dichlorobenzene-D4	2199-69-1	24	121
2-Fluorobiphenyl	321-60-8	27	135
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	21	123

Sub-Matrix: DI WATER ZHE LEACHATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	78	133
Toluene-D8	2037-26-5	79	129
4-Bromofluorobenzene	460-00-4	81	124

Sub-Matrix: SOLID		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP074S(SIM) : VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	131
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	64	130
Toluene-D8	2037-26-5	66	136
4-Bromofluorobenzene	460-00-4	60	122
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	29	149

Sub-Matrix: SOLID		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075S: Acid Extractable Surrogates - Continued			
Phenol-d6	13127-88-3	32	128
2-Chlorophenol-D4	93951-73-6	32	128
2.4.6-Tribromophenol	118-79-6	13	121
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	33	125
1.2-Dichlorobenzene-D4	2199-69-1	34	108
2-Fluorobiphenyl	321-60-8	35	121
Anthracene-d10	1719-06-8	35	123
4-Terphenyl-d14	1718-51-0	33	125
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP202S: Phenoxyacetic Acid Herbicide Surrogate			
2.4-Dichlorophenyl Acetic Acid	19719-28-9	45	139

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP003: Total Organic Carbon (TOC) in Soil

(SOIL) EA013: Acid Neutralising Capacity

(SOIL) EA003 :pH (field/fox)

(SOIL) ED042T: Total Sulfur by LECO

(SOIL) EA011: Net Acid Generation

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EK040T: Fluoride Total

CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: **ES2233009**	Page	: 1 of 27
Amendment	: **(Preliminary Report)**		
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 14-Sep-2022 15:15
Order number	: J200096	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: ----	Issue Date	: 11-Oct-2022 09:51
Sampler	: HENRY NOAKES		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 6		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to Assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Hez Weldermariam	Lab Technician	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty **must be** considered. Refer to the ALS Contract Terms and Conditions for details, and EnviroMail 53 for a guide on how to interpret the measurement of uncertainty (MU).

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

This report contains preliminary authorised results. The report may contain semi-quantitative results. Any result presented in this preliminary report may be subject to change in the final report.

- EP202: Poor matrix spike recoveries for Clopyralid due to matrix effects.
- EG048G: Poor spike recovery for Hexavalent Chromium by Alkaline Digestion due to matrix interferences.
- EP075: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- NSW-WCG: Where reported, Total Chlorinated Hydrocarbons is the sum of the reported concentrations of all Chlorinated Hydrocarbons at or above the LOR.
- EP074: Where reported, Total Trihalomethanes is the sum of the reported concentrations of all Trihalomethanes at or above the LOR.
- EP074: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP074: Where reported, Sum of chlorinated hydrocarbons includes carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichlorothene, trans-1,2-dichlorothene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, vinyl chloride, hexachlorobutadiene and methylene chloride.
- EP074: Where reported, Total Trimethylbenzenes is the sum of the reported concentrations of 1.2.3-Trimethylbenzene, 1.2.4-Trimethylbenzene and 1.3.5-Trimethylbenzene at or above the LOR.
- EG048G: Poor spike recovery for Alkaline Hexavalent Chromium due to matrix interferences
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.
- EP075: Where reported, 'Sum of PAH' is the sum of the USEPA 16 priority PAHs
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

- EP132: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

Analytical Results

NSW DECCW Table 1 - Contaminant Threshold Values for Classifying Waste by Chemical Assessment 2009: General Waste - CT1

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
						Sampling date/time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
							ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
EG005(ED093)T: Total Metals by ICP-AES											
Arsenic	EG005T	5	mg/kg	----	100		----	<5 - -	<5 - -	----	<5 - -
Beryllium	EG005T	1	mg/kg	----	20		----	<1 - -	<1 - -	----	<1 - -
Cadmium	EG005T	1	mg/kg	----	20		----	<1 - -	<1 - -	----	<1 - -
Lead	EG005T	5	mg/kg	----	100		----	<5 - -	<5 - -	----	<5 - -
Molybdenum	EG005T	2	mg/kg	----	100		----	<2	<2	----	<2
Nickel	EG005T	2	mg/kg	----	40		----	**3** ± 0.5	**4** ± 0.6	----	**3** ± 0.6
Selenium	EG005T	5	mg/kg	----	20		----	<5 - -	<5 - -	----	<5 - -
Silver	EG005T	2	mg/kg	----	100		----	<2 - -	<2 - -	----	<2 - -
EG035T: Total Recoverable Mercury by FIMS											
Mercury	EG035T	0.1	mg/kg	----	4		----	<0.1	<0.1	----	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)											
Hexavalent Chromium	EG048G	0.5	mg/kg	----	100		----	<0.5	<0.5	----	<0.5
EK026SF: Total CN by Segmented Flow Analyser											
Total Cyanide	EK026SF	1	mg/kg	----	320		----	<1	<1	----	<1
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser											
Weak Acid Dissociable Cyanide	EK028SF	1	mg/kg	----	70		----	<1	<1	----	<1
EK040T: Fluoride Total											
Fluoride	EK040T	40	mg/kg	----	3000		----	**320**	**330**	----	**250**
EP066: Polychlorinated Biphenyls (PCB)											
Total Polychlorinated biphenyls	EP066	0.1	mg/kg	----	49		----	<0.1	<0.1	----	<0.1
EP068B: Organophosphorus Pesticides (OP)											
Chlorpyrifos	EP068	0.05	mg/kg	----	4		----	<0.05	<0.05	----	<0.05
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup											
C10 - C36 Fraction (sum)	EP071SG-S	50	mg/kg	----	10000		----	<50	<50	----	<50
EP074A: Monocyclic Aromatic Hydrocarbons											
Benzene	EP074	0.2	mg/kg	----	10		----	<0.2	<0.2	----	<0.2
Toluene	EP074	0.5	mg/kg	----	288		----	<0.5	<0.5	----	<0.5
Ethylbenzene	EP074	0.5	mg/kg	----	600		----	<0.5	<0.5	----	<0.5
Styrene	EP074	0.5	mg/kg	----	60		----	<0.5	<0.5	----	<0.5
EP074B: Oxygenated Compounds											
2-Butanone (MEK)	EP074	5	mg/kg	----	4000		----	<5	<5	----	<5
EP074E(SIM): Halogenated Aliphatic Compounds											
Vinyl chloride	EP074E(SIM)	0.2	mg/kg	----	4		----	<0.2	<0.2	----	<0.2
EP074E: Halogenated Aliphatic Compounds											
Vinyl chloride	EP074	4	mg/kg	----	4		----	<4	<4	----	<4

NSW DECCW Table 1 - Contaminant Threshold Values for Classifying Waste by Chemical Assessment 2009: General Waste - CT1

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
Sample ID						ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
EP074E: Halogenated Aliphatic Compounds - Continued										
1.1-Dichloroethene	EP074	0.5	mg/kg	----	14	----	<0.5	<0.5	----	<0.5
Methylene chloride	EP074	0.5	mg/kg	----	172	----	<0.5	<0.5	----	<0.5
1.1.1-Trichloroethane	EP074	0.5	mg/kg	----	600	----	<0.5	<0.5	----	<0.5
Carbon Tetrachloride	EP074	0.5	mg/kg	----	10	----	<0.5	<0.5	----	<0.5
1.2-Dichloroethane	EP074	0.5	mg/kg	----	10	----	<0.5	<0.5	----	<0.5
Trichloroethene	EP074	0.5	mg/kg	----	10	----	<0.5	<0.5	----	<0.5
1.1.2-Trichloroethane	EP074	0.5	mg/kg	----	24	----	<0.5	<0.5	----	<0.5
Tetrachloroethene	EP074	0.5	mg/kg	----	14	----	<0.5	<0.5	----	<0.5
1.1.1.2-Tetrachloroethane	EP074	0.5	mg/kg	----	200	----	<0.5	<0.5	----	<0.5
1.1.2.2-Tetrachloroethane	EP074	0.5	mg/kg	----	26	----	<0.5	<0.5	----	<0.5
EP074F: Halogenated Aromatic Compounds										
Chlorobenzene	EP074	0.5	mg/kg	----	2000	----	<0.5	<0.5	----	<0.5
EP074G: Trihalomethanes										
Chloroform	EP074	0.5	mg/kg	----	120	----	<0.5	<0.5	----	<0.5
EP075A: Phenolic Compounds										
Phenol	EP075	0.5	mg/kg	----	288	----	<0.5	<0.5	----	<0.5
2-Methylphenol	EP075	0.5	mg/kg	----	4000	----	<0.5	<0.5	----	<0.5
3- & 4-Methylphenol	EP075	0.5	mg/kg	----	4000	----	<0.5	<0.5	----	<0.5
2.4.6-Trichlorophenol	EP075	0.5	mg/kg	----	40	----	<0.5	<0.5	----	<0.5
2.4.5-Trichlorophenol	EP075	0.5	mg/kg	----	8000	----	<0.5	<0.5	----	<0.5
EP075B: Polynuclear Aromatic Hydrocarbons										
Benzo(a)pyrene	EP075	0.5	mg/kg	----	0.8	----	<0.5	<0.5	----	<0.5
Sum of PAHs	EP075	0.5	mg/kg	----	200	----	<0.5	<0.5	----	<0.5
EP075E: Nitroaromatics and Ketones										
Nitrobenzene	EP075	0.5	mg/kg	----	40	----	<0.5	<0.5	----	<0.5
2.4-Dinitrotoluene	EP075	1.0	mg/kg	----	2.6	----	<1.0	<1.0	----	<1.0
EP075G: Chlorinated Hydrocarbons										
1.4-Dichlorobenzene	EP075	0.5	mg/kg	----	150	----	<0.5	<0.5	----	<0.5
1.2-Dichlorobenzene	EP075	0.5	mg/kg	----	86	----	<0.5	<0.5	----	<0.5
1.2.3.4-Tetrachlorobenzene	EP075	0.5	mg/kg	----	10	----	<0.5	<0.5	----	<0.5
EP080/071: Total Petroleum Hydrocarbons										
C6 - C9 Fraction	EP080	10	mg/kg	----	650	----	<10	<10	----	<10
EP202A: Phenoxyacetic Acid Herbicides by LCMS										
2.4-D	EP202	0.02	mg/kg	----	200	----	<0.02	<0.02	----	<0.02
Triclopyr	EP202	0.02	mg/kg	----	40	----	<0.02	<0.02	----	<0.02
Picloram	EP202	0.02	mg/kg	----	60	----	<0.02	<0.02	----	<0.02
Fluroxypyr	EP202	0.02	mg/kg	----	40	----	<0.02	<0.02	----	<0.02

NSW DECCW Table 1 - Contaminant Threshold Values for Classifying Waste by Chemical Assessment 2009: General Waste - CT1

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	Sample ID / Sampling date/time	MB01A_26-36.5 12-Sep-2022 15:00 ES2233009-001 MU	MB02B_0-9 12-Sep-2022 15:00 ES2233009-002 MU	MB03B_7-20 12-Sep-2022 15:00 ES2233009-004 MU	MB03B_21-29 12-Sep-2022 15:00 ES2233009-006 MU	MB02B_178-187 12-Sep-2022 15:00 ES2233009-007 MU
NSW-CWG: Aggregate Organics for Guideline Evaluation											
ø Sum of Endosulfans (inc. sulfate)	NSW-WCG	0.05	mg/kg	----	60		**----**	<0.05	<0.05	**----**	<0.05
ø Sum of Scheduled Chemicals	NSW-WCG	0.05	mg/kg	----	49		**----**	<10.0	<10.0	**----**	<10.0
ø Sum of plasticisers	NSW-WCG	0.50	mg/kg	----	600		**----**	<5.00	<5.00	**----**	<5.00

NSW DECCW Table 1 - Contaminant Threshold Values for Classifying Waste by Chemical Assessment 2009: Restricted Soild Waste - CT2

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	Sample ID	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
						Sampling date/time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
							ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
EG005(ED093)T: Total Metals by ICP-AES											
Arsenic	EG005T	5	mg/kg	----	400		----	<5 --	<5 --	----	<5 --
Beryllium	EG005T	1	mg/kg	----	80		----	<1 --	<1 --	----	<1 --
Cadmium	EG005T	1	mg/kg	----	80		----	<1 --	<1 --	----	<1 --
Lead	EG005T	5	mg/kg	----	400		----	<5 --	<5 --	----	<5 --
Molybdenum	EG005T	2	mg/kg	----	400		----	<2	<2	----	<2
Nickel	EG005T	2	mg/kg	----	160		----	**3** ± 0.5	**4** ± 0.6	----	**3** ± 0.6
Selenium	EG005T	5	mg/kg	----	80		----	<5 --	<5 --	----	<5 --
Silver	EG005T	2	mg/kg	----	400		----	<2 --	<2 --	----	<2 --
EG035T: Total Recoverable Mercury by FIMS											
Mercury	EG035T	0.1	mg/kg	----	16		----	<0.1	<0.1	----	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)											
Hexavalent Chromium	EG048G	0.5	mg/kg	----	400		----	<0.5	<0.5	----	<0.5
EK026SF: Total CN by Segmented Flow Analyser											
Total Cyanide	EK026SF	1	mg/kg	----	1280		----	<1	<1	----	<1
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser											
Weak Acid Dissociable Cyanide	EK028SF	1	mg/kg	----	280		----	<1	<1	----	<1
EK040T: Fluoride Total											
Fluoride	EK040T	40	mg/kg	----	12000		----	**320**	**330**	----	**250**
EP066: Polychlorinated Biphenyls (PCB)											
Total Polychlorinated biphenyls	EP066	0.1	mg/kg	----	49		----	<0.1	<0.1	----	<0.1
EP068B: Organophosphorus Pesticides (OP)											
Chlorpyrifos	EP068	0.05	mg/kg	----	16		----	<0.05	<0.05	----	<0.05
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup											
C10 - C36 Fraction (sum)	EP071SG-S	50	mg/kg	----	40000		----	<50	<50	----	<50
EP074A: Monocyclic Aromatic Hydrocarbons											
Benzene	EP074	0.2	mg/kg	----	40		----	<0.2	<0.2	----	<0.2
Toluene	EP074	0.5	mg/kg	----	1152		----	<0.5	<0.5	----	<0.5
Ethylbenzene	EP074	0.5	mg/kg	----	2400		----	<0.5	<0.5	----	<0.5
Styrene	EP074	0.5	mg/kg	----	240		----	<0.5	<0.5	----	<0.5
EP074B: Oxygenated Compounds											
2-Butanone (MEK)	EP074	5	mg/kg	----	16000		----	<5	<5	----	<5
EP074E(SIM): Halogenated Aliphatic Compounds											
Vinyl chloride	EP074E(SIM)	0.2	mg/kg	----	16		----	<0.2	<0.2	----	<0.2
EP074E: Halogenated Aliphatic Compounds											
Vinyl chloride	EP074	4	mg/kg	----	16		----	<4	<4	----	<4
1.1-Dichloroethene	EP074	0.5	mg/kg	----	56		----	<0.5	<0.5	----	<0.5

NSW DECCW Table 1 - Contaminant Threshold Values for Classifying Waste by Chemical Assessment 2009: Restricted Soild Waste - CT2

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
Sample ID						ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
EP074E: Halogenated Aliphatic Compounds - Continued										
Methylene chloride	EP074	0.5	mg/kg	----	688	----	<0.5	<0.5	----	<0.5
1.1.1-Trichloroethane	EP074	0.5	mg/kg	----	2400	----	<0.5	<0.5	----	<0.5
Carbon Tetrachloride	EP074	0.5	mg/kg	----	40	----	<0.5	<0.5	----	<0.5
1.2-Dichloroethane	EP074	0.5	mg/kg	----	40	----	<0.5	<0.5	----	<0.5
Trichloroethene	EP074	0.5	mg/kg	----	40	----	<0.5	<0.5	----	<0.5
1.1.2-Trichloroethane	EP074	0.5	mg/kg	----	96	----	<0.5	<0.5	----	<0.5
Tetrachloroethene	EP074	0.5	mg/kg	----	56	----	<0.5	<0.5	----	<0.5
1.1.1.2-Tetrachloroethane	EP074	0.5	mg/kg	----	800	----	<0.5	<0.5	----	<0.5
1.1.2.2-Tetrachloroethane	EP074	0.5	mg/kg	----	104	----	<0.5	<0.5	----	<0.5
EP074F: Halogenated Aromatic Compounds										
Chlorobenzene	EP074	0.5	mg/kg	----	8000	----	<0.5	<0.5	----	<0.5
EP074G: Trihalomethanes										
Chloroform	EP074	0.5	mg/kg	----	480	----	<0.5	<0.5	----	<0.5
EP075A: Phenolic Compounds										
Phenol	EP075	0.5	mg/kg	----	1152	----	<0.5	<0.5	----	<0.5
2-Methylphenol	EP075	0.5	mg/kg	----	16000	----	<0.5	<0.5	----	<0.5
3- & 4-Methylphenol	EP075	0.5	mg/kg	----	16000	----	<0.5	<0.5	----	<0.5
2.4.6-Trichlorophenol	EP075	0.5	mg/kg	----	160	----	<0.5	<0.5	----	<0.5
2.4.5-Trichlorophenol	EP075	0.5	mg/kg	----	32000	----	<0.5	<0.5	----	<0.5
EP075B: Polynuclear Aromatic Hydrocarbons										
Benzo(a)pyrene	EP075	0.5	mg/kg	----	3.2	----	<0.5	<0.5	----	<0.5
Sum of PAHs	EP075	0.5	mg/kg	----	800	----	<0.5	<0.5	----	<0.5
EP075E: Nitroaromatics and Ketones										
Nitrobenzene	EP075	0.5	mg/kg	----	160	----	<0.5	<0.5	----	<0.5
2.4-Dinitrotoluene	EP075	1.0	mg/kg	----	10.4	----	<1.0	<1.0	----	<1.0
EP075G: Chlorinated Hydrocarbons										
1.4-Dichlorobenzene	EP075	0.5	mg/kg	----	600	----	<0.5	<0.5	----	<0.5
1.2-Dichlorobenzene	EP075	0.5	mg/kg	----	344	----	<0.5	<0.5	----	<0.5
1.2.3.4-Tetrachlorobenzene	EP075	0.5	mg/kg	----	40	----	<0.5	<0.5	----	<0.5
EP080/071: Total Petroleum Hydrocarbons										
C6 - C9 Fraction	EP080	10	mg/kg	----	2600	----	<10	<10	----	<10
EP202A: Phenoxyacetic Acid Herbicides by LCMS										
2.4-D	EP202	0.02	mg/kg	----	800	----	<0.02	<0.02	----	<0.02
Triclopyr	EP202	0.02	mg/kg	----	160	----	<0.02	<0.02	----	<0.02
Picloram	EP202	0.02	mg/kg	----	240	----	<0.02	<0.02	----	<0.02
Fluroxypyr	EP202	0.02	mg/kg	----	160	----	<0.02	<0.02	----	<0.02
NSW-CWG: Aggregate Organics for Guideline Evaluation										

NSW DECCW Table 1 - Contaminant Threshold Values for Classifying Waste by Chemical Assessment 2009: Restricted Soild Waste - CT2

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
Sample ID						ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
NSW-CWG: Aggregate Organics for Guideline Evaluation - Continued										
ø Sum of Endosulfans (inc. sulfate)	NSW-WCG	0.05	mg/kg	----	240	----	<0.05	<0.05	----	<0.05
ø Sum of Scheduled Chemicals	NSW-WCG	0.05	mg/kg	----	49	----	<10.0	<10.0	----	<10.0
ø Sum of plasticisers	NSW-WCG	0.50	mg/kg	----	2400	----	<5.00	<5.00	----	<5.00

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	Sample ID	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
						Sampling date/time	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
							ES2233009-002 MU	ES2233009-004 MU	ES2233009-007 MU	-------- MU	-------- MU
EA005P: pH by PC Titrator											
pH Value	EA005-P	0.01	pH Unit	----	----		**6.73** ± 0.08	**6.52** ± 0.08	**7.03** ± 0.08	----	----
EA010P: Conductivity by PC Titrator											
Electrical Conductivity @ 25°C	EA010-P	1	µS/cm	----	----		**19** ± 2	**25** ± 3	**27** ± 3	----	----
ED037P: Alkalinity by PC Titrator											
Hydroxide Alkalinity as CaCO3	ED037-P	1	mg/L	----	----		<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	ED037-P	1	mg/L	----	----		<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	ED037-P	1	mg/L	----	----		**4**	**6**	**11**	----	----
Total Alkalinity as CaCO3	ED037-P	1	mg/L	----	----		**4** ± 0.8	**6** ± 1	**11** ± 2	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA											
Sulfate as SO4 - Turbidimetric	ED041G	1	mg/L	----	----		<1 - -	**4** ± 0.7	<1 - -	----	----
ED045G: Chloride by Discrete Analyser											
Chloride	ED045G	1	mg/L	----	----		**2** ± 0.7	**2** ± 0.7	**2** ± 0.7	----	----
EG005(ED093)C: Leachable Metals by ICPAES											
Aluminium	EG005C	0.1	mg/L	----	----		**3.9**	**2.4**	**3.0**	----	----
Antimony	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
Arsenic	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
Beryllium	EG005C	0.05	mg/L	----	----		<0.05	<0.05	<0.05	----	----
Boron	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
Cadmium	EG005C	0.05	mg/L	----	----		<0.05	<0.05	<0.05	----	----
Chromium	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
Iron	EG005C	0.1	mg/L	----	----		**5.9**	**2.1**	**4.8**	----	----
Lead	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
Manganese	EG005C	0.1	mg/L	----	----		**0.1**	<0.1	<0.1	----	----
Nickel	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
Selenium	EG005C	0.05	mg/L	----	----		<0.05	<0.05	<0.05	----	----
Silver	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
Molybdenum	EG005C	0.1	mg/L	----	----		<0.1	<0.1	<0.1	----	----
EG035C: Leachable Mercury by FIMS											
Mercury	EG035C	0.0010	mg/L	----	----		<0.0010	<0.0010	<0.0010	----	----
EG050G-W: Hexavalent Chromium - Water Leachable											
Hexavalent Chromium	EG050G-W	0.01	mg/L	----	----		<0.01	<0.01	<0.01	----	----
EK040P: Fluoride by PC Titrator											
Fluoride	EK040P	0.1	mg/L	----	----		**0.2** ± 0.05	**0.1** ± 0.04	<0.1 - -	----	----
EP068A: Organochlorine Pesticides (OC)											
alpha-BHC	EP068	0.5	µg/L	----	----		<0.5	<0.5	<0.5	----	----
Hexachlorobenzene (HCB)	EP068	0.5	µg/L	----	----		<0.5	<0.5	<0.5	----	----
beta-BHC	EP068	0.5	µg/L	----	----		<0.5	<0.5	<0.5	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
Sample ID										
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
						ES2233009-002 MU	ES2233009-004 MU	ES2233009-007 MU	-------- MU	-------- MU
EP068A: Organochlorine Pesticides (OC) - Continued										
gamma-BHC	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
delta-BHC	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Heptachlor	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Aldrin	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Heptachlor epoxide	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
trans-Chlordane	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
alpha-Endosulfan	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
cis-Chlordane	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Dieldrin	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
4.4`-DDE	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Endrin	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
beta-Endosulfan	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
4.4`-DDD	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Endrin aldehyde	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Endosulfan sulfate	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
4.4`-DDT	EP068	2.0	µg/L	----	----	<2.0	<2.0	<2.0	----	----
Endrin ketone	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Methoxychlor	EP068	2.0	µg/L	----	----	<2.0	<2.0	<2.0	----	----
^ Total Chlordane (sum)	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
^ Sum of DDD + DDE + DDT	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
^ Sum of Aldrin + Dieldrin	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
EP068B: Organophosphorus Pesticides (OP)										
Dichlorvos	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Demeton-S-methyl	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Monocrotophos	EP068	2.0	µg/L	----	----	<2.0	<2.0	<2.0	----	----
Dimethoate	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Diazinon	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Chlorpyrifos-methyl	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Parathion-methyl	EP068	2.0	µg/L	----	----	<2.0	<2.0	<2.0	----	----
Malathion	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Fenthion	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Chlorpyrifos	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Parathion	EP068	2.0	µg/L	----	----	<2.0	<2.0	<2.0	----	----
Pirimphos-ethyl	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Chlorfenvinphos	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Bromophos-ethyl	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Fenamiphos	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
Sample ID										
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
						ES2233009-002 MU	ES2233009-004 MU	ES2233009-007 MU	-------- MU	-------- MU
EP068B: Organophosphorus Pesticides (OP) - Continued										
Prothiofos	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Ethion	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Carbophenothion	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Azinphos Methyl	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
EP068C: Triazines										
Atrazine	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
Simazine	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
EP068D: Cypermethrins										
Cypermethrins	EP068	2.0	µg/L	----	----	<2.0	<2.0	<2.0	----	----
EP068E: Other Pesticides										
Methoprene	EP068	0.5	µg/L	----	----	<0.5	<0.5	<0.5	----	----
EP075A: Phenolic Compounds										
Phenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2-Chlorophenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2-Methylphenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
3- & 4-Methylphenol	EP075	4	µg/L	----	----	<4	<4	<4	----	----
2-Nitrophenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2.4-Dimethylphenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2.4-Dichlorophenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2.6-Dichlorophenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4-Chloro-3-methylphenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2.4.6-Trichlorophenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2.4.5-Trichlorophenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Pentachlorophenol	EP075	4	µg/L	----	----	<4	<4	<4	----	----
EP075B: Polynuclear Aromatic Hydrocarbons										
Naphthalene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2-Methylnaphthalene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2-Chloronaphthalene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Acenaphthylene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Acenaphthene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Fluorene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Phenanthrene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Anthracene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Fluoranthene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Pyrene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
N-2-Fluorenyl Acetamide	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Benz(a)anthracene	EP075	2	µg/L	----	----	<2	<2	<2	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
Sample ID										
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
						ES2233009-002 MU	ES2233009-004 MU	ES2233009-007 MU	-------- MU	-------- MU
EP075B: Polynuclear Aromatic Hydrocarbons - Continued										
Chrysene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Benzo(b+j) & Benzo(k)fluoranthene	EP075	4	µg/L	----	----	<4	<4	<4	----	----
7.12-Dimethylbenz(a)anthracene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Benzo(a)pyrene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
3-Methylcholanthrene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Indeno(1.2.3.cd)pyrene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Dibenz(a.h)anthracene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Benzo(g.h.i)perylene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
^ Sum of PAHs	EP075	2	µg/L	----	----	<2	<2	<2	----	----
^ Benzo(a)pyrene TEQ (zero)	EP075	2	µg/L	----	----	<2	<2	<2	----	----
EP075C: Phthalate Esters										
Dimethyl phthalate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Diethyl phthalate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Di-n-butyl phthalate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Butyl benzyl phthalate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
bis(2-ethylhexyl) phthalate	EP075	10	µg/L	----	----	<10	<10	<10	----	----
Di-n-octylphthalate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
EP075D: Nitrosamines										
N-Nitrosomethylethylamine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
N-Nitrosodiethylamine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
N-Nitrosopyrrolidine	EP075	4	µg/L	----	----	<4	<4	<4	----	----
N-Nitrosomorpholine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
N-Nitrosodi-n-propylamine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
N-Nitrosopiperidine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
N-Nitrosodibutylamine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
N-Nitrosodiphenyl & Diphenylamine	EP075	4	µg/L	----	----	<4	<4	<4	----	----
Methapyrilene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
EP075E: Nitroaromatics and Ketones										
2-Picoline	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Acetophenone	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Nitrobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Isophorone	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2.6-Dinitrotoluene	EP075	4	µg/L	----	----	<4	<4	<4	----	----
2.4-Dinitrotoluene	EP075	4	µg/L	----	----	<4	<4	<4	----	----
1-Naphthylamine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4-Nitroquinoline-N-oxide	EP075	2	µg/L	----	----	<2	<2	<2	----	----
5-Nitro-o-toluidine	EP075	2	µg/L	----	----	<2	<2	<2	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
Sample ID										
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
						ES2233009-002 MU	ES2233009-004 MU	ES2233009-007 MU	-------- MU	-------- MU
EP075E: Nitroaromatics and Ketones - Continued										
Azobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
1.3.5-Trinitrobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Phenacetin	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4-Aminobiphenyl	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Pentachloronitrobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Pronamide	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Dimethylaminoazobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Chlorobenzilate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
EP075F: Haloethers										
Bis(2-chloroethyl) ether	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Bis(2-chloroethoxy) methane	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4-Chlorophenyl phenyl ether	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4-Bromophenyl phenyl ether	EP075	2	µg/L	----	----	<2	<2	<2	----	----
EP075G: Chlorinated Hydrocarbons										
1.3-Dichlorobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
1.4-Dichlorobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
1.2-Dichlorobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Hexachloroethane	EP075	2	µg/L	----	----	<2	<2	<2	----	----
1.2.4-Trichlorobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Hexachloropropylene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Hexachlorobutadiene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Hexachlorocyclopentadiene	EP075	10	µg/L	----	----	<10	<10	<10	----	----
Pentachlorobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Hexachlorobenzene (HCB)	EP075	4	µg/L	----	----	<4	<4	<4	----	----
EP075H: Anilines and Benzidines										
Aniline	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4-Chloroaniline	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2-Nitroaniline	EP075	4	µg/L	----	----	<4	<4	<4	----	----
3-Nitroaniline	EP075	4	µg/L	----	----	<4	<4	<4	----	----
Dibenzofuran	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4-Nitroaniline	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Carbazole	EP075	2	µg/L	----	----	<2	<2	<2	----	----
3.3`-Dichlorobenzidine	EP075	2	µg/L	----	----	<2	<2	<2	----	----
EP075I: Organochlorine Pesticides										
alpha-BHC	EP075	2	µg/L	----	----	<2	<2	<2	----	----
beta-BHC	EP075	2	µg/L	----	----	<2	<2	<2	----	----
gamma-BHC	EP075	2	µg/L	----	----	<2	<2	<2	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
Sample ID										
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
						ES2233009-002 MU	ES2233009-004 MU	ES2233009-007 MU	-------- MU	-------- MU
EP075I: Organochlorine Pesticides - Continued										
delta-BHC	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Heptachlor	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Aldrin	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Heptachlor epoxide	EP075	2	µg/L	----	----	<2	<2	<2	----	----
alpha-Endosulfan	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4.4`-DDE	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Dieldrin	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Endrin	EP075	2	µg/L	----	----	<2	<2	<2	----	----
beta-Endosulfan	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4.4`-DDD	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Endosulfan sulfate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
4.4`-DDT	EP075	4	µg/L	----	----	<4	<4	<4	----	----
^ Sum of Aldrin + Dieldrin	EP075	4	µg/L	----	----	<4	<4	<4	----	----
^ Sum of DDD + DDE + DDT	EP075	4	µg/L	----	----	<4	<4	<4	----	----
EP075J: Organophosphorus Pesticides										
Dichlorvos	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Dimethoate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Diazinon	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Chlorpyrifos-methyl	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Malathion	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Fenthion	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Chlorpyrifos	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Pirimphos-ethyl	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Chlorfenvinphos	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Prothiofos	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Ethion	EP075	2	µg/L	----	----	<2	<2	<2	----	----
EP075K: Miscellaneous Compounds										
1.3.5-Trichlorobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
1.2.4.5-Tetrachlorobenzene	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Methanesulfonate methyl	EP075	2	µg/L	----	----	<2	<2	<2	----	----
cis-Isosafrole	EP075	2	µg/L	----	----	<2	<2	<2	----	----
trans-Isosafrole	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Safrole	EP075	2	µg/L	----	----	<2	<2	<2	----	----
Diallate	EP075	2	µg/L	----	----	<2	<2	<2	----	----
2.3.4.6-Tetrachlorophenol	EP075	2	µg/L	----	----	<2	<2	<2	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER ZHE LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	Sample ID: MB02B_0-9 Sampling date/time: 12-Sep-2022 15:00 ES2233009-002 MU	Sample ID: MB03B_7-20 Sampling date/time: 12-Sep-2022 15:00 ES2233009-004 MU	Sample ID: MB02B_178-187 Sampling date/time: 12-Sep-2022 15:00 ES2233009-007 MU	Sample ID: ---- Sampling date/time: ---- -------- MU	Sample ID: ---- Sampling date/time: ---- -------- MU
EK026SF: Total CN by Segmented Flow Analyser										
Total Cyanide	EK026SF	0.004	mg/L	----	----	<0.004	<0.004	<0.004	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser										
Weak Acid Dissociable Cyanide	EK028SF	0.004	mg/L	----	----	<0.004	<0.004	<0.004	----	----
EP074A: Monocyclic Aromatic Hydrocarbons										
Benzene	EP074	1	µg/L	----	----	<1	<1	<1	----	----
Toluene	EP074	2	µg/L	----	----	<2	<2	<2	----	----
Ethylbenzene	EP074	2	µg/L	----	----	<2	<2	<2	----	----
meta- & para-Xylene	EP074	2	µg/L	----	----	<2	<2	<2	----	----
Styrene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
ortho-Xylene	EP074	2	µg/L	----	----	<2	<2	<2	----	----
Isopropylbenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
n-Propylbenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.3.5-Trimethylbenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
sec-Butylbenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2.4-Trimethylbenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
tert-Butylbenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
p-Isopropyltoluene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
n-Butylbenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
EP074B: Oxygenated Compounds										
2-Propanone (Acetone)	EP074	50	µg/L	----	----	<50	<50	<50	----	----
Vinyl Acetate	EP074	50	µg/L	----	----	<50	<50	<50	----	----
2-Butanone (MEK)	EP074	50	µg/L	----	----	<50	<50	<50	----	----
4-Methyl-2-pentanone (MIBK)	EP074	50	µg/L	----	----	<50	<50	<50	----	----
2-Hexanone (MBK)	EP074	50	µg/L	----	----	<50	<50	<50	----	----
EP074C: Sulfonated Compounds										
Carbon disulfide	EP074	5	µg/L	----	----	<5	<5	<5	----	----
EP074D: Fumigants										
2.2-Dichloropropane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2-Dichloropropane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
cis-1.3-Dichloropropylene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
trans-1.3-Dichloropropylene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2-Dibromoethane (EDB)	EP074	5	µg/L	----	----	<5	<5	<5	----	----
EP074E: Halogenated Aliphatic Compounds										
Dichlorodifluoromethane	EP074	50	µg/L	----	----	<50	<50	<50	----	----
Chloromethane	EP074	50	µg/L	----	----	<50	<50	<50	----	----
Vinyl chloride	EP074	50	µg/L	----	----	<50	<50	<50	----	----
Bromomethane	EP074	50	µg/L	----	----	<50	<50	<50	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER ZHE LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB02B_0-9	MB03B_7-20	MB02B_178-187	----	----
Sample ID										
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
						ES2233009-002 MU	ES2233009-004 MU	ES2233009-007 MU	-------- MU	-------- MU
EP074E: Halogenated Aliphatic Compounds - Continued										
Chloroethane	EP074	50	µg/L	----	----	<50	<50	<50	----	----
Trichlorofluoromethane	EP074	50	µg/L	----	----	<50	<50	<50	----	----
1.1-Dichloroethene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Iodomethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Methylene chloride	EP074	5	µg/L	----	----	<5	<5	<5	----	----
trans-1.2-Dichloroethene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.1-Dichloroethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
cis-1.2-Dichloroethene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.1.1-Trichloroethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.1-Dichloropropylene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Carbon Tetrachloride	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2-Dichloroethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Trichloroethene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Dibromomethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.1.2-Trichloroethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.3-Dichloropropane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Tetrachloroethene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.1.1.2-Tetrachloroethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
trans-1.4-Dichloro-2-butene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
cis-1.4-Dichloro-2-butene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.1.2.2-Tetrachloroethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2.3-Trichloropropane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Pentachloroethane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2-Dibromo-3-chloropropane	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Hexachlorobutadiene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
EP074F: Halogenated Aromatic Compounds										
Chlorobenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
Bromobenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
2-Chlorotoluene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
4-Chlorotoluene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.3-Dichlorobenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.4-Dichlorobenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2-Dichlorobenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2.4-Trichlorobenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
1.2.3-Trichlorobenzene	EP074	5	µg/L	----	----	<5	<5	<5	----	----
EP074G: Trihalomethanes										
Chloroform	EP074	5	µg/L	----	----	<5	<5	<5	----	----

No Guideline Evaluation Required

Sub-Matrix: **DI WATER ZHE LEACHATE**

Compound	*Method*	*LOR*	*Unit*	Lower Limit	Upper Limit	*Sample ID* / *Sampling date/time*				
						MB02B_0-9	**MB03B_7-20**	**MB02B_178-187**	**----**	**----**
						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----
						ES2233009-002 MU	**ES2233009-004 MU**	**ES2233009-007 MU**	**-------- MU**	**-------- MU**
EP074G: Trihalomethanes - Continued										
Bromodichloromethane	EP074	5	µg/L	----	----	<5	<5	<5	**----**	**----**
Dibromochloromethane	EP074	5	µg/L	----	----	<5	<5	<5	**----**	**----**
Bromoform	EP074	5	µg/L	----	----	<5	<5	<5	**----**	**----**
EP074H: Naphthalene										
Naphthalene	EP074	5	µg/L	----	----	<5	<5	<5	**----**	**----**

No Guideline Evaluation Required

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
Sample ID						ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
EA003 :pH (field/fox)										
pH (F)	EA003	0.1	pH Unit	----	----	**8.5**	**----**	**----**	**9.3**	**----**
pH (Fox)	EA003	0.1	pH Unit	----	----	**6.2**	**----**	**----**	**5.7**	**----**
Reaction Rate	EA003	1	Reaction Unit	----	----	**1**	**----**	**----**	**1**	**----**
EA011: Net Acid Generation										
pH (OX)	EA011	0.1	pH Unit	----	----	**9.8**	**----**	**----**	**5.9**	**----**
NAG (pH 4.5)	EA011	0.1	kg H2SO4/t	----	----	<0.1	**----**	**----**	<0.1	**----**
NAG (pH 7.0)	EA011	0.1	kg H2SO4/t	----	----	<0.1	**----**	**----**	**1.2**	**----**
EA013: Acid Neutralising Capacity										
ANC as H2SO4	EA013	0.5	kg H2SO4 equiv./t	----	----	**43.3**	**----**	**----**	**18.7**	**----**
ANC as CaCO3	EA013	0.1	% CaCO3	----	----	**4.4**	**----**	**----**	**1.9**	**----**
Fizz Rating	EA013	0	Fizz Unit	----	----	**2**	**----**	**----**	**1**	**----**
EA055: Moisture Content (Dried @ 105-110°C)										
Moisture Content	EA055	0.1	%	----	----	**----**	**0.3**	**2.0**	**----**	**0.6**
ED042T: Total Sulfur by LECO										
Sulfur - Total as S (LECO)	ED042T	0.01	%	----	----	**0.03**	**----**	**----**	**0.16**	**----**
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)										
Final pH	EN60-DIa-G	0.1	pH Unit	----	----	**----**	**7.2**	**7.4**	**----**	**8.8**
EN60Z: ASLP Leachate - ZHE										
Extraction Fluid pH	EN60Za	0.1	pH Unit	----	----	**----**	**7.2**	**7.4**	**----**	**8.8**
EP003: Total Organic Carbon (TOC) in Soil										
Total Organic Carbon	EP003	0.02	%	----	----	<0.02	**----**	**----**	**0.02**	**----**
EP068A: Organochlorine Pesticides (OC)										
alpha-BHC	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
Hexachlorobenzene (HCB)	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
beta-BHC	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
gamma-BHC	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
delta-BHC	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
Heptachlor	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
Aldrin	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
Heptachlor epoxide	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
^ Total Chlordane (sum)	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
trans-Chlordane	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
alpha-Endosulfan	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
cis-Chlordane	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
Dieldrin	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05
4.4`-DDE	EP068	0.05	mg/kg	----	----	**----**	<0.05	<0.05	**----**	<0.05

No Guideline Evaluation Required

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
Sample ID						ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
EP068A: Organochlorine Pesticides (OC) - Continued										
Endrin	EP068	0.05	mg/kg	----	----	----	<0.05	<0.05	----	<0.05
beta-Endosulfan	EP068	0.05	mg/kg	----	----	----	<0.05	<0.05	----	<0.05
4.4`-DDD	EP068	0.05	mg/kg	----	----	----	<0.05	<0.05	----	<0.05
Endrin aldehyde	EP068	0.05	mg/kg	----	----	----	<0.05	<0.05	----	<0.05
Endosulfan sulfate	EP068	0.05	mg/kg	----	----	----	<0.05	<0.05	----	<0.05
4.4`-DDT	EP068	0.2	mg/kg	----	----	----	<0.2	<0.2	----	<0.2
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup										
>C10 - C16 Fraction	EP071SG-S	50	mg/kg	----	----	----	<50	<50	----	<50
>C16 - C34 Fraction	EP071SG-S	100	mg/kg	----	----	----	<100	<100	----	<100
>C34 - C40 Fraction	EP071SG-S	100	mg/kg	----	----	----	<100	<100	----	<100
^ >C10 - C40 Fraction (sum)	EP071SG-S	50	mg/kg	----	----	----	<50	<50	----	<50
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup										
C10 - C14 Fraction	EP071SG-S	50	mg/kg	----	----	----	<50	<50	----	<50
C15 - C28 Fraction	EP071SG-S	100	mg/kg	----	----	----	<100	<100	----	<100
C29 - C36 Fraction	EP071SG-S	100	mg/kg	----	----	----	<100	<100	----	<100
EP074A: Monocyclic Aromatic Hydrocarbons										
meta- & para-Xylene	EP074	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
ortho-Xylene	EP074	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
EP075A: Phenolic Compounds										
4-Chloro-3-methylphenol	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Pentachlorophenol	EP075	1	mg/kg	----	----	----	<1	<1	----	<1
EP075B: Polynuclear Aromatic Hydrocarbons										
Naphthalene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Acenaphthylene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Acenaphthene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Fluorene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Phenanthrene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Anthracene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Fluoranthene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Pyrene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Benz(a)anthracene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Chrysene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Benzo(b+j) & Benzo(k)fluoranthene	EP075	1	mg/kg	----	----	----	<1	<1	----	<1
Indeno(1.2.3.cd)pyrene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Dibenz(a.h)anthracene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Benzo(g.h.i)perylene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
EP075C: Phthalate Esters										

No Guideline Evaluation Required

Sub-Matrix: **SOLID**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB01A_26-36.5	MB02B_0-9	MB03B_7-20	MB03B_21-29	MB02B_178-187
Sample ID						ES2233009-001 MU	ES2233009-002 MU	ES2233009-004 MU	ES2233009-006 MU	ES2233009-007 MU
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00	12-Sep-2022 15:00
EP075C: Phthalate Esters - Continued										
bis(2-ethylhexyl) phthalate	EP075	5.0	mg/kg	----	----	----	<5.0	<5.0	----	<5.0
EP075E: Nitroaromatics and Ketones										
Pentachloronitrobenzene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
EP075G: Chlorinated Hydrocarbons										
1.2.4-Trichlorobenzene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Pentachlorobenzene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
EP075K: Miscellaneous Compounds										
1.2.4.5-Tetrachlorobenzene	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
2.3.4.6-Tetrachlorophenol	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Isodrin	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
Di (2-ethylhexyl) adipate	EP075	0.5	mg/kg	----	----	----	<0.5	<0.5	----	<0.5
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions										
C6 - C10 Fraction	EP080	10	mg/kg	----	----	----	<10	<10	----	<10
EP132A: Phenolic Compounds										
Hexachlorophene	EP132	0.01	mg/kg	----	----	----	<0.01	<0.01	----	<0.01
EP202A: Phenoxyacetic Acid Herbicides by LCMS										
2.4.5-TP (Silvex)	EP202	0.02	mg/kg	----	----	----	<0.02	<0.02	----	<0.02
2.4.5-T	EP202	0.02	mg/kg	----	----	----	<0.02	<0.02	----	<0.02

Guideline values - NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014) - Table 1

		Limits
General Waste - CT1		
1.1.1.2-Tetrachloroethane:	No overview description available for this compound in this guideline.	< 200 mg/kg
1.1.1-Trichloroethane:	No overview description available for this compound in this guideline.	< 600 mg/kg
1.1.2.2-Tetrachloroethane:	No overview description available for this compound in this guideline.	< 26 mg/kg
1.1.2-Trichloroethane:	No overview description available for this compound in this guideline.	< 24 mg/kg
1.1-Dichloroethene:	No overview description available for this compound in this guideline.	< 14 mg/kg
1.2.3.4-Tetrachlorobenzene:	No overview description available for this compound in this guideline.	< 10 mg/kg
1.2-Dichlorobenzene:	No overview description available for this compound in this guideline.	< 86 mg/kg
1.2-Dichloroethane:	No overview description available for this compound in this guideline.	< 10 mg/kg
1.4-Dichlorobenzene:	No overview description available for this compound in this guideline.	< 150 mg/kg
2.4.5-Trichlorophenol:	No overview description available for this compound in this guideline.	< 8,000 mg/kg
2.4.6-Trichlorophenol:	No overview description available for this compound in this guideline.	< 40 mg/kg
2.4-D:	No overview description available for this compound in this guideline.	< 200 mg/kg
2.4-Dinitrotoluene:	No overview description available for this compound in this guideline.	< 2.6 mg/kg
2-Butanone (MEK):	No overview description available for this compound in this guideline.	< 4,000 mg/kg
2-Methylphenol:	No overview description available for this compound in this guideline.	< 4,000 mg/kg
3- & 4-Methylphenol:	No overview description available for this compound in this guideline.	< 4,000 mg/kg
Arsenic:	No overview description available for this compound in this guideline.	< 100 mg/kg
Benzene:	No overview description available for this compound in this guideline.	< 10 mg/kg
Benzo(a)pyrene:	No overview description available for this compound in this guideline.	< 0.8 mg/kg
Beryllium:	No overview description available for this compound in this guideline.	< 20 mg/kg
C10 - C36 Fraction (sum):	No overview description available for this compound in this guideline.	< 10,000 mg/kg
C6 - C9 Fraction:	No overview description available for this compound in this guideline.	< 650 mg/kg
Cadmium:	No overview description available for this compound in this guideline.	< 20 mg/kg
Carbon Tetrachloride:	No overview description available for this compound in this guideline.	< 10 mg/kg
Chlorobenzene:	No overview description available for this compound in this guideline.	< 2,000 mg/kg
Chloroform:	No overview description available for this compound in this guideline.	< 120 mg/kg
Chlorpyrifos:	No overview description available for this compound in this guideline.	< 4 mg/kg
Ethylbenzene:	No overview description available for this compound in this guideline.	< 600 mg/kg
Fluoride:	No overview description available for this compound in this guideline.	< 3,000 mg/kg
Fluroxypyr:	No overview description available for this compound in this guideline.	< 40 mg/kg

Guideline values - NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014) - Table 1

		Limits
General Waste - CT1		
Hexavalent Chromium:	No overview description available for this compound in this guideline.	< 100 mg/kg
Lead:	No overview description available for this compound in this guideline.	< 100 mg/kg
Mercury:	No overview description available for this compound in this guideline.	< 4 mg/kg
Methylene chloride:	No overview description available for this compound in this guideline.	< 172 mg/kg
Molybdenum:	No overview description available for this compound in this guideline.	< 100 mg/kg
Nickel:	No overview description available for this compound in this guideline.	< 40 mg/kg
Nitrobenzene:	No overview description available for this compound in this guideline.	< 40 mg/kg
Phenol:	No overview description available for this compound in this guideline.	< 288 mg/kg
Picloram:	No overview description available for this compound in this guideline.	< 60 mg/kg
Selenium:	No overview description available for this compound in this guideline.	< 20 mg/kg
Silver:	No overview description available for this compound in this guideline.	< 100 mg/kg
Styrene:	No overview description available for this compound in this guideline.	< 60 mg/kg
Sum of Endosulfans (inc. sulfate):	No overview description available for this compound in this guideline.	< 60 mg/kg
Sum of PAHs:	No overview description available for this compound in this guideline.	< 200 mg/kg
Sum of plasticisers:	No overview description available for this compound in this guideline.	< 600 mg/kg
Sum of Scheduled Chemicals:	No overview description available for this compound in this guideline.	< 49 mg/kg
Tetrachloroethene:	No overview description available for this compound in this guideline.	< 14 mg/kg
Toluene:	No overview description available for this compound in this guideline.	< 288 mg/kg
Total Cyanide:	No overview description available for this compound in this guideline.	< 320 mg/kg
Total Polychlorinated biphenyls:	No overview description available for this compound in this guideline.	< 49 mg/kg
Trichloroethene:	No overview description available for this compound in this guideline.	< 10 mg/kg
Triclopyr:	No overview description available for this compound in this guideline.	< 40 mg/kg
Vinyl chloride:	No overview description available for this compound in this guideline.	< 4 mg/kg
Weak Acid Dissociable Cyanide:	No overview description available for this compound in this guideline.	< 70 mg/kg
Restricted Soild Waste - CT2		
1.1.1.2-Tetrachloroethane :	No overview description available for this compound in this guideline.	< 800 mg/kg
1.1.1-Trichloroethane:	No overview description available for this compound in this guideline.	< 2,400 mg/kg
1.1.2.2-Tetrachloroethane :	No overview description available for this compound in this guideline.	< 104 mg/kg

Guideline values - NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014) - Table 1

		Limits
Restricted Soild Waste - CT2		
1.1.2-Trichloroethane:	No overview description available for this compound in this guideline.	< 96 mg/kg
1.1-Dichloroethene:	No overview description available for this compound in this guideline.	< 56 mg/kg
1.2.3.4-Tetrachlorobenzene:	No overview description available for this compound in this guideline.	< 40 mg/kg
1.2-Dichlorobenzene:	No overview description available for this compound in this guideline.	< 344 mg/kg
1.2-Dichloroethane:	No overview description available for this compound in this guideline.	< 40 mg/kg
1.4-Dichlorobenzene:	No overview description available for this compound in this guideline.	< 600 mg/kg
2.4.5-Trichlorophenol:	No overview description available for this compound in this guideline.	< 32,000 mg/kg
2.4.6-Trichlorophenol:	No overview description available for this compound in this guideline.	< 160 mg/kg
2.4-D:	No overview description available for this compound in this guideline.	< 800 mg/kg
2.4-Dinitrotoluene:	No overview description available for this compound in this guideline.	< 10.4 mg/kg
2-Butanone (MEK):	No overview description available for this compound in this guideline.	< 16,000 mg/kg
2-Methylphenol:	No overview description available for this compound in this guideline.	< 16,000 mg/kg
3- & 4-Methylphenol:	No overview description available for this compound in this guideline.	< 16,000 mg/kg
Arsenic:	No overview description available for this compound in this guideline.	< 400 mg/kg
Benzene:	No overview description available for this compound in this guideline.	< 40 mg/kg
Benzo(a)pyrene:	No overview description available for this compound in this guideline.	< 3.2 mg/kg
Beryllium:	No overview description available for this compound in this guideline.	< 80 mg/kg
C10 - C36 Fraction (sum):	No overview description available for this compound in this guideline.	< 40,000 mg/kg
C6 - C9 Fraction:	No overview description available for this compound in this guideline.	< 2,600 mg/kg
Cadmium:	No overview description available for this compound in this guideline.	< 80 mg/kg
Carbon Tetrachloride:	No overview description available for this compound in this guideline.	< 40 mg/kg
Chlorobenzene:	No overview description available for this compound in this guideline.	< 8,000 mg/kg
Chloroform:	No overview description available for this compound in this guideline.	< 480 mg/kg
Chlorpyrifos:	No overview description available for this compound in this guideline.	< 16 mg/kg
Ethylbenzene:	No overview description available for this compound in this guideline.	< 2,400 mg/kg
Fluoride:	No overview description available for this compound in this guideline.	< 12,000 mg/kg
Fluroxypyr:	No overview description available for this compound in this guideline.	< 160 mg/kg
Hexavalent Chromium:	No overview description available for this compound in this guideline.	< 400 mg/kg
Lead:	No overview description available for this compound in this guideline.	< 400 mg/kg
Mercury:	No overview description available for this compound in this guideline.	< 16 mg/kg
Methylene chloride:	No overview description available for this compound in this guideline.	< 688 mg/kg

Guideline values - NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014) - Table 1

		Limits
Restricted Soild Waste - CT2		
Molybdenum:	No overview description available for this compound in this guideline.	< 400 mg/kg
Nickel:	No overview description available for this compound in this guideline.	< 160 mg/kg
Nitrobenzene:	No overview description available for this compound in this guideline.	< 160 mg/kg
Phenol:	No overview description available for this compound in this guideline.	< 1,152 mg/kg
Picloram:	No overview description available for this compound in this guideline.	< 240 mg/kg
Selenium:	No overview description available for this compound in this guideline.	< 80 mg/kg
Silver:	No overview description available for this compound in this guideline.	< 400 mg/kg
Styrene:	No overview description available for this compound in this guideline.	< 240 mg/kg
Sum of Endosulfans (inc. sulfate):	No overview description available for this compound in this guideline.	< 240 mg/kg
Sum of PAHs:	No overview description available for this compound in this guideline.	< 800 mg/kg
Sum of plasticisers:	No overview description available for this compound in this guideline.	< 2,400 mg/kg
Sum of Scheduled Chemicals:	No overview description available for this compound in this guideline.	< 49 mg/kg
Tetrachloroethene:	No overview description available for this compound in this guideline.	< 56 mg/kg
Toluene:	No overview description available for this compound in this guideline.	< 1,152 mg/kg
Total Cyanide:	No overview description available for this compound in this guideline.	< 1,280 mg/kg
Total Polychlorinated biphenyls:	No overview description available for this compound in this guideline.	< 49 mg/kg
Trichloroethene:	No overview description available for this compound in this guideline.	< 40 mg/kg
Triclopyr:	No overview description available for this compound in this guideline.	< 160 mg/kg
Vinyl chloride:	No overview description available for this compound in this guideline.	< 16 mg/kg
Weak Acid Dissociable Cyanide:	No overview description available for this compound in this guideline.	< 280 mg/kg

Surrogate Control Limits

Sub-Matrix: DI WATER LEACHATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	10	117
Phenol-d6	13127-88-3	10	69
2-Chlorophenol-D4	93951-73-6	21	130
2.4.6-Tribromophenol	118-79-6	10	151
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	29	142
1.2-Dichlorobenzene-D4	2199-69-1	24	121
2-Fluorobiphenyl	321-60-8	27	135
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	21	123

Sub-Matrix: DI WATER ZHE LEACHATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	78	133
Toluene-D8	2037-26-5	79	129
4-Bromofluorobenzene	460-00-4	81	124

Sub-Matrix: SOLID		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP074S(SIM) : VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	131
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	64	130
Toluene-D8	2037-26-5	66	136
4-Bromofluorobenzene	460-00-4	60	122
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	29	149
Phenol-d6	13127-88-3	32	128

Sub-Matrix: **SOLID**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075S: Acid Extractable Surrogates - Continued			
2-Chlorophenol-D4	93951-73-6	32	128
2.4.6-Tribromophenol	118-79-6	13	121
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	33	125
1.2-Dichlorobenzene-D4	2199-69-1	34	108
2-Fluorobiphenyl	321-60-8	35	121
Anthracene-d10	1719-06-8	35	123
4-Terphenyl-d14	1718-51-0	33	125
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP202S: Phenoxyacetic Acid Herbicide Surrogate			
2.4-Dichlorophenyl Acetic Acid	19719-28-9	45	139

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2233009**	Page	: 1 of 30
Amendment	: **(Preliminary Report)**		
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 14-Sep-2022
Order number	: J200096	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: ----	Issue Date	: 11-Oct-2022
Sampler	: HENRY NOAKES		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 6		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Hez Weldermariam	Lab Technician	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4585113)									
ES2232912-003	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	19	19	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4588949)									
ES2233009-007	MB02B_178-187	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	3	3	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
EA003 :pH (field/fox) (QC Lot: 4594163)									
EM2218261-008	Anonymous	EA003: pH (F)	----	0.1	pH Unit	6.7	7.0	3.6	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	4.4	4.4	0.0	0% - 20%
EA011: Net Acid Generation (QC Lot: 4597028)									
ES2233009-001	MB01A_26-36.5	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA011: Net Acid Generation (QC Lot: 4597028) - continued									
ES2233009-001	MB01A_26-36.5	EA011: pH (OX)	----	0.1	pH Unit	9.8	9.8	0.0	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 4597029)									
ES2233009-001	MB01A_26-36.5	EA013: ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	43.3	44.8	3.4	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4585120)									
ES2232842-001	Anonymous	EA055: Moisture Content	----	0.1	%	6.4	6.7	5.1	No Limit
ES2232912-003	Anonymous	EA055: Moisture Content	----	0.1	%	13.6	15.8	15.1	0% - 50%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4585121)									
ES2233013-001	Anonymous	EA055: Moisture Content	----	0.1	%	22.4	21.8	2.7	0% - 20%
ED042T: Total Sulfur by LECO (QC Lot: 4599111)									
ES2233009-001	MB01A_26-36.5	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.03	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4585112)									
ES2232912-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4588950)									
ES2233287-005	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.1	0.0	No Limit
ES2233009-007	MB02B_178-187	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 4584078)									
ES2232407-004	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	1.4	2.8	63.4	No Limit
ES2232708-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	1.4	93.9	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 4587216)									
ES2231661-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	4.1	7.7	60.3	No Limit
ES2233009-007	MB02B_178-187	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 4585506)									
ES2231661-001	Anonymous	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<4	<4	0.0	No Limit
ES2233009-004	MB03B_7-20	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.0	No Limit
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QC Lot: 4585505)									
ES2231661-001	Anonymous	EK028SF: Weak Acid Dissociable Cyanide	----	1	mg/kg	<4	<4	0.0	No Limit
ES2233009-004	MB03B_7-20	EK028SF: Weak Acid Dissociable Cyanide	----	1	mg/kg	<1	<1	0.0	No Limit
EK040T: Fluoride Total (QC Lot: 4589794)									
ES2233009-002	MB02B_0-9	EK040T: Fluoride	16984-48-8	40	mg/kg	320	360	13.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 4599112)									
ES2233009-001	MB01A_26-36.5	EP003: Total Organic Carbon	----	0.02	%	<0.02	<0.02	0.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 4584740)									
ES2233009-002	MB02B_0-9	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 4585917)									
ES2233009-007	MB02B_178-187	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 4584738)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP068A: Organochlorine Pesticides (OC) (QC Lot: 4584738) - continued									
ES2233009-002	MB02B_0-9	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 4585920)									
ES2233009-007	MB02B_178-187	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 4584738)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 4584738) - continued									
ES2233009-002	MB02B_0-9	EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 4585920)									
ES2233009-007	MB02B_178-187	EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QC Lot: 4584739)									
ES2233009-002	MB02B_0-9	EP071SG-S: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
		EP071SG-S: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	0.0	No Limit
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QC Lot: 4585918)									
ES2233009-007	MB02B_178-187	EP071SG-S: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
		EP071SG-S: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	0.0	No Limit
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QC Lot: 4584739)									
ES2233009-002	MB02B_0-9	EP071SG-S: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QC Lot: 4585918)									
ES2233009-007	MB02B_178-187	EP071SG-S: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 4584521)									
ES2233009-002	MB02B_0-9	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 4585545)									
ES2233009-007	MB02B_178-187	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 4584521)									
ES2233009-002	MB02B_0-9	EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074B: Oxygenated Compounds (QC Lot: 4585545)									
ES2233009-007	MB02B_178-187	EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit
EP074E(SIM): Halogenated Aliphatic Compounds (QC Lot: 4584523)									
ES2233009-002	MB02B_0-9	EP074E(SIM): Vinyl chloride	75-01-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP074E(SIM): Halogenated Aliphatic Compounds (QC Lot: 4585544)									
ES2233009-007	MB02B_178-187	EP074E(SIM): Vinyl chloride	75-01-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 4584521)									
ES2233009-002	MB02B_0-9	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Methylene chloride	75-09-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<4	<4	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 4585545)									
ES2233009-007	MB02B_178-187	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Methylene chloride	75-09-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<4	<4	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 4584521)									
ES2233009-002	MB02B_0-9	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 4585545)									
ES2233009-007	MB02B_178-187	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 4584521)									
ES2233009-002	MB02B_0-9	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 4585545)									
ES2233009-007	MB02B_178-187	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 4584737)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075A: Phenolic Compounds (QC Lot: 4584737) - continued									
ES2233009-002	MB02B_0-9	EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	<1	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 4585919)									
ES2233009-007	MB02B_178-187	EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	<1	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4584737)									
ES2233009-002	MB02B_0-9	EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	<1	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4585919)									
ES2233009-007	MB02B_178-187	EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4585919) - continued									
ES2233009-007	MB02B_178-187	EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	<1	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 4584737)									
ES2233009-002	MB02B_0-9	EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 4585919)									
ES2233009-007	MB02B_178-187	EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075G: Chlorinated Hydrocarbons (QC Lot: 4584737)									
ES2233009-002	MB02B_0-9	EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075G: Chlorinated Hydrocarbons (QC Lot: 4585919)									
ES2233009-007	MB02B_178-187	EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075K: Miscellaneous Compounds (QC Lot: 4584737)									
ES2233009-002	MB02B_0-9	EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075K: Miscellaneous Compounds (QC Lot: 4585919)									
ES2233009-007	MB02B_178-187	EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4584522)									
ES2233009-002	MB02B_0-9	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4585543)									
ES2233009-007	MB02B_178-187	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4584522)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4584522) - continued									
ES2233009-002	MB02B_0-9	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4585543)									
ES2233009-007	MB02B_178-187	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP202A: Phenoxyacetic Acid Herbicides by LCMS (QC Lot: 4586607)									
EB2226985-001	Anonymous	EP202: 2.4-D	94-75-7	0.02	mg/kg	<0.04	<0.04	0.0	No Limit
		EP202: Triclopyr	55335-06-3	0.02	mg/kg	<0.04	<0.04	0.0	No Limit
		EP202: 2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg	<0.04	<0.04	0.0	No Limit
		EP202: 2.4.5-T	93-76-5	0.02	mg/kg	<0.04	<0.04	0.0	No Limit
		EP202: Picloram	1918-02-1	0.02	mg/kg	<0.04	<0.04	0.0	No Limit
		EP202: Fluroxypyr	69377-81-7	0.02	mg/kg	0.16	0.16	0.0	No Limit
EP2211723-002	Anonymous	EP202: 2.4-D	94-75-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Triclopyr	55335-06-3	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: 2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: 2.4.5-T	93-76-5	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Picloram	1918-02-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Fluroxypyr	69377-81-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)C: Leachable Metals by ICPAES (QC Lot: 4590347)									
ES2233009-002	MB02B_0-9	EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Aluminium	7429-90-5	0.1	mg/L	3.9	3.8	0.0	0% - 20%
		EG005C: Antimony	7440-36-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Iron	7439-89-6	0.1	mg/L	5.9	6.1	3.8	0% - 20%
		EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Manganese	7439-96-5	0.1	mg/L	0.1	0.1	0.0	No Limit
		EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Silver	7440-22-4	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Molybdenum	7439-98-7	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EA005P: pH by PC Titrator (QC Lot: 4591666)									
ES2232949-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.90	8.04	1.8	0% - 20%
ES2233009-002	MB02B_0-9	EA005-P: pH Value	----	0.01	pH Unit	6.73	6.10	9.8	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 4591665)									
EW2204279-004	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1700	1700	0.1	0% - 20%
ES2232949-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	52800	52600	0.4	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA010P: Conductivity by PC Titrator (QC Lot: 4591665) - continued									
ES2233009-002	MB02B_0-9	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	19	16	16.8	0% - 50%
ED037P: Alkalinity by PC Titrator (QC Lot: 4591668)									
ES2232949-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	134	136	1.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	134	136	1.9	0% - 20%
ES2233009-002	MB02B_0-9	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	4	2	53.5	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	4	2	53.5	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4590993)									
ES2233009-002	MB02B_0-9	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 4590992)									
ES2233009-002	MB02B_0-9	ED045G: Chloride	16887-00-6	1	mg/L	2	2	0.0	No Limit
EG035C: Leachable Mercury by FIMS (QC Lot: 4590440)									
ES2233009-002	MB02B_0-9	EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0010	<0.0010	0.0	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 4591356)									
ES2233009-002	MB02B_0-9	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 4593212)									
ES2233009-002	MB02B_0-9	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QC Lot: 4593213)									
ES2233009-002	MB02B_0-9	EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4591669)									
ES2233009-002	MB02B_0-9	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4585113)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	105	88.0	113
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	0.5 mg/kg	106	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	110	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	60.8 mg/kg	105	82.0	119
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	2.3 mg/kg	119	77.0	119
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.3 mg/kg	106	80.0	120
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.3 mg/kg	136	42.0	158
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4588949)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	91.0	88.0	113
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	0.5 mg/kg	91.3	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	94.7	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	60.8 mg/kg	97.8	82.0	119
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	2.3 mg/kg	108	77.0	119
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.3 mg/kg	98.0	80.0	120
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.3 mg/kg	111	42.0	158
EA011: Net Acid Generation (QCLot: 4597028)								
EA011: NAG (pH 7.0)	----	----	kg H2SO4/t	----	22.83 kg H2SO4/t	108	70.0	130
EA013: Acid Neutralising Capacity (QCLot: 4597029)								
EA013: ANC as H2SO4	----	----	kg H2SO4 equiv./t	----	49 kg H2SO4 equiv./t	104	82.0	120
ED042T: Total Sulfur by LECO (QCLot: 4599111)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.16 %	102	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4585112)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	99.4	70.0	125
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4588950)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	80.4	70.0	125
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 4584078)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	20 mg/kg	106	68.0	114
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 4587216)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	20 mg/kg	98.9	68.0	114
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4585506)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	92.8	81.0	129

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4585505)								
EK028SF: Weak Acid Dissociable Cyanide	----	1	mg/kg	<1	40 mg/kg	110	70.0	130
EK040T: Fluoride Total (QCLot: 4589794)								
EK040T: Fluoride	16984-48-8	40	mg/kg	<40	400 mg/kg	82.1	67.2	96.3
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 4599112)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.56 %	96.1	80.0	120
				<0.02	27.8 %	99.9	80.0	120
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 4584740)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	79.0	62.0	126
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 4585917)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	80.1	62.0	126
EP068A: Organochlorine Pesticides (OC) (QCLot: 4584738)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	94.6	69.0	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	96.8	65.0	117
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	94.0	67.0	119
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	95.2	68.0	116
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	91.7	65.0	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	93.8	67.0	115
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	97.9	69.0	115
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	92.4	62.0	118
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	89.3	63.0	117
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	98.1	66.0	116
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	92.3	64.0	116
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	94.1	66.0	116
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	92.4	67.0	115
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	104	67.0	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	91.4	69.0	115
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	88.4	69.0	121
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	78.1	56.0	120
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	83.7	62.0	124
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	96.2	66.0	120
EP068A: Organochlorine Pesticides (OC) (QCLot: 4585920)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	94.8	69.0	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	96.3	65.0	117
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	95.4	67.0	119
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	96.0	68.0	116
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	93.1	65.0	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	93.1	67.0	115
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	97.3	69.0	115

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 4585920) - continued								
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	94.6	62.0	118
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	90.8	63.0	117
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	99.9	66.0	116
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	95.4	64.0	116
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	98.9	66.0	116
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	94.6	67.0	115
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	99.0	67.0	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	93.7	69.0	115
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	90.2	69.0	121
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	88.8	56.0	120
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	90.2	62.0	124
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	89.3	66.0	120
EP068B: Organophosphorus Pesticides (OP) (QCLot: 4584738)								
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	96.8	76.0	118
EP068B: Organophosphorus Pesticides (OP) (QCLot: 4585920)								
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	99.6	76.0	118
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QCLot: 4584739)								
EP071SG-S: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	90.8	80.0	116
EP071SG-S: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	98.3	85.0	115
EP071SG-S: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	100	75.0	123
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QCLot: 4585918)								
EP071SG-S: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	98.0	80.0	116
EP071SG-S: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	104	85.0	115
EP071SG-S: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	106	75.0	123
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QCLot: 4584739)								
EP071SG-S: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	96.5	89.0	109
EP071SG-S: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	98.3	84.0	112
EP071SG-S: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	108	71.0	119
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QCLot: 4585918)								
EP071SG-S: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	102	89.0	109
EP071SG-S: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	100	84.0	112
EP071SG-S: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	97.0	71.0	119
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4584521)								
EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	96.4	71.0	121
EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	95.4	65.0	131
EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	95.8	72.0	114
EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	94.6	70.0	116

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4584521) - continued								
EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	1 mg/kg	90.7	67.0	113
EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	92.5	75.0	115
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4585545)								
EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	100	71.0	121
EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	100	65.0	131
EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	100	72.0	114
EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	99.4	70.0	116
EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	1 mg/kg	97.8	67.0	113
EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	101	75.0	115
EP074B: Oxygenated Compounds (QCLot: 4584521)								
EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	10 mg/kg	92.8	58.0	136
EP074B: Oxygenated Compounds (QCLot: 4585545)								
EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	10 mg/kg	88.0	58.0	136
EP074E(SIM): Halogenated Aliphatic Compounds (QCLot: 4584523)								
EP074E(SIM): Vinyl chloride	75-01-4	0.2	mg/kg	<0.2	1 mg/kg	94.5	73.0	124
EP074E(SIM): Halogenated Aliphatic Compounds (QCLot: 4585544)								
EP074E(SIM): Vinyl chloride	75-01-4	0.2	mg/kg	<0.2	1 mg/kg	100	73.0	124
EP074E: Halogenated Aliphatic Compounds (QCLot: 4584521)								
EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	10 mg/kg	96.8	43.0	147
EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	1 mg/kg	97.4	54.0	126
EP074: Methylene chloride	75-09-2	0.5	mg/kg	<0.5	1 mg/kg	106	58.0	148
EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	1 mg/kg	95.8	65.0	117
EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	1 mg/kg	94.2	59.0	125
EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	1 mg/kg	103	65.0	125
EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	1 mg/kg	95.6	70.0	118
EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	1 mg/kg	95.2	64.0	126
EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	1 mg/kg	94.2	67.0	143
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	1 mg/kg	96.5	62.0	122
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	1 mg/kg	98.9	65.0	121
EP074E: Halogenated Aliphatic Compounds (QCLot: 4585545)								
EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	10 mg/kg	104	43.0	147
EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	1 mg/kg	97.3	54.0	126
EP074: Methylene chloride	75-09-2	0.5	mg/kg	<0.5	1 mg/kg	105	58.0	148
EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	1 mg/kg	98.0	65.0	117
EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	1 mg/kg	97.8	59.0	125
EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	1 mg/kg	102	65.0	125
EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	1 mg/kg	99.9	70.0	118

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 4585545) - continued								
EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	1 mg/kg	101	64.0	126
EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	1 mg/kg	99.1	67.0	143
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	1 mg/kg	99.8	62.0	122
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	1 mg/kg	102	65.0	121
EP074F: Halogenated Aromatic Compounds (QCLot: 4584521)								
EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	1 mg/kg	95.7	68.0	116
EP074F: Halogenated Aromatic Compounds (QCLot: 4585545)								
EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	1 mg/kg	101	68.0	116
EP074G: Trihalomethanes (QCLot: 4584521)								
EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	1 mg/kg	99.6	66.0	124
EP074G: Trihalomethanes (QCLot: 4585545)								
EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	1 mg/kg	102	66.0	124
EP075A: Phenolic Compounds (QCLot: 4584737)								
EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	1.5 mg/kg	92.6	64.0	114
EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	1.5 mg/kg	88.1	55.0	117
EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	1.5 mg/kg	81.7	46.0	122
EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	1.5 mg/kg	76.4	57.0	113
EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	1.5 mg/kg	70.4	49.0	109
EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	1.5 mg/kg	74.5	49.0	107
EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	3 mg/kg	35.4	12.0	76.0
EP075A: Phenolic Compounds (QCLot: 4585919)								
EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	1.5 mg/kg	81.0	64.0	114
EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	1.5 mg/kg	75.4	55.0	117
EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	1.5 mg/kg	92.5	46.0	122
EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	1.5 mg/kg	67.6	57.0	113
EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	1.5 mg/kg	55.1	49.0	109
EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	1.5 mg/kg	58.7	49.0	107
EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	3 mg/kg	18.2	12.0	76.0
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4584737)								
EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	1.5 mg/kg	90.2	62.0	118
EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	1.5 mg/kg	84.4	56.0	114
EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	1.5 mg/kg	84.4	62.0	112
EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	88.3	59.0	115
EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5 mg/kg	83.7	63.0	113
EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	81.7	57.0	111
EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	1.5 mg/kg	79.5	58.0	114
EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	1.5 mg/kg	80.2	57.0	117
EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	76.2	59.0	115

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4584737) - continued								
EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	1.5 mg/kg	78.8	61.0	117
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	3 mg/kg	74.0	57.0	119
EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	1.5 mg/kg	76.2	56.0	116
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5 mg/kg	70.2	55.0	117
EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	1.5 mg/kg	69.9	53.0	119
EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	1.5 mg/kg	68.7	56.0	120
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4585919)								
EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	1.5 mg/kg	78.2	62.0	118
EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	1.5 mg/kg	79.4	56.0	114
EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	1.5 mg/kg	78.5	62.0	112
EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	74.8	59.0	115
EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5 mg/kg	80.7	63.0	113
EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	78.1	57.0	111
EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	1.5 mg/kg	75.5	58.0	114
EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	1.5 mg/kg	74.0	57.0	117
EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	72.5	59.0	115
EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	1.5 mg/kg	71.9	61.0	117
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	3 mg/kg	70.9	57.0	119
EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	1.5 mg/kg	72.4	56.0	116
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5 mg/kg	67.8	55.0	117
EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	1.5 mg/kg	65.4	53.0	119
EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	1.5 mg/kg	66.8	56.0	120
EP075C: Phthalate Esters (QCLot: 4584737)								
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	mg/kg	----	1.5 mg/kg	79.9	69.0	133
EP075C: Phthalate Esters (QCLot: 4585919)								
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	mg/kg	----	1.5 mg/kg	80.1	69.0	133
EP075E: Nitroaromatics and Ketones (QCLot: 4584737)								
EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	1.5 mg/kg	92.6	65.0	119
EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<0.5	1.5 mg/kg	88.5	59.0	115
EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	1.5 mg/kg	90.1	56.0	110
EP075E: Nitroaromatics and Ketones (QCLot: 4585919)								
EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	1.5 mg/kg	79.3	65.0	119
EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<0.5	1.5 mg/kg	70.7	59.0	115
EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	1.5 mg/kg	70.6	56.0	110
EP075G: Chlorinated Hydrocarbons (QCLot: 4584737)								
EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	1.5 mg/kg	89.2	58.0	116

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075G: Chlorinated Hydrocarbons (QCLot: 4584737) - continued								
EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	1.5 mg/kg	89.8	57.0	115
EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	1.5 mg/kg	86.5	62.9	108
EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	1.5 mg/kg	85.7	57.0	109
EP075: 1.2.3.4-Tetrachlorobenzene	634-66-2	0.5	mg/kg	<0.5	----	----	----	----
EP075G: Chlorinated Hydrocarbons (QCLot: 4585919)								
EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	1.5 mg/kg	78.0	58.0	116
EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	1.5 mg/kg	83.7	57.0	115
EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	1.5 mg/kg	81.6	62.9	108
EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	1.5 mg/kg	78.4	57.0	109
EP075: 1.2.3.4-Tetrachlorobenzene	634-66-2	0.5	mg/kg	<0.5	----	----	----	----
EP075K: Miscellaneous Compounds (QCLot: 4584737)								
EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg	<0.5	1.5 mg/kg	79.2	54.0	120
EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg	<0.5	----	----	----	----
EP075: Isodrin	465-73-6	0.5	mg/kg	<0.5	----	----	----	----
EP075: Di (2-ethylhexyl) adipate	103-23-1	0.5	mg/kg	<0.5	----	----	----	----
EP075K: Miscellaneous Compounds (QCLot: 4585919)								
EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg	<0.5	1.5 mg/kg	79.4	54.0	120
EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg	<0.5	----	----	----	----
EP075: Isodrin	465-73-6	0.5	mg/kg	<0.5	----	----	----	----
EP075: Di (2-ethylhexyl) adipate	103-23-1	0.5	mg/kg	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4584522)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	86.4	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4585543)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	79.1	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4584522)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	90.1	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4585543)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	81.3	68.4	128
EP132A: Phenolic Compounds (QCLot: 4585925)								
EP132: Hexachlorophene	70-30-4	10	µg/kg	<10	100 µg/kg	48.2	15.6	94.0
EP202A: Phenoxyacetic Acid Herbicides by LCMS (QCLot: 4586607)								
EP202: 2.4-D	94-75-7	0.02	mg/kg	<0.02	0.1 mg/kg	95.7	68.5	131
EP202: Triclopyr	55335-06-3	0.02	mg/kg	<0.02	0.1 mg/kg	94.8	50.8	141
EP202: 2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg	<0.02	0.1 mg/kg	82.6	40.8	126
EP202: 2.4.5-T	93-76-5	0.02	mg/kg	<0.02	0.1 mg/kg	93.9	57.4	139
EP202: Picloram	1918-02-1	0.02	mg/kg	<0.02	0.1 mg/kg	76.7	48.7	129
EP202: Fluroxypyr	69377-81-7	0.02	mg/kg	<0.02	0.1 mg/kg	99.8	53.2	128

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4590347)								
EG005C: Aluminium	7429-90-5	0.1	mg/L	<0.1	0.5 mg/L	101	80.0	122
EG005C: Antimony	7440-36-0	0.1	mg/L	<0.1	0.02 mg/L	130	70.0	130
EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	0.1 mg/L	98.8	80.0	124
EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	0.1 mg/L	104	87.0	117
EG005C: Boron	7440-42-8	0.1	mg/L	<0.1	0.5 mg/L	101	80.0	130
EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	0.1 mg/L	98.8	80.0	118
EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	0.1 mg/L	98.7	88.0	114
EG005C: Iron	7439-89-6	0.1	mg/L	<0.1	0.5 mg/L	103	83.0	123
EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	0.1 mg/L	95.2	80.0	118
EG005C: Manganese	7439-96-5	0.1	mg/L	<0.1	0.1 mg/L	98.2	81.0	111
EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	0.1 mg/L	96.6	83.0	115
EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	0.1 mg/L	101	77.0	125
EG005C: Silver	7440-22-4	0.1	mg/L	<0.1	----	----	----	----
EG005C: Molybdenum	7439-98-7	0.1	mg/L	<0.1	0.1 mg/L	110	86.0	122
EA005P: pH by PC Titrator (QCLot: 4591666)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.5	98.8	101
				----	7 pH Unit	99.7	99.2	101
EA010P: Conductivity by PC Titrator (QCLot: 4591665)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	95.4	89.9	110
				<1	2100 µS/cm	99.8	90.2	111
ED037P: Alkalinity by PC Titrator (QCLot: 4591668)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	102	81.0	111
				----	50 mg/L	107	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4590993)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.6	82.0	122
				<1	500 mg/L	94.0	82.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 4590992)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	104	80.9	127
				<1	1000 mg/L	99.5	80.9	127
EG035C: Leachable Mercury by FIMS (QCLot: 4590440)								
EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.1	79.0	109
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 4591356)								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.05 mg/L	106	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4593212)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	110	73.0	133
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4593213)								
EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	115	93.0	127

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EK040P: Fluoride by PC Titrator (QCLot: 4591669)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	110	82.0	116
EP068A: Organochlorine Pesticides (OC) (QCLot: 4590453)								
EP068: alpha-BHC	319-84-6	0.5	µg/L	<0.5	5 µg/L	83.0	64.9	107
EP068: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L	<0.5	5 µg/L	79.0	58.3	111
EP068: beta-BHC	319-85-7	0.5	µg/L	<0.5	5 µg/L	85.8	69.0	117
EP068: gamma-BHC	58-89-9	0.5	µg/L	<0.5	5 µg/L	82.2	70.0	112
EP068: delta-BHC	319-86-8	0.5	µg/L	<0.5	5 µg/L	86.3	68.9	110
EP068: Heptachlor	76-44-8	0.5	µg/L	<0.5	5 µg/L	81.9	65.2	108
EP068: Aldrin	309-00-2	0.5	µg/L	<0.5	5 µg/L	81.9	65.8	109
EP068: Heptachlor epoxide	1024-57-3	0.5	µg/L	<0.5	5 µg/L	84.8	67.1	107
EP068: trans-Chlordane	5103-74-2	0.5	µg/L	<0.5	5 µg/L	78.8	64.1	110
EP068: alpha-Endosulfan	959-98-8	0.5	µg/L	<0.5	5 µg/L	77.3	66.7	112
EP068: cis-Chlordane	5103-71-9	0.5	µg/L	<0.5	5 µg/L	81.4	63.2	111
EP068: Dieldrin	60-57-1	0.5	µg/L	<0.5	5 µg/L	83.2	65.2	113
EP068: 4.4`-DDE	72-55-9	0.5	µg/L	<0.5	5 µg/L	81.0	66.0	112
EP068: Endrin	72-20-8	0.5	µg/L	<0.5	5 µg/L	84.7	65.2	113
EP068: beta-Endosulfan	33213-65-9	0.5	µg/L	<0.5	5 µg/L	86.0	67.3	114
EP068: 4.4`-DDD	72-54-8	0.5	µg/L	<0.5	5 µg/L	82.5	72.0	122
EP068: Endrin aldehyde	7421-93-4	0.5	µg/L	<0.5	5 µg/L	84.1	66.9	109
EP068: Endosulfan sulfate	1031-07-8	0.5	µg/L	<0.5	5 µg/L	100	65.2	112
EP068: 4.4`-DDT	50-29-3	2	µg/L	<2.0	5 µg/L	98.4	65.2	112
EP068: Endrin ketone	53494-70-5	0.5	µg/L	<0.5	5 µg/L	104	63.8	110
EP068: Methoxychlor	72-43-5	2	µg/L	<2.0	5 µg/L	101	61.1	114
EP068B: Organophosphorus Pesticides (OP) (QCLot: 4590453)								
EP068: Dichlorvos	62-73-7	0.5	µg/L	<0.5	5 µg/L	92.1	65.6	114
EP068: Demeton-S-methyl	919-86-8	0.5	µg/L	<0.5	5 µg/L	74.7	63.7	113
EP068: Monocrotophos	6923-22-4	2	µg/L	<2.0	5 µg/L	23.5	19.7	48.0
EP068: Dimethoate	60-51-5	0.5	µg/L	<0.5	5 µg/L	80.8	69.5	110
EP068: Diazinon	333-41-5	0.5	µg/L	<0.5	5 µg/L	85.0	71.1	110
EP068: Chlorpyrifos-methyl	5598-13-0	0.5	µg/L	<0.5	5 µg/L	82.9	77.0	119
EP068: Parathion-methyl	298-00-0	2	µg/L	<2.0	5 µg/L	84.4	70.0	124
EP068: Malathion	121-75-5	0.5	µg/L	<0.5	5 µg/L	86.3	68.4	116
EP068: Fenthion	55-38-9	0.5	µg/L	<0.5	5 µg/L	81.4	68.6	112
EP068: Chlorpyrifos	2921-88-2	0.5	µg/L	<0.5	5 µg/L	84.9	75.0	119
EP068: Parathion	56-38-2	2	µg/L	<2.0	5 µg/L	83.1	67.0	121
EP068: Pirimphos-ethyl	23505-41-1	0.5	µg/L	<0.5	5 µg/L	83.4	69.0	121
EP068: Chlorfenvinphos	470-90-6	0.5	µg/L	<0.5	5 µg/L	85.9	71.8	110
EP068: Bromophos-ethyl	4824-78-6	0.5	µg/L	<0.5	5 µg/L	78.0	67.5	112
EP068: Fenamiphos	22224-92-6	0.5	µg/L	<0.5	5 µg/L	106	64.1	116

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP068B: Organophosphorus Pesticides (OP) (QCLot: 4590453) - continued								
EP068: Prothiofos	34643-46-4	0.5	µg/L	<0.5	5 µg/L	81.1	67.8	114
EP068: Ethion	563-12-2	0.5	µg/L	<0.5	5 µg/L	83.3	74.0	120
EP068: Carbophenothion	786-19-6	0.5	µg/L	<0.5	5 µg/L	106	66.2	114
EP068: Azinphos Methyl	86-50-0	0.5	µg/L	<0.5	5 µg/L	54.3	51.6	128
EP068C: Triazines (QCLot: 4590453)								
EP068: Atrazine	1912-24-9	0.5	µg/L	<0.5	5 µg/L	91.7	69.3	113
EP068: Simazine	122-34-9	0.5	µg/L	<0.5	5 µg/L	84.8	62.6	118
EP068D: Pyrethroids (QCLot: 4590453)								
EP068: Cypermethrins	----	2	µg/L	<2.0	5 µg/L	86.2	64.2	113
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4593223)								
EP074: Benzene	71-43-2	1	µg/L	<1	10 µg/L	102	77.0	119
EP074: Toluene	108-88-3	2	µg/L	<2	10 µg/L	105	69.0	129
EP074: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	110	76.0	118
EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	20 µg/L	108	77.0	119
EP074: Styrene	100-42-5	5	µg/L	<5	10 µg/L	105	73.0	119
EP074: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	108	79.0	117
EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	10 µg/L	104	76.0	118
EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	10 µg/L	101	69.0	119
EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	10 µg/L	101	74.0	116
EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	10 µg/L	103	73.0	119
EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	10 µg/L	103	74.0	116
EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	10 µg/L	101	72.0	116
EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	10 µg/L	100	71.0	119
EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	10 µg/L	102	65.0	123
EP074B: Oxygenated Compounds (QCLot: 4593223)								
EP074: 2-Propanone (Acetone)	67-64-1	50	µg/L	<50	100 µg/L	71.8	64.7	137
EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	100 µg/L	105	61.4	134
EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	100 µg/L	93.7	73.6	130
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	100 µg/L	104	66.0	132
EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	100 µg/L	105	65.0	137
EP074C: Sulfonated Compounds (QCLot: 4593223)								
EP074: Carbon disulfide	75-15-0	5	µg/L	<5	10 µg/L	77.0	72.8	127
EP074D: Fumigants (QCLot: 4593223)								
EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	10 µg/L	103	68.0	122
EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	10 µg/L	98.3	76.0	118
EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	10 µg/L	96.7	62.0	120
EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	10 µg/L	98.0	60.0	114

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074D: Fumigants (QCLot: 4593223) - continued								
EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	10 µg/L	107	69.0	117
EP074E: Halogenated Aliphatic Compounds (QCLot: 4593223)								
EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	100 µg/L	78.8	60.6	138
EP074: Chloromethane	74-87-3	50	µg/L	<50	100 µg/L	91.2	67.4	130
EP074: Vinyl chloride	75-01-4	50	µg/L	<50	100 µg/L	99.0	69.4	129
EP074: Bromomethane	74-83-9	50	µg/L	<50	100 µg/L	98.1	56.0	140
EP074: Chloroethane	75-00-3	50	µg/L	<50	100 µg/L	98.3	61.0	139
EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	100 µg/L	76.8	69.0	131
EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	10 µg/L	89.4	70.0	124
EP074: Iodomethane	74-88-4	5	µg/L	<5	10 µg/L	78.5	70.2	128
EP074: Methylene chloride	75-09-2	5	µg/L	<5	10 µg/L	69.5	69.3	133
EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	10 µg/L	102	74.0	118
EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	10 µg/L	102	74.0	120
EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	10 µg/L	103	77.0	119
EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	10 µg/L	103	67.0	119
EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	10 µg/L	104	73.0	119
EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	10 µg/L	104	62.0	120
EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	10 µg/L	101	73.0	123
EP074: Trichloroethene	79-01-6	5	µg/L	<5	10 µg/L	104	76.0	118
EP074: Dibromomethane	74-95-3	5	µg/L	<5	10 µg/L	100	73.0	119
EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	10 µg/L	109	72.0	126
EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	10 µg/L	108	71.0	129
EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	10 µg/L	98.0	72.0	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	10 µg/L	104	66.0	114
EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	10 µg/L	95.6	60.0	120
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	10 µg/L	92.6	70.6	128
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	10 µg/L	113	70.0	124
EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	10 µg/L	98.6	74.0	126
EP074: Pentachloroethane	76-01-7	5	µg/L	<5	10 µg/L	125	71.8	126
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	10 µg/L	94.3	66.4	136
EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	10 µg/L	95.2	58.0	130
EP074F: Halogenated Aromatic Compounds (QCLot: 4593223)								
EP074: Chlorobenzene	108-90-7	5	µg/L	<5	10 µg/L	104	79.0	117
EP074: Bromobenzene	108-86-1	5	µg/L	<5	10 µg/L	102	76.0	116
EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	10 µg/L	114	73.0	119
EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	10 µg/L	104	73.0	119
EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	10 µg/L	100	75.0	117
EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	10 µg/L	99.1	74.0	118
EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	10 µg/L	102	75.0	117

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074F: Halogenated Aromatic Compounds (QCLot: 4593223) - continued								
EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	10 µg/L	94.0	61.0	125
EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	10 µg/L	99.8	67.0	123
EP074G: Trihalomethanes (QCLot: 4593223)								
EP074: Chloroform	67-66-3	5	µg/L	<5	10 µg/L	104	72.0	120
EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	10 µg/L	98.4	64.0	118
EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	10 µg/L	96.2	65.0	115
EP074: Bromoform	75-25-2	5	µg/L	<5	10 µg/L	94.3	73.5	126
EP074H: Naphthalene (QCLot: 4593223)								
EP074: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	107	72.0	122
EP075A: Phenolic Compounds (QCLot: 4590454)								
EP075: Phenol	108-95-2	2	µg/L	<2	10 µg/L	39.9	25.5	64.1
EP075: 2-Chlorophenol	95-57-8	2	µg/L	<2	10 µg/L	68.9	52.0	88.0
EP075: 2-Methylphenol	95-48-7	2	µg/L	<2	10 µg/L	68.6	50.0	94.0
EP075: 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	10 µg/L	67.1	45.0	96.2
EP075: 2-Nitrophenol	88-75-5	2	µg/L	<2	10 µg/L	82.7	48.0	98.0
EP075: 2.4-Dimethylphenol	105-67-9	2	µg/L	<2	10 µg/L	90.1	50.0	94.0
EP075: 2.4-Dichlorophenol	120-83-2	2	µg/L	<2	10 µg/L	89.3	61.9	109
EP075: 2.6-Dichlorophenol	87-65-0	2	µg/L	<2	10 µg/L	86.1	61.5	108
EP075: 4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	10 µg/L	96.9	61.4	107
EP075: 2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	10 µg/L	102	57.6	112
EP075: 2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	10 µg/L	104	58.0	110
EP075: Pentachlorophenol	87-86-5	4	µg/L	<4	20 µg/L	91.1	12.8	95.0
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4590454)								
EP075: Naphthalene	91-20-3	2	µg/L	<2	10 µg/L	76.7	51.0	95.0
EP075: 2-Methylnaphthalene	91-57-6	2	µg/L	<2	10 µg/L	82.8	59.0	108
EP075: 2-Chloronaphthalene	91-58-7	2	µg/L	<2	10 µg/L	84.4	60.6	106
EP075: Acenaphthylene	208-96-8	2	µg/L	<2	10 µg/L	98.4	64.0	108
EP075: Acenaphthene	83-32-9	2	µg/L	<2	10 µg/L	83.3	65.0	108
EP075: Fluorene	86-73-7	2	µg/L	<2	10 µg/L	86.6	65.2	107
EP075: Phenanthrene	85-01-8	2	µg/L	<2	10 µg/L	92.7	66.7	108
EP075: Anthracene	120-12-7	2	µg/L	<2	10 µg/L	92.9	65.8	108
EP075: Fluoranthene	206-44-0	2	µg/L	<2	10 µg/L	95.9	64.9	109
EP075: Pyrene	129-00-0	2	µg/L	<2	10 µg/L	96.8	60.1	111
EP075: N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	10 µg/L	# 111	59.7	110
EP075: Benz(a)anthracene	56-55-3	2	µg/L	<2	10 µg/L	106	62.2	112
EP075: Chrysene	218-01-9	2	µg/L	<2	10 µg/L	102	59.3	114
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	20 µg/L	100	60.1	111

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4590454) - continued								
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	10 µg/L	# 125	50.0	108
EP075: Benzo(a)pyrene	50-32-8	2	µg/L	<2	10 µg/L	102	59.2	112
EP075: 3-Methylcholanthrene	56-49-5	2	µg/L	<2	10 µg/L	103	60.1	110
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	10 µg/L	101	59.6	110
EP075: Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	10 µg/L	102	57.2	109
EP075: Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	10 µg/L	99.3	60.6	110
EP075: Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	----	----	----	----
EP075C: Phthalate Esters (QCLot: 4590454)								
EP075: Dimethyl phthalate	131-11-3	2	µg/L	<2	10 µg/L	108	64.3	112
EP075: Diethyl phthalate	84-66-2	2	µg/L	<2	10 µg/L	95.7	67.3	111
EP075: Di-n-butyl phthalate	84-74-2	2	µg/L	<2	10 µg/L	104	68.4	122
EP075: Butyl benzyl phthalate	85-68-7	2	µg/L	<2	10 µg/L	100	61.2	114
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	µg/L	----	10 µg/L	104	60.0	132
EP075: Di-n-octylphthalate	117-84-0	2	µg/L	<2	10 µg/L	96.7	62.1	115
EP075D: Nitrosamines (QCLot: 4590454)								
EP075: N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	10 µg/L	56.9	46.0	110
EP075: N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	10 µg/L	69.4	60.6	113
EP075: N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	10 µg/L	76.7	45.0	91.0
EP075: N-Nitrosomorpholine	59-89-2	2	µg/L	<2	10 µg/L	78.8	42.0	100
EP075: N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	10 µg/L	89.4	63.5	108
EP075: N-Nitrosopiperidine	100-75-4	2	µg/L	<2	10 µg/L	85.8	61.7	107
EP075: N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	10 µg/L	89.0	62.5	108
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	20 µg/L	89.7	64.6	112
EP075: Methapyrilene	91-80-5	2	µg/L	<2	10 µg/L	33.9	23.3	125
EP075E: Nitroaromatics and Ketones (QCLot: 4590454)								
EP075: 2-Picoline	109-06-8	2	µg/L	<2	10 µg/L	46.8	41.0	109
EP075: Acetophenone	98-86-2	2	µg/L	<2	10 µg/L	84.2	68.3	112
EP075: Nitrobenzene	98-95-3	2	µg/L	<2	10 µg/L	82.1	68.3	112
EP075: Isophorone	78-59-1	2	µg/L	<2	10 µg/L	92.9	67.6	111
EP075: 2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	10 µg/L	104	64.4	113
EP075: 2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	10 µg/L	89.9	59.5	109
EP075: 1-Naphthylamine	134-32-7	2	µg/L	<2	10 µg/L	82.8	46.8	102
EP075: 4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	10 µg/L	91.0	40.0	96.0
EP075: 5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	10 µg/L	87.4	58.3	106
EP075: Azobenzene	103-33-3	2	µg/L	<2	10 µg/L	88.5	66.0	112
EP075: 1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	10 µg/L	93.1	46.0	108
EP075: Phenacetin	62-44-2	2	µg/L	<2	10 µg/L	91.5	57.8	101

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075E: Nitroaromatics and Ketones (QCLot: 4590454) - continued								
EP075: 4-Aminobiphenyl	92-67-1	2	µg/L	<2	10 µg/L	75.4	60.1	112
EP075: Pentachloronitrobenzene	82-68-8	2	µg/L	<2	10 µg/L	104	59.0	109
EP075: Pronamide	23950-58-5	2	µg/L	<2	10 µg/L	95.4	62.7	109
EP075: Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	10 µg/L	94.9	59.4	108
EP075: Chlorobenzilate	510-15-6	2	µg/L	<2	10 µg/L	102	57.7	110
EP075F: Haloethers (QCLot: 4590454)								
EP075: Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	10 µg/L	75.2	69.1	112
EP075: Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	10 µg/L	84.2	66.2	111
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	10 µg/L	90.2	64.7	109
EP075: 4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	10 µg/L	93.3	61.6	108
EP075G: Chlorinated Hydrocarbons (QCLot: 4590454)								
EP075: 1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	10 µg/L	70.0	41.0	97.0
EP075: 1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	10 µg/L	70.2	40.0	96.0
EP075: 1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	10 µg/L	72.3	41.0	95.0
EP075: Hexachloroethane	67-72-1	2	µg/L	<2	10 µg/L	79.8	46.0	88.0
EP075: 1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	10 µg/L	77.3	46.0	96.0
EP075: Hexachloropropylene	1888-71-7	2	µg/L	<2	10 µg/L	82.2	34.0	96.0
EP075: Hexachlorobutadiene	87-68-3	2	µg/L	<2	10 µg/L	85.0	37.4	100
EP075: Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	10 µg/L	80.9	23.5	107
EP075: Pentachlorobenzene	608-93-5	2	µg/L	<2	10 µg/L	86.2	64.5	107
EP075: Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	10 µg/L	95.0	65.7	110
EP075H: Anilines and Benzidines (QCLot: 4590454)								
EP075: Aniline	62-53-3	2	µg/L	<2	10 µg/L	63.3	50.0	104
EP075: 4-Chloroaniline	106-47-8	2	µg/L	<2	10 µg/L	79.3	42.0	106
EP075: 2-Nitroaniline	88-74-4	4	µg/L	<4	10 µg/L	99.0	60.9	110
EP075: 3-Nitroaniline	99-09-2	4	µg/L	<4	10 µg/L	80.2	51.5	96.9
EP075: Dibenzofuran	132-64-9	2	µg/L	<2	10 µg/L	84.0	65.3	108
EP075: 4-Nitroaniline	100-01-6	2	µg/L	<2	10 µg/L	82.4	48.9	99.5
EP075: Carbazole	86-74-8	2	µg/L	<2	10 µg/L	93.5	64.3	107
EP075: 3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	10 µg/L	111	60.3	119
EP075I: Organochlorine Pesticides (QCLot: 4590454)								
EP075: alpha-BHC	319-84-6	2	µg/L	<2	10 µg/L	100	64.3	110
EP075: beta-BHC	319-85-7	2	µg/L	<2	10 µg/L	89.9	53.0	107
EP075: gamma-BHC	58-89-9	2	µg/L	<2	10 µg/L	95.5	51.0	111
EP075: delta-BHC	319-86-8	2	µg/L	<2	10 µg/L	102	57.0	111
EP075: Heptachlor	76-44-8	2	µg/L	<2	10 µg/L	96.0	57.9	108
EP075: Aldrin	309-00-2	2	µg/L	<2	10 µg/L	102	56.0	112
EP075: Heptachlor epoxide	1024-57-3	2	µg/L	<2	10 µg/L	99.2	50.0	118

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075I: Organochlorine Pesticides (QCLot: 4590454) - continued								
EP075: alpha-Endosulfan	959-98-8	2	µg/L	<2	10 µg/L	109	59.0	111
EP075: 4.4`-DDE	72-55-9	2	µg/L	<2	10 µg/L	107	53.0	115
EP075: Dieldrin	60-57-1	2	µg/L	<2	10 µg/L	107	59.0	115
EP075: Endrin	72-20-8	2	µg/L	<2	10 µg/L	103	58.0	114
EP075: beta-Endosulfan	33213-65-9	2	µg/L	<2	10 µg/L	101	54.0	116
EP075: 4.4`-DDD	72-54-8	2	µg/L	<2	10 µg/L	103	55.0	115
EP075: Endosulfan sulfate	1031-07-8	2	µg/L	<2	10 µg/L	110	52.8	114
EP075: 4.4`-DDT	50-29-3	4	µg/L	<4	10 µg/L	101	56.0	114
EP075: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	----	----	----	----
EP075: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	4	µg/L	<4	----	----	----	----
EP075J: Organophosphorus Pesticides (QCLot: 4590454)								
EP075: Dichlorvos	62-73-7	2	µg/L	<2	10 µg/L	109	51.0	113
EP075: Dimethoate	60-51-5	2	µg/L	<2	10 µg/L	89.7	43.0	109
EP075: Diazinon	333-41-5	2	µg/L	<2	10 µg/L	100.0	49.0	113
EP075: Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	10 µg/L	102	54.1	116
EP075: Malathion	121-75-5	2	µg/L	<2	10 µg/L	110	54.0	124
EP075: Fenthion	55-38-9	2	µg/L	<2	10 µg/L	105	57.0	115
EP075: Chlorpyrifos	2921-88-2	2	µg/L	<2	10 µg/L	99.1	53.0	109
EP075: Pirimphos-ethyl	23505-41-1	2	µg/L	<2	10 µg/L	102	55.0	111
EP075: Chlorfenvinphos	470-90-6	2	µg/L	<2	10 µg/L	99.6	50.0	116
EP075: Prothiofos	34643-46-4	2	µg/L	<2	10 µg/L	97.4	54.0	118
EP075: Ethion	563-12-2	2	µg/L	<2	10 µg/L	104	51.0	117
EP075K: Miscellaneous Compounds (QCLot: 4590454)								
EP075: 1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	10 µg/L	71.9	40.9	110
EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	10 µg/L	80.3	52.5	109
EP075: Methanesulfonate methyl	66-27-3	2	µg/L	<2	10 µg/L	63.3	41.0	115
EP075: cis-Isosafrole	17627-76-8	2	µg/L	<2	10 µg/L	87.4	61.7	106
EP075: trans-Isosafrole	4043-71-4	2	µg/L	<2	10 µg/L	95.4	57.3	114
EP075: Safrole	94-59-7	2	µg/L	<2	10 µg/L	108	64.5	110
EP075: Diallate	2303-16-4	2	µg/L	<2	10 µg/L	84.4	53.0	111
EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	10 µg/L	95.1	50.0	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Matrix Spike (MS) Report

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4585113)							
ES2232912-003	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	99.7	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	101	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	101	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	100	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4588949)							
ES2233009-007	MB02B_178-187	EG005T: Arsenic	7440-38-2	50 mg/kg	99.8	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	107	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	98.6	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	95.7	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4585112)							
ES2232912-003	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.5	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4588950)							
ES2233009-007	MB02B_178-187	EG035T: Mercury	7439-97-6	5 mg/kg	97.6	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 4584078)							
ES2232708-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	# 0.6	70.0	130
ES2232708-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	# 6.6	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 4587216)							
ES2233009-007	MB02B_178-187	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	97.6	70.0	130
ES2233009-007	MB02B_178-187	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	# 68.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4585506)							
ES2231661-001	Anonymous	EK026SF: Total Cyanide	57-12-5	40 mg/kg	98.9	70.0	130
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4585505)							
ES2231661-001	Anonymous	EK028SF: Weak Acid Dissociable Cyanide	----	40 mg/kg	109	70.0	130
EK040T: Fluoride Total (QCLot: 4589794)							
ES2233009-002	MB02B_0-9	EK040T: Fluoride	16984-48-8	400 mg/kg	89.7	70.0	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 4584740)							
ES2233009-002	MB02B_0-9	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	110	70.0	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 4585917)							
ES2233009-007	MB02B_178-187	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	103	70.0	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 4584738)							
ES2233009-002	MB02B_0-9	EP068: gamma-BHC	58-89-9	0.5 mg/kg	114	70.0	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	104	70.0	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	98.6	70.0	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	101	70.0	130
		EP068: Endrin	72-20-8	2 mg/kg	72.6	70.0	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 4584738) - continued							
ES2233009-002	MB02B_0-9	EP068: 4.4`-DDT	50-29-3	2 mg/kg	95.4	70.0	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 4585920)							
ES2233009-007	MB02B_178-187	EP068: gamma-BHC	58-89-9	0.5 mg/kg	90.8	70.0	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	83.9	70.0	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	83.6	70.0	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	87.6	70.0	130
		EP068: Endrin	72-20-8	2 mg/kg	71.6	70.0	130
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	74.7	70.0	130
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QCLot: 4584739)							
ES2233009-002	MB02B_0-9	EP071SG-S: C10 - C14 Fraction	----	480 mg/kg	124	43.0	139
		EP071SG-S: C15 - C28 Fraction	----	3100 mg/kg	108	49.0	131
		EP071SG-S: C29 - C36 Fraction	----	2060 mg/kg	120	64.0	158
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QCLot: 4585918)							
ES2233009-007	MB02B_178-187	EP071SG-S: C10 - C14 Fraction	----	480 mg/kg	89.8	43.0	139
		EP071SG-S: C15 - C28 Fraction	----	3100 mg/kg	94.3	49.0	131
		EP071SG-S: C29 - C36 Fraction	----	2060 mg/kg	107	64.0	158
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QCLot: 4584739)							
ES2233009-002	MB02B_0-9	EP071SG-S: >C10 - C16 Fraction	----	900 mg/kg	106	33.0	137
		EP071SG-S: >C16 - C34 Fraction	----	4320 mg/kg	126	40.0	137
		EP071SG-S: >C34 - C40 Fraction	----	890 mg/kg	115	30.0	190
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QCLot: 4585918)							
ES2233009-007	MB02B_178-187	EP071SG-S: >C10 - C16 Fraction	----	900 mg/kg	91.8	33.0	137
		EP071SG-S: >C16 - C34 Fraction	----	4320 mg/kg	99.0	40.0	137
		EP071SG-S: >C34 - C40 Fraction	----	890 mg/kg	104	30.0	190
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4584521)							
ES2233009-002	MB02B_0-9	EP074: Benzene	71-43-2	2.5 mg/kg	95.9	70.0	130
		EP074: Toluene	108-88-3	2.5 mg/kg	95.4	70.0	130
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4585545)							
ES2233009-007	MB02B_178-187	EP074: Benzene	71-43-2	2.5 mg/kg	96.3	70.0	130
		EP074: Toluene	108-88-3	2.5 mg/kg	94.5	70.0	130
EP074E(SIM): Halogenated Aliphatic Compounds (QCLot: 4584523)							
ES2233009-002	MB02B_0-9	EP074E(SIM): Vinyl chloride	75-01-4	2.5 mg/kg	109	70.0	130
EP074E(SIM): Halogenated Aliphatic Compounds (QCLot: 4585544)							
ES2233009-007	MB02B_178-187	EP074E(SIM): Vinyl chloride	75-01-4	2.5 mg/kg	107	70.0	130
EP074E: Halogenated Aliphatic Compounds (QCLot: 4584521)							
ES2233009-002	MB02B_0-9						

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 4584521) - continued							
ES2233009-002	MB02B_0-9	EP074: 1.1-Dichloroethene	75-35-4	2.5 mg/kg	85.1	70.0	130
		EP074: Trichloroethene	79-01-6	2.5 mg/kg	94.2	70.0	130
EP074E: Halogenated Aliphatic Compounds (QCLot: 4585545)							
ES2233009-007	MB02B_178-187	EP074: 1.1-Dichloroethene	75-35-4	2.5 mg/kg	82.0	70.0	130
		EP074: Trichloroethene	79-01-6	2.5 mg/kg	93.7	70.0	130
EP074F: Halogenated Aromatic Compounds (QCLot: 4584521)							
ES2233009-002	MB02B_0-9	EP074: Chlorobenzene	108-90-7	2.5 mg/kg	93.8	70.0	130
EP074F: Halogenated Aromatic Compounds (QCLot: 4585545)							
ES2233009-007	MB02B_178-187	EP074: Chlorobenzene	108-90-7	2.5 mg/kg	90.8	70.0	130
EP075A: Phenolic Compounds (QCLot: 4584737)							
ES2233009-002	MB02B_0-9	EP075: Phenol	108-95-2	10 mg/kg	95.1	60.0	130
		EP075: 4-Chloro-3-methylphenol	59-50-7	10 mg/kg	87.5	50.0	130
		EP075: Pentachlorophenol	87-86-5	10 mg/kg	60.6	10.0	130
EP075A: Phenolic Compounds (QCLot: 4585919)							
ES2233009-007	MB02B_178-187	EP075: Phenol	108-95-2	10 mg/kg	98.3	60.0	130
		EP075: 4-Chloro-3-methylphenol	59-50-7	10 mg/kg	90.6	50.0	130
		EP075: Pentachlorophenol	87-86-5	10 mg/kg	31.1	10.0	130
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4584737)							
ES2233009-002	MB02B_0-9	EP075: Acenaphthene	83-32-9	10 mg/kg	84.8	50.0	130
		EP075: Pyrene	129-00-0	10 mg/kg	80.7	50.0	130
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4585919)							
ES2233009-007	MB02B_178-187	EP075: Acenaphthene	83-32-9	10 mg/kg	88.3	50.0	130
		EP075: Pyrene	129-00-0	10 mg/kg	90.5	50.0	130
EP075E: Nitroaromatics and Ketones (QCLot: 4584737)							
ES2233009-002	MB02B_0-9	EP075: 2.4-Dinitrotoluene	121-14-2	10 mg/kg	68.8	40.0	130
EP075E: Nitroaromatics and Ketones (QCLot: 4585919)							
ES2233009-007	MB02B_178-187	EP075: 2.4-Dinitrotoluene	121-14-2	10 mg/kg	81.7	40.0	130
EP075G: Chlorinated Hydrocarbons (QCLot: 4584737)							
ES2233009-002	MB02B_0-9	EP075: 1.4-Dichlorobenzene	106-46-7	10 mg/kg	83.2	60.0	130
		EP075: 1.2.4-Trichlorobenzene	120-82-1	10 mg/kg	90.4	50.0	130
EP075G: Chlorinated Hydrocarbons (QCLot: 4585919)							
ES2233009-007	MB02B_178-187	EP075: 1.4-Dichlorobenzene	106-46-7	10 mg/kg	83.8	60.0	130
		EP075: 1.2.4-Trichlorobenzene	120-82-1	10 mg/kg	89.8	50.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4584522)							
ES2233009-002	MB02B_0-9	EP080: C6 - C9 Fraction	----	32.5 mg/kg	110	70.0	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4585543)							
ES2233009-007	MB02B_178-187	EP080: C6 - C9 Fraction	----	32.5 mg/kg	108	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4584522)							
ES2233009-002	MB02B_0-9	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	115	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4585543)							
ES2233009-007	MB02B_178-187	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	110	70.0	130
EP202A: Phenoxyacetic Acid Herbicides by LCMS (QCLot: 4586607)							
EB2226985-001	Anonymous	EP202: 2.4-D	94-75-7	0.1 mg/kg	81.8	68.0	139
		EP202: Triclopyr	55335-06-3	0.1 mg/kg	72.8	51.0	145
		EP202: 2.4.5-T	93-76-5	0.1 mg/kg	95.0	57.0	142
		EP202: Picloram	1918-02-1	0.1 mg/kg	59.1	49.0	138

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4590347)							
ES2233009-004	MB03B_7-20	EG005C: Arsenic	7440-38-2	1 mg/L	97.9	70.0	130
		EG005C: Beryllium	7440-41-7	1 mg/L	101	70.0	130
		EG005C: Cadmium	7440-43-9	0.25 mg/L	101	70.0	130
		EG005C: Chromium	7440-47-3	1 mg/L	98.6	70.0	130
		EG005C: Lead	7439-92-1	1 mg/L	101	70.0	130
		EG005C: Manganese	7439-96-5	1 mg/L	100.0	70.0	130
		EG005C: Nickel	7440-02-0	1 mg/L	98.8	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4590993)							
ES2233009-002	MB02B_0-9	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	104	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4590992)							
ES2233009-002	MB02B_0-9	ED045G: Chloride	16887-00-6	50 mg/L	101	70.0	130
EG035C: Leachable Mercury by FIMS (QCLot: 4590440)							
ES2233009-004	MB03B_7-20	EG035C: Mercury	7439-97-6	0.01 mg/L	91.5	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 4591356)							
ES2233009-002	MB02B_0-9	EG050G-W: Hexavalent Chromium	18540-29-9	0.05 mg/L	98.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4593212)							
ES2233009-002	MB02B_0-9	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	102	70.0	130
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4593213)							
ES2233009-002	MB02B_0-9	EK028SF: Weak Acid Dissociable Cyanide	----	0.2 mg/L	97.5	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4591669)							
ES2233009-004	MB03B_7-20	EK040P: Fluoride	16984-48-8	5 mg/L	89.0	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2233009**	Page	: 1 of 19
Amendment	: **(Preliminary Report)**		
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 14-Sep-2022
Site	: ----	Issue Date	: 11-Oct-2022
Sampler	: HENRY NOAKES	No. of samples received	: 6
Order number	: J200096	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG048: Hexavalent Chromium (Alkaline Digest)	ES2232708--001	Anonymous	**Hexavalent Chromium**	18540-29-9	0.6 %	70.0-130%	**Recovery less than lower data quality objective**
EG048: Hexavalent Chromium (Alkaline Digest)	ES2232708--001	Anonymous	**Hexavalent Chromium**	18540-29-9	6.6 %	70.0-130%	**Recovery less than lower data quality objective**
EG048: Hexavalent Chromium (Alkaline Digest)	ES2233009--007	MB02B_178-187	**Hexavalent Chromium**	18540-29-9	68.0 %	70.0-130%	**Recovery less than lower data quality objective**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EP075B: Polynuclear Aromatic Hydrocarbons	QC-4590454-002	----	**N-2-Fluorenyl Acetamide**	53-96-3	111 %	59.7-110%	**Recovery greater than upper control limit**
EP075B: Polynuclear Aromatic Hydrocarbons	QC-4590454-002	----	**7.12-Dimethylbenz(a)anthracene**	57-97-6	125 %	50.0-108%	**Recovery greater than upper control limit**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA003 :pH (field/fox)							
Soil Glass Jar - Unpreserved							
MB01A_26-36.5,	MB03B_21-29	21-Sep-2022	13-Sep-2022	**8**	----	----	----
EN60Z: ASLP Leachate - ZHE							
ZHE Leach: 7 day HT (e.g. VOC)							
MB02B_0-9, MB02B_178-187	MB03B_7-20,	20-Sep-2022	19-Sep-2022	**1**	----	----	----

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
MB02B_0-9, MB02B_178-187	MB03B_7-20,	----	----	----	20-Sep-2022	18-Sep-2022	**2**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Moisture Content	3	34	8.82	10.00	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	0	3	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Pesticides by GCMS	0	3	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	0	3	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	0	4	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Pesticides by GCMS	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	0	4	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)		*Sample Date*	*Extraction / Preparation*			*Analysis*		
			Date extracted	Due for extraction	Evaluation	*Date analysed*	Due for analysis	Evaluation
EA003 :pH (field/fox)								
Soil Glass Jar - Unpreserved (EA003)								
MB01A_26-36.5,	MB03B_21-29	**12-Sep-2022**	**21-Sep-2022**	13-Sep-2022	×	**23-Sep-2022**	20-Dec-2022	✓
EA011: Net Acid Generation								
Soil Glass Jar - Unpreserved (EA011)								
MB01A_26-36.5,	MB03B_21-29	**12-Sep-2022**	**23-Sep-2022**	12-Sep-2023	✓	**23-Sep-2022**	22-Mar-2023	✓
EA013: Acid Neutralising Capacity								
Soil Glass Jar - Unpreserved (EA013)								
MB01A_26-36.5,	MB03B_21-29	**12-Sep-2022**	**23-Sep-2022**	12-Sep-2023	✓	**23-Sep-2022**	22-Mar-2023	✓
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
MB02B_0-9, MB02B_178-187	MB03B_7-20,	**12-Sep-2022**	**----**	----	----	**16-Sep-2022**	26-Sep-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED042T: Total Sulfur by LECO							
Pulp Bag (ED042T)							
MB01A_26-36.5, MB03B_21-29	**12-Sep-2022**	**26-Sep-2022**	11-Mar-2023	✓	**26-Sep-2022**	11-Mar-2023	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	11-Mar-2023	✓	**19-Sep-2022**	11-Mar-2023	✓
Soil Glass Jar - Unpreserved (EG005T)							
MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	11-Mar-2023	✓	**19-Sep-2022**	11-Mar-2023	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	10-Oct-2022	✓	**19-Sep-2022**	10-Oct-2022	✓
Soil Glass Jar - Unpreserved (EG035T)							
MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	10-Oct-2022	✓	**19-Sep-2022**	10-Oct-2022	✓
EG048: Hexavalent Chromium (Alkaline Digest)							
Soil Glass Jar - Unpreserved (EG048G)							
MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	10-Oct-2022	✓	**16-Sep-2022**	23-Sep-2022	✓
Soil Glass Jar - Unpreserved (EG048G)							
MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	10-Oct-2022	✓	**19-Sep-2022**	26-Sep-2022	✓
EK026SF: Total CN by Segmented Flow Analyser							
Soil Glass Jar - Unpreserved (EK026SF)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	30-Sep-2022	✓
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser							
Soil Glass Jar - Unpreserved (EK028SF)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	30-Sep-2022	✓
EK040T: Fluoride Total							
Snap Lock Bag (EK040T)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**12-Sep-2022**	**20-Sep-2022**	10-Oct-2022	✓	**20-Sep-2022**	10-Oct-2022	✓
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)							
Non-Volatile Leach: 14 day HT(e.g. SV organics) (EN60-DIa-G)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**12-Sep-2022**	**18-Sep-2022**	26-Sep-2022	✓	**----**	----	----
EN60Z: ASLP Leachate - ZHE							
ZHE Leach: 7 day HT (e.g. VOC) (EN60Za)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**12-Sep-2022**	**20-Sep-2022**	19-Sep-2022	✓	**----**	----	----
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag (EP003)							
MB01A_26-36.5, MB03B_21-29	**12-Sep-2022**	**26-Sep-2022**	10-Oct-2022	✓	**26-Sep-2022**	10-Oct-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP066) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP068) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP068) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup							
Soil Glass Jar - Unpreserved (EP071SG-S) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP071SG-S) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup							
Soil Glass Jar - Unpreserved (EP071SG-S) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP071SG-S) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP074) MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**16-Sep-2022**	19-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP074) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**18-Sep-2022**	19-Sep-2022	✓
EP074B: Oxygenated Compounds							
Soil Glass Jar - Unpreserved (EP074) MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**16-Sep-2022**	19-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP074) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**18-Sep-2022**	19-Sep-2022	✓
EP074E(SIM): Halogenated Aliphatic Compounds							
Soil Glass Jar - Unpreserved (EP074E(SIM)) MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**16-Sep-2022**	19-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP074E(SIM)) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**18-Sep-2022**	19-Sep-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074E: Halogenated Aliphatic Compounds							
Soil Glass Jar - Unpreserved (EP074) MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**16-Sep-2022**	19-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP074) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**18-Sep-2022**	19-Sep-2022	✓
EP074F: Halogenated Aromatic Compounds							
Soil Glass Jar - Unpreserved (EP074) MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**16-Sep-2022**	19-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP074) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**18-Sep-2022**	19-Sep-2022	✓
EP074G: Trihalomethanes							
Soil Glass Jar - Unpreserved (EP074) MB02B_178-187	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**16-Sep-2022**	19-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP074) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	19-Sep-2022	✓	**18-Sep-2022**	19-Sep-2022	✓
EP075A: Phenolic Compounds							
Soil Glass Jar - Unpreserved (EP075) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP075) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP075B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP075) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP075C: Phthalate Esters							
Soil Glass Jar - Unpreserved (EP075) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP075) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP075E: Nitroaromatics and Ketones							
Soil Glass Jar - Unpreserved (EP075) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP075) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓
EP075G: Chlorinated Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075) MB02B_0-9, MB03B_7-20	**12-Sep-2022**	**16-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP075) MB02B_178-187	**12-Sep-2022**	**19-Sep-2022**	26-Sep-2022	✓	**19-Sep-2022**	29-Oct-2022	✓

Matrix: **SOIL**

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Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075K: Miscellaneous Compounds							
Soil Glass Jar - Unpreserved (EP075) MB02B_0-9, MB03B_7-20	12-Sep-2022	16-Sep-2022	26-Sep-2022	✓	19-Sep-2022	26-Oct-2022	✓
Soil Glass Jar - Unpreserved (EP075) MB02B_178-187	12-Sep-2022	19-Sep-2022	26-Sep-2022	✓	19-Sep-2022	29-Oct-2022	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080) MB02B_178-187	12-Sep-2022	16-Sep-2022	26-Sep-2022	✓	16-Sep-2022	26-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP080) MB02B_0-9, MB03B_7-20	12-Sep-2022	16-Sep-2022	26-Sep-2022	✓	18-Sep-2022	26-Sep-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080) MB02B_178-187	12-Sep-2022	16-Sep-2022	26-Sep-2022	✓	16-Sep-2022	26-Sep-2022	✓
Soil Glass Jar - Unpreserved (EP080) MB02B_0-9, MB03B_7-20	12-Sep-2022	16-Sep-2022	26-Sep-2022	✓	18-Sep-2022	26-Sep-2022	✓
EP132A: Phenolic Compounds							
Soil Glass Jar - Unpreserved (EP132) MB02B_0-9, MB03B_7-20, MB02B_178-187	12-Sep-2022	16-Sep-2022	26-Sep-2022	✓	19-Sep-2022	26-Oct-2022	✓
EP202A: Phenoxyacetic Acid Herbicides by LCMS							
Soil Glass Jar - Unpreserved (EP202) MB02B_0-9, MB03B_7-20, MB02B_178-187	12-Sep-2022	20-Sep-2022	26-Sep-2022	✓	20-Sep-2022	30-Oct-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P) MB02B_0-9, MB03B_7-20, MB02B_178-187	18-Sep-2022	----	----	----	20-Sep-2022	18-Sep-2022	×
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) MB02B_0-9, MB03B_7-20, MB02B_178-187	18-Sep-2022	----	----	----	20-Sep-2022	16-Oct-2022	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) MB02B_0-9, MB03B_7-20, MB02B_178-187	18-Sep-2022	----	----	----	20-Sep-2022	02-Oct-2022	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) MB02B_0-9, MB03B_7-20, MB02B_178-187	18-Sep-2022	----	----	----	20-Sep-2022	16-Oct-2022	✓

Matrix: **WATER**

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Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**----**	----	----	**20-Sep-2022**	16-Oct-2022	✓
EG005(ED093)C: Leachable Metals by ICPAES							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG005C)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	17-Mar-2023	✓	**20-Sep-2022**	17-Mar-2023	✓
EG035C: Leachable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035C)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**----**	----	----	**20-Sep-2022**	16-Oct-2022	✓
EG050G-W: Hexavalent Chromium - Water Leachable							
Clear Plastic Bottle - NaOH (EG050G-W)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**----**	----	----	**20-Sep-2022**	16-Oct-2022	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**----**	----	----	**21-Sep-2022**	04-Oct-2022	✓
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK028SF)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**----**	----	----	**21-Sep-2022**	04-Oct-2022	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**----**	----	----	**20-Sep-2022**	16-Oct-2022	✓
EP068A: Organochlorine Pesticides (OC)							
Amber Glass Bottle - Unpreserved (EP068)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP068B: Organophosphorus Pesticides (OP)							
Amber Glass Bottle - Unpreserved (EP068)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP068C: Triazines							
Amber Glass Bottle - Unpreserved (EP068)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓

Matrix: **WATER**

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Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP068D: Cypermethrins							
Amber Glass Bottle - Unpreserved (EP068)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP068E: Other Pesticides							
Amber Glass Bottle - Unpreserved (EP068)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓
EP074B: Oxygenated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓
EP074C: Sulfonated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓
EP074D: Fumigants							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓
EP074E: Halogenated Aliphatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓
EP074F: Halogenated Aromatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓
EP074G: Trihalomethanes							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓
EP074H: Naphthalene							
Amber VOC Vial - Sulfuric Acid (EP074)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**20-Sep-2022**	**21-Sep-2022**	04-Oct-2022	✓	**21-Sep-2022**	04-Oct-2022	✓

Matrix: **WATER**

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Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075C: Phthalate Esters							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075D: Nitrosamines							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075E: Nitroaromatics and Ketones							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075F: Haloethers							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075G: Chlorinated Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075H: Anilines and Benzidines							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075I: Organochlorine Pesticides							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓
EP075J: Organophosphorus Pesticides							
Amber Glass Bottle - Unpreserved (EP075) MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075K: Miscellaneous Compounds							
Amber Glass Bottle - Unpreserved (EP075)							
MB02B_0-9, MB03B_7-20, MB02B_178-187	**18-Sep-2022**	**20-Sep-2022**	25-Sep-2022	✓	**20-Sep-2022**	30-Oct-2022	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	4	35	**11.43**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	2	4	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	3	34	**8.82**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation	EA011	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH field/fox	EA003	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	0	3	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	4	35	**11.43**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	2	4	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation	EA011	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Total Organic Carbon	EP003	2	2	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	35	**5.71**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	2	4	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	4	35	**11.43**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	2	4	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	2	3	**66.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	2	11	**18.18**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	3	20	**15.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	0	3	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	0	3	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	0	4	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	3	20	**15.00**	**8.33**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	20	**5.00**	**1.67**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Leachable Metals by ICPAES	EG005C	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	0	4	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH field/fox	EA003	SOIL	In house: Referenced to Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.
pH by Auto Titrator	EA005-P	SOIL	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by Auto Titrator	EA010-P	SOIL	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Net Acid Generation	EA011	SOIL	In house: Referenced to Miller (1998) Titremetric procedure determines net acidity in a soil following peroxide oxidation. Titrations to both pH 4.5 and pH 7 are reported.
Acid Neutralising Capacity (ANC)	EA013	SOIL	In house: Referenced to USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Alkalinity by Auto Titrator	ED037-P	SOIL	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	SOIL	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Sulfur - Total as S (LECO)	ED042T	SOIL	In house: Dried and pulverised sample is combusted in a high temperature furnace in the presence of strong oxidants / catalysts. The evolved S (as SO2) is measured by infra-red detector
Chloride by Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Leachable Metals by ICPAES	EG005C	SOIL	In house: referenced to APHA 3120; USEPA SW 846 - 6010: The ICPAES technique ionises leachate sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Leachable Mercury by FIMS	EG035C	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Descrete Analyser and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511 / ISO 14403. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3).
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	SOIL	In house: Referenced to APHA 4500-CN C&O / ISO 14403. Samples preserved with sodium hydroxide are introduced into an automated segmented flow analyser. Hydrogen cyanide is liberated from a slightly acidified (pH 4.5) and is dialysed. Tight cyanide complexes that would not be amenable to oxidation by chlorine are not converted. Iron cyanide complexes are precipitated with zinc acetate. Liberated HCN diffuses through a membrane into a stream of sodium hydroxide where it is carried as CN- The cyanide in caustic solution is buffered to pH 5.2 and further converted to cyanogen chloride by reaction with chloramine-T. Cyanogen chloride subsequently reacts with 4 ¿pyridine carboxylic and 1,3 - dimethylbarbituric acids to give a red colour complex. This colour is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Fluoride by Auto Titrator	EK040P	SOIL	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Total Fluoride	EK040T	SOIL	(In-house) Total fluoride is determined by ion specific electrode (ISE) in a solution obtained after a Sodium Carbonate / Potassium Carbonate fusion dissolution.
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
Polychlorinated Biphenyls (PCB)	EP066	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	SOIL	In house: Referenced to USEPA SW 846 - 8015. Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
Volatile Organic Compounds	EP074	SOIL	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
Low level CHC (SIM)	EP074E(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).
Semivolatile Organic Compounds	EP075	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	SOIL	In house: Referenced to USEPA 8270 GCMS Capiliary column, SIM mode.
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	SOIL	In house: LCMS (Electrospray in negative mode). Residues of acid herbicides are extracted from soil samples under the alkaline condition. An aliquot of the alkaline aqueous phase is taken and acidified before a SPE cleanup. After eluting off from the SPE cartridge, residues of acid herbicides are dissolved in HPLC mobile phase prior to instrument analysis.
NSW Waste Classification Guidelines - Aggregate Sums	* NSW-WCG	SOIL	In house: This method provides rounded sums for diverse trace organics to suit NSW Waste Classification Guidelines.

Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
Total Fluoride	EK040T-PR	SOIL	In house: Samples are fused with Sodium Carbonate / Potassium Carbonate flux.
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
Digestion for Total Recoverable Metals in TCLP Leachate	EN25C	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Deionised Water Leach - Glass Leaching Vessel	EN60-Dla-G	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
ASLP for Volatile Analytes (Zero Headspace Extraction)	EN60Za	SOIL	In house QWI-EN/60 referenced to AS4439.2 Preparation of Leachates

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Extraction for Phenoxy Acid Herbicides in Soils.	EP202-PR	SOIL	In-House: Alkaline extract followed by SPE clean up of acidified portion of the sample extract.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
Separatory Funnel Extraction of Liquids	ORG14	SOIL	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Volatiles Water Preparation	ORG16-W	SOIL	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids/ Acetylation	ORG17A-AC	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to 1 mL with exchange into cyclohexane. Phenolic compounds are reacted with acetic anhydride to yield phenyl acetates suitable for ultra-trace analysis.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: EMM CONSULTING	TURNAROUND REQUIREMENTS : ☐☑ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: 20 Chandos Street, St Leonards	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: Oven Mountain Pumped Storage Project PROJECT NO.: J200098	ALS QUOTE NO: NA	Free ice / frozen ice bricks present upon receipt? Yes No N/A
PURCHASE ORDER: J200098	COUNTRY OF ORIGIN:	COC SEQUENCE NUMBER (Circle) COC: ① 2 3 4 5 6 7
PROJECT MANAGER: Henry Noakes	CONTACT PH: 0445 772 835	OF: ① 2 3 4 5 6 7
SAMPLER: KB	SAMPLER MOBILE: 0401 881 447	Random Sample Temperature on Receipt C
COC Emailed to ALS? (YES)	EDD FORMAT (or default): esdat	Other comment:

Email Reports to: hnoakes@emmconsulting.com.au / scassidy@emmconsulting.com.au / abayer@emmconsulting.com.au / emmconsulting@esdat.net; rirusoos@emmconsulting.com.au; mbold@emmconsulting.com.au	RELINQUISHED BY: KB	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Email Invoice to: finance@emmconsulting.com.au / hnoakes@emmconsulting.com.au	DATE/TIME: 26/08/2022	DATE/TIME: 26/08/22 1920	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).									Additional Information
LAB ID	SAMPLE ID	DATE	TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BAGS	Hold - analytical suite to be confirmed via email								Please forward to Envirolab for similar analysis	
1	BH4B_2.39-2.51	25/08/2022		Rock		1	x									
2	BH4B_6.40-6.52	25/08/2022		Rock		1	x									
3	BH4B_13.85-14.0	25/08/2022		Rock		1	x									
4	BH4B_22.05-22.30	26/08/2022		Rock		1	x									
5	BH4B_33.0-33.27	26/08/2022		Rock		1	x									
6	BH4B_39.74-39.91	26/08/2022		Rock		1	x									
7	BH4B_47.89-48.00	26/08/2022		Rock		1	x									
8	BH4B_56.81-57.0	25/08/2022		Rock		1	x									
9	BH4B_62.10-62.30	25/08/2022		Rock		1	x									
10	BH4B_71.07-71.20	25/08/2022		Rock		1	x									
11	BH4B_84.0-84.15	25/08/2022		Rock		1	x									
12	BH4B_86.0-86.15	25/08/2022		Rock		1	x									
13	BH4B_99.82-99.95	25/08/2022		Rock		1	x									
14	BH4B_126.27-126.37	25/08/2022		Rock		1	x									
15	BH4B_148.17-148.36	25/08/2022		Rock		1	x									
16	BH4B_191.75-191.94	25/08/2022		Rock		1	x									
17	BH4B_221.74-221.87	25/08/2022		Rock		1	x									
18	BH4B_325.0-325.16	25/08/2022		Rock		1	x									
19	BH4B_349.86-350.0	25/08/2022		Rock		1	x									

Environmental Division
Sydney
Work Order Reference
ES2230654

Telephone : 61-2-8784 8555

20	BH4B_373.86-374.0	25/08/2022		Rock				1	x																								
21	BH4B_388.0-388.13	25/08/2022		Rock				1	x																								
22	BH4B_419.0-419.14	25/08/2022		Rock				1	x																								
							TOTAL	22	0	0	0	0	0	0	0	0	0	0																

Water Container Codes: P = Unpreserved Plastic, N = Nitric Preserved Plastic, ORC = Nitric Preserved ORC, SH = Sodium Hydroxide/Cd Preserved, S = Sodium Hydroxide Preserved Plastic, AG = Amber Glass Unpreserved, AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved, VB = VOA Vial Sodium Bisulphate Preserved, VS = VOA Vial Sulfuric Preserved, AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass, H = HCl preserved Plastic, HS = HCl preserved Speciation bottle, SP = Sulfuric Preserved Plastic, F = Formaldehyde Preserved Glass,
Z = Zinc Acetate Preserved Bottle, E = EDTA Preserved Bottles, ST = Sterile Bottle, ASS = Plastic Bag for Acid Sulphate Soils, B = Unpreserved Bag, U = Lugols Iodine Preserved Bottles, STT = Sterile Sodium Thiosulfate Preserved Bottles

Rec: L Cas 26/08/22 1920

UPDATED COC

CHAIN OF CUSTODY
ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 1/73 Sydney Road Mudgee NSW 2850 Ph: 02 6372 0735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
NOWRA 4/19 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 1/19-21 Rach Black Dr. North Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: EMM CONSULTING	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: 20 Chandos Street, St Leonards	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) X Non Standard or urgent TAT (List due date): FRIDAY - 16 December 2022		Custody Seal Intact? Yes No N/A
PROJECT: Oven Mountain Pumped Storage Project PROJECT NO.: J200096	ALS QUOTE NO: NA	COC SEQUENCE NUMBER (Circle)	Frozen ice / frozen ice bricks present upon receipt? Yes No N/A
PURCHASE ORDER: J200096	COUNTRY OF ORIGIN:	COC: ① 2 3 4 5 6 7	Random Sample Temperature on Receipt: C
PROJECT MANAGER: Henry Noakes	CONTACT PH: 0448 772 835	OF: ① 2 3 4 5 6 7	Other comment:
SAMPLER: KB	SAMPLER MOBILE: 0401 881 447	RELINQUISHED BY: HJN	RECEIVED BY: JC
COC Emailed to ALS? (YES)	EDD FORMAT (or default): esdat	DATE/TIME: 14/09/1902	DATE/TIME: 14/09/22 1550
Email Reports to: hnoakes@emmconsulting.com.au / kcassidy@emmconsulting.com.au / abayor@emmconsulting.com.au / emmconsulting@esdat.net; rbrusaolt@emmconsulting.com.au, mskold@emmconsulting.com.au		RELINQUISHED BY:	RECEIVED BY:
Email Invoice to: finance@emmconsulting.com.au / hnoakes@emmconsulting.com.au		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).									Additional Information
LAB ID	SAMPLE ID	DATE	TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL	Waste classification (P-773 leng)	Acid neutralising capacity	Total sulfur (S-IR08)	Metals and metalloids (ME-MS61m)	ASLP Suite (as per attached quote)	Rock analysis (as per attached quote)				
1	BH4B_2.39-2.51	25/08/2022		Rock	BAG	1	1				1					
2	BH4B_6.40-6.52	25/08/2022		Rock	BAG	1				1	1	1				
3	BH4B_13.85-14.0	25/08/2022		Rock	BAG	1										
4	BH4B_22.05-22.30	25/08/2022		Rock	BAG	1	1				1					
5	BH4B_33.0-33.27	25/08/2022		Rock	BAG	1										
6	BH4B_39.74-39.91	25/08/2022		Rock	BAG	1				1	1	1				
7	BH4B_47.89-48.00	25/08/2022		Rock	BAG	1										
8	BH4B_56.81-57.0	25/08/2022		Rock	BAG	1										
9	BH4B_62.10-62.30	25/08/2022		Rock	BAG	1										
10	BH4B_71.07-71.20	25/08/2022		Rock	BAG	1				1	1	1				
11	BH4B_84.0-84.15	25/08/2022		Rock	BAG	1										
12	BH4B_86.0-86.15	25/08/2022		Rock	BAG	1										
13	BH4B_99.82-99.95	25/08/2022		Rock	BAG	1										
14	BH4B_126.27-126.37	25/08/2022		Rock	BAG	1	1				1					
15	BH4B_148.17-148.36	25/08/2022		Rock	BAG	1				1	1	1				
16	BH4B_191.75-191.94	25/08/2022		Rock	BAG	1										
17	BH4B_221.74-221.87	25/08/2022		Rock	BAG	1										
18	BH4B_325.0-325.16	25/08/2022		Rock	BAG	1										
19	BH4B_349.86-350.0	25/08/2022		Rock	BAG	1										
20	BH4B_373.86-374.0	25/08/2022		Rock	BAG	1										
21	BH4B_388.0-388.13	25/08/2022		Rock	BAG	1										
22	BH4B_419.0-419.14	25/08/2022		Rock	BAG	1				1	1	1				
23	MB01A_26-36.5	12/09/2022	15:00	Solids	JAR	1				1	1	1				

Environmental Division
Sydney
Work Order Reference
ES2230654

Telephone : – 61-2-8784 8555

24	MB02B_0-9	12/09/2022	15:00	Solids	JAR	1	1				1					
25	MB02B_178-187	12/09/2022	15:00	Solids	JAR	1										
26	MB03B_7-20	12/09/2022	15:00	Solids	JAR	1	1			1	1	1				
29	MB03B_54-63	12/09/2022	15:00	Solids	JAR	1										
					TOTAL	27	5	0	0	7	11	7	0	0	0	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VS = VOA Vial Sodium Bisulphate Preserved; VA = VOA Vial Sulfuric Preserved, AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass, H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; U = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles

Rec: L Cu 14/09/22 1550

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2230654**	Page	: 1 of 28
Amendment	: **(Preliminary Report)**		
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 26-Aug-2022 19:20
Order number	: J200096	Date Analysis Commenced	: 26-Sep-2022
C-O-C number	: ----	Issue Date	: 11-Oct-2022 09:52
Sampler	: KB		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 22		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Khin Htwe	LAB TECH	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

This report contains preliminary authorised results. The report may contain semi-quantitative results. Any result presented in this preliminary report may be subject to change in the final report.

- EP202: Poor matrix spike recoveries for Clopyralid due to matrix effects.
- EG050G: Poor spike recovery for Hexavalent Chromium due to matrix interferences(confirmed by re-analysis).
- EG048G: Poor spike recovery forAlkaline Hexavalent Chromium due to matrix interferences.
- EG050G: LOR raised for Hexavalent Chromium on sample 1 due to sample matrix.
- EP075: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- NSW-WCG: Where reported, Total Chlorinated Hydrocarbons is the sum of the reported concentrations of all Chlorinated Hydrocarbons at or above the LOR.
- EP074: Where reported, Total Trihalomethanes is the sum of the reported concentrations of all Trihalomethanes at or above the LOR.
- EP074: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP074: Where reported, Sum of chlorinated hydrocarbons includes carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichlorothene, trans-1,2-dichlorothene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, vinyl chloride, hexachlorobutadiene and methylene chloride.
- EP074: Where reported, Total Trimethylbenzenes is the sum of the reported concentrations of 1.2.3-Trimethylbenzene, 1.2.4-Trimethylbenzene and 1.3.5-Trimethylbenzene at or above the LOR.
- EP075: Poor surrogate recovery due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.
- EP075: Where reported, 'Sum of PAH' is the sum of the USEPA 16 priority PAHs
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

- EP132: Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit	ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.21**	**7.62**	**7.53**	**7.62**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**19**	**37**	**31**	**27**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**7**	**14**	**16**	**15**	----
Total Alkalinity as CaCO3	----	1	mg/L	**7**	**14**	**16**	**15**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	<1	<1	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	<1	<1	<1	----
EG005(ED093)C: Leachable Metals by ICPAES								
Aluminium	7429-90-5	0.1	mg/L	**4.1**	**3.1**	**4.0**	**4.2**	----
Antimony	7440-36-0	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Iron	7439-89-6	0.1	mg/L	**2.6**	**1.0**	**4.2**	**4.3**	----
Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Manganese	7439-96-5	0.1	mg/L	**0.1**	**0.1**	<0.1	<0.1	----
Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
Silver	7440-22-4	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Molybdenum	7439-98-7	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
EG035C: Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	----
EG050G: Hexavalent Chromium by Discrete Analyser								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.10	<0.01	<0.01	<0.01	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	**0.1**	**0.1**	<0.1	----
EP068A: Organochlorine Pesticides (OC)								

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP068A: Organochlorine Pesticides (OC) - Continued									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
beta-BHC	319-85-7	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
4.4`-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
4.4`-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
4.4`-DDT	50-29-3	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Methoxychlor	72-43-5	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
^ Total Chlordane (sum)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Monocrotophos	6923-22-4	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Parathion-methyl	298-00-0	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP068B: Organophosphorus Pesticides (OP) - Continued									
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Parathion	56-38-2	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Chlorfenvinphos	470-90-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP068C: Triazines									
Atrazine	1912-24-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Simazine	122-34-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP068D: Cypermethrins									
Cypermethrins	----	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
EP068E: Other Pesticides									
Methoprene	40596-69-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP075A: Phenolic Compounds									
Phenol	108-95-2	2	µg/L		<2	<2	<2	<2	----
2-Chlorophenol	95-57-8	2	µg/L		<2	<2	<2	<2	----
2-Methylphenol	95-48-7	2	µg/L		<2	<2	<2	<2	----
3- & 4-Methylphenol	1319-77-3	4	µg/L		<4	<4	<4	<4	----
2-Nitrophenol	88-75-5	2	µg/L		<2	<2	<2	<2	----
2.4-Dimethylphenol	105-67-9	2	µg/L		<2	<2	<2	<2	----
2.4-Dichlorophenol	120-83-2	2	µg/L		<2	<2	<2	<2	----
2.6-Dichlorophenol	87-65-0	2	µg/L		<2	<2	<2	<2	----
4-Chloro-3-methylphenol	59-50-7	2	µg/L		<2	<2	<2	<2	----
2.4.6-Trichlorophenol	88-06-2	2	µg/L		<2	<2	<2	<2	----
2.4.5-Trichlorophenol	95-95-4	2	µg/L		<2	<2	<2	<2	----
Pentachlorophenol	87-86-5	4	µg/L		<4	<4	<4	<4	----
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	2	µg/L		<2	<2	<2	<2	----
2-Methylnaphthalene	91-57-6	2	µg/L		<2	<2	<2	<2	----
2-Chloronaphthalene	91-58-7	2	µg/L		<2	<2	<2	<2	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP075B: Polynuclear Aromatic Hydrocarbons - Continued									
Acenaphthylene	208-96-8	2	µg/L		<2	<2	<2	<2	----
Acenaphthene	83-32-9	2	µg/L		<2	<2	<2	<2	----
Fluorene	86-73-7	2	µg/L		<2	<2	<2	<2	----
Phenanthrene	85-01-8	2	µg/L		<2	<2	<2	<2	----
Anthracene	120-12-7	2	µg/L		<2	<2	<2	<2	----
Fluoranthene	206-44-0	2	µg/L		<2	<2	<2	<2	----
Pyrene	129-00-0	2	µg/L		<2	<2	<2	<2	----
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L		<2	<2	<2	<2	----
Benz(a)anthracene	56-55-3	2	µg/L		<2	<2	<2	<2	----
Chrysene	218-01-9	2	µg/L		<2	<2	<2	<2	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L		<4	<4	<4	<4	----
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L		<2	<2	<2	<2	----
Benzo(a)pyrene	50-32-8	2	µg/L		<2	<2	<2	<2	----
3-Methylcholanthrene	56-49-5	2	µg/L		<2	<2	<2	<2	----
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L		<2	<2	<2	<2	----
Dibenz(a.h)anthracene	53-70-3	2	µg/L		<2	<2	<2	<2	----
Benzo(g.h.i)perylene	191-24-2	2	µg/L		<2	<2	<2	<2	----
^ Sum of PAHs	----	2	µg/L		<2	<2	<2	<2	----
^ Benzo(a)pyrene TEQ (zero)	----	2	µg/L		<2	<2	<2	<2	----
EP075C: Phthalate Esters									
Dimethyl phthalate	131-11-3	2	µg/L		<2	<2	<2	<2	----
Diethyl phthalate	84-66-2	2	µg/L		<2	<2	<2	<2	----
Di-n-butyl phthalate	84-74-2	2	µg/L		<2	<2	<2	<2	----
Butyl benzyl phthalate	85-68-7	2	µg/L		<2	<2	<2	<2	----
bis(2-ethylhexyl) phthalate	117-81-7	10	µg/L		<10	<10	<10	<10	----
Di-n-octylphthalate	117-84-0	2	µg/L		<2	<2	<2	<2	----
EP075D: Nitrosamines									
N-Nitrosomethylethylamine	10595-95-6	2	µg/L		<2	<2	<2	<2	----
N-Nitrosodiethylamine	55-18-5	2	µg/L		<2	<2	<2	<2	----
N-Nitrosopyrrolidine	930-55-2	4	µg/L		<4	<4	<4	<4	----
N-Nitrosomorpholine	59-89-2	2	µg/L		<2	<2	<2	<2	----
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L		<2	<2	<2	<2	----
N-Nitrosopiperidine	100-75-4	2	µg/L		<2	<2	<2	<2	----
N-Nitrosodibutylamine	924-16-3	2	µg/L		<2	<2	<2	<2	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP075D: Nitrosamines - Continued									
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L		<4	<4	<4	<4	----
Methapyrilene	91-80-5	2	µg/L		<2	<2	<2	<2	----
EP075E: Nitroaromatics and Ketones									
2-Picoline	109-06-8	2	µg/L		<2	<2	<2	<2	----
Acetophenone	98-86-2	2	µg/L		<2	<2	<2	<2	----
Nitrobenzene	98-95-3	2	µg/L		<2	<2	<2	<2	----
Isophorone	78-59-1	2	µg/L		<2	<2	<2	<2	----
2.6-Dinitrotoluene	606-20-2	4	µg/L		<4	<4	<4	<4	----
2.4-Dinitrotoluene	121-14-2	4	µg/L		<4	<4	<4	<4	----
1-Naphthylamine	134-32-7	2	µg/L		<2	<2	<2	<2	----
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L		<2	<2	<2	<2	----
5-Nitro-o-toluidine	99-55-8	2	µg/L		<2	<2	<2	<2	----
Azobenzene	103-33-3	2	µg/L		<2	<2	<2	<2	----
1.3.5-Trinitrobenzene	99-35-4	2	µg/L		<2	<2	<2	<2	----
Phenacetin	62-44-2	2	µg/L		<2	<2	<2	<2	----
4-Aminobiphenyl	92-67-1	2	µg/L		<2	<2	<2	<2	----
Pentachloronitrobenzene	82-68-8	2	µg/L		<2	<2	<2	<2	----
Pronamide	23950-58-5	2	µg/L		<2	<2	<2	<2	----
Dimethylaminoazobenzene	60-11-7	2	µg/L		<2	<2	<2	<2	----
Chlorobenzilate	510-15-6	2	µg/L		<2	<2	<2	<2	----
EP075F: Haloethers									
Bis(2-chloroethyl) ether	111-44-4	2	µg/L		<2	<2	<2	<2	----
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L		<2	<2	<2	<2	----
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L		<2	<2	<2	<2	----
4-Bromophenyl phenyl ether	101-55-3	2	µg/L		<2	<2	<2	<2	----
EP075G: Chlorinated Hydrocarbons									
1.3-Dichlorobenzene	541-73-1	2	µg/L		<2	<2	<2	<2	----
1.4-Dichlorobenzene	106-46-7	2	µg/L		<2	<2	<2	<2	----
1.2-Dichlorobenzene	95-50-1	2	µg/L		<2	<2	<2	<2	----
Hexachloroethane	67-72-1	2	µg/L		<2	<2	<2	<2	----
1.2.4-Trichlorobenzene	120-82-1	2	µg/L		<2	<2	<2	<2	----
Hexachloropropylene	1888-71-7	2	µg/L		<2	<2	<2	<2	----
Hexachlorobutadiene	87-68-3	2	µg/L		<2	<2	<2	<2	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP075G: Chlorinated Hydrocarbons - Continued									
Hexachlorocyclopentadiene	77-47-4	10	µg/L		<10	<10	<10	<10	----
Pentachlorobenzene	608-93-5	2	µg/L		<2	<2	<2	<2	----
Hexachlorobenzene (HCB)	118-74-1	4	µg/L		<4	<4	<4	<4	----
EP075H: Anilines and Benzidines									
Aniline	62-53-3	2	µg/L		<2	<2	<2	<2	----
4-Chloroaniline	106-47-8	2	µg/L		<2	<2	<2	<2	----
2-Nitroaniline	88-74-4	4	µg/L		<4	<4	<4	<4	----
3-Nitroaniline	99-09-2	4	µg/L		<4	<4	<4	<4	----
Dibenzofuran	132-64-9	2	µg/L		<2	<2	<2	<2	----
4-Nitroaniline	100-01-6	2	µg/L		<2	<2	<2	<2	----
Carbazole	86-74-8	2	µg/L		<2	<2	<2	<2	----
3.3`-Dichlorobenzidine	91-94-1	2	µg/L		<2	<2	<2	<2	----
EP075I: Organochlorine Pesticides									
alpha-BHC	319-84-6	2	µg/L		<2	<2	<2	<2	----
beta-BHC	319-85-7	2	µg/L		<2	<2	<2	<2	----
gamma-BHC	58-89-9	2	µg/L		<2	<2	<2	<2	----
delta-BHC	319-86-8	2	µg/L		<2	<2	<2	<2	----
Heptachlor	76-44-8	2	µg/L		<2	<2	<2	<2	----
Aldrin	309-00-2	2	µg/L		<2	<2	<2	<2	----
Heptachlor epoxide	1024-57-3	2	µg/L		<2	<2	<2	<2	----
alpha-Endosulfan	959-98-8	2	µg/L		<2	<2	<2	<2	----
4.4`-DDE	72-55-9	2	µg/L		<2	<2	<2	<2	----
Dieldrin	60-57-1	2	µg/L		<2	<2	<2	<2	----
Endrin	72-20-8	2	µg/L		<2	<2	<2	<2	----
beta-Endosulfan	33213-65-9	2	µg/L		<2	<2	<2	<2	----
4.4`-DDD	72-54-8	2	µg/L		<2	<2	<2	<2	----
Endosulfan sulfate	1031-07-8	2	µg/L		<2	<2	<2	<2	----
4.4`-DDT	50-29-3	4	µg/L		<4	<4	<4	<4	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L		<4	<4	<4	<4	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	4	µg/L		<4	<4	<4	<4	----
EP075J: Organophosphorus Pesticides									
Dichlorvos	62-73-7	2	µg/L		<2	<2	<2	<2	----
Dimethoate	60-51-5	2	µg/L		<2	<2	<2	<2	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP075J: Organophosphorus Pesticides - Continued									
Diazinon	333-41-5	2	µg/L		<2	<2	<2	<2	----
Chlorpyrifos-methyl	5598-13-0	2	µg/L		<2	<2	<2	<2	----
Malathion	121-75-5	2	µg/L		<2	<2	<2	<2	----
Fenthion	55-38-9	2	µg/L		<2	<2	<2	<2	----
Chlorpyrifos	2921-88-2	2	µg/L		<2	<2	<2	<2	----
Pirimphos-ethyl	23505-41-1	2	µg/L		<2	<2	<2	<2	----
Chlorfenvinphos	470-90-6	2	µg/L		<2	<2	<2	<2	----
Prothiofos	34643-46-4	2	µg/L		<2	<2	<2	<2	----
Ethion	563-12-2	2	µg/L		<2	<2	<2	<2	----
EP075K: Miscellaneous Compounds									
1.3.5-Trichlorobenzene	108-70-3	2	µg/L		<2	<2	<2	<2	----
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L		<2	<2	<2	<2	----
Methanesulfonate methyl	66-27-3	2	µg/L		<2	<2	<2	<2	----
cis-Isosafrole	17627-76-8	2	µg/L		<2	<2	<2	<2	----
trans-Isosafrole	4043-71-4	2	µg/L		<2	<2	<2	<2	----
Safrole	94-59-7	2	µg/L		<2	<2	<2	<2	----
Diallate	2303-16-4	2	µg/L		<2	<2	<2	<2	----
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L		<2	<2	<2	<2	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%		89.8	116	82.6	93.1	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.5	%		78.1	109	77.3	92.8	----
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	2	%		10.3	5.1	7.5	8.6	----
Phenol-d6	13127-88-3	2	%		23.1	19.2	22.2	24.6	----
2-Chlorophenol-D4	93951-73-6	2	%		26.6	13.9	21.8	24.0	----
2.4.6-Tribromophenol	118-79-6	2	%		13.2	5.4	7.9	9.3	----
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	2	%		65.1	72.3	65.8	69.4	----
1.2-Dichlorobenzene-D4	2199-69-1	2	%		56.5	59.2	55.3	58.9	----
2-Fluorobiphenyl	321-60-8	2	%		59.8	65.1	58.4	62.1	----
Anthracene-d10	1719-06-8	2	%		69.8	82.1	65.4	72.8	----
4-Terphenyl-d14	1718-51-0	2	%		75.3	94.6	72.0	80.5	----

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Sample ID	BH4B_2.39-2.51	BH4B_6.40-6.52	BH4B_22.05-22.30	BH4B_39.74-39.91	BH4B_71.0-71.20
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
Compound	CAS Number	LOR	Unit	ES2230654-001	ES2230654-002	ES2230654-004	ES2230654-006	ES2230654-010
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	----	8.5	----	8.1	7.0
pH (Fox)	----	0.1	pH Unit	----	4.9	----	3.4	2.9
Reaction Rate	----	1	Reaction Unit	----	2	----	2	2
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	----	7.1	----	6.9	4.6
NAG (pH 4.5)	----	0.1	kg H2SO4/t	----	<0.1	----	<0.1	<0.1
NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	<0.1	----	0.5	3.5
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	----	17.8	----	9.5	14.8
ANC as CaCO3	----	0.1	% CaCO3	----	1.8	----	1.0	1.5
Fizz Rating	----	0	Fizz Unit	----	1	----	0	1
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	<1.0	----	<1.0	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	----	0.03	----	0.05	0.18
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	6	----	<5	----	----
Beryllium	7440-41-7	1	mg/kg	<1	----	<1	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	<1	----	----
Lead	7439-92-1	5	mg/kg	<5	----	19	----	----
Molybdenum	7439-98-7	2	mg/kg	<2	----	<2	----	----
Nickel	7440-02-0	2	mg/kg	3	----	<2	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	<5	----	----
Silver	7440-22-4	2	mg/kg	<2	----	<2	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	<0.1	----	----
EG048: Hexavalent Chromium (Alkaline Digest)								
Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	----	<0.5	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	----	<1	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser								
Weak Acid Dissociable Cyanide	----	1	mg/kg	<1	----	<1	----	----
EK040T: Fluoride Total								

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Sample ID	BH4B_2.39-2.51	BH4B_6.40-6.52	BH4B_22.05-22.30	BH4B_39.74-39.91	BH4B_71.0-71.20
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
Compound	CAS Number	LOR	Unit	ES2230654-001	ES2230654-002	ES2230654-004	ES2230654-006	ES2230654-010
				Result	Result	Result	Result	Result
EK040T: Fluoride Total - Continued								
Fluoride	16984-48-8	40	mg/kg	500	----	770	----	----
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)								
Final pH	----	0.1	pH Unit	8.9	----	9.6	----	----
EN60Z: ASLP Leachate - ZHE								
Extraction Fluid pH	----	0.1	pH Unit	8.9	----	9.6	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	----	0.02	----	0.38	0.06
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	<0.05	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	<0.2	----	----
EP068B: Organophosphorus Pesticides (OP)								
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	<0.05	----	----
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup								
>C10 - C16 Fraction	----	50	mg/kg	<50	----	<50	----	----

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_2.39-2.51	BH4B_6.40-6.52	BH4B_22.05-22.30	BH4B_39.74-39.91	BH4B_71.0-71.20
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-002	ES2230654-004	ES2230654-006	ES2230654-010
					Result	Result	Result	Result	Result
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup - Continued									
>C16 - C34 Fraction	----	100	mg/kg		<100	----	<100	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	----	<100	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	----	<50	----	----
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup									
C10 - C14 Fraction	----	50	mg/kg		<50	----	<50	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	----	<100	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	----	<100	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	----	<50	----	----
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	<0.2	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	<0.5	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Styrene	100-42-5	0.5	mg/kg		<0.5	----	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	<0.5	----	----
EP074B: Oxygenated Compounds									
2-Butanone (MEK)	78-93-3	5	mg/kg		<5	----	<5	----	----
EP074E(SIM): Halogenated Aliphatic Compounds									
Vinyl chloride	75-01-4	0.2	mg/kg		<0.2	----	<0.2	----	----
EP074E: Halogenated Aliphatic Compounds									
Vinyl chloride	75-01-4	4	mg/kg		<4	----	<4	----	----
1.1-Dichloroethene	75-35-4	0.5	mg/kg		<0.5	----	<0.5	----	----
Methylene chloride	75-09-2	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg		<0.5	----	<0.5	----	----
Carbon Tetrachloride	56-23-5	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2-Dichloroethane	107-06-2	0.5	mg/kg		<0.5	----	<0.5	----	----
Trichloroethene	79-01-6	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg		<0.5	----	<0.5	----	----
Tetrachloroethene	127-18-4	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg		<0.5	----	<0.5	----	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	0.5	mg/kg		<0.5	----	<0.5	----	----
EP074G: Trihalomethanes									

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_2.39-2.51	BH4B_6.40-6.52	BH4B_22.05-22.30	BH4B_39.74-39.91	BH4B_71.0-71.20
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-002	ES2230654-004	ES2230654-006	ES2230654-010
					Result	Result	Result	Result	Result
EP074G: Trihalomethanes - Continued									
Chloroform	67-66-3	0.5	mg/kg		<0.5	----	<0.5	----	----
EP075A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		<0.5	----	<0.5	----	----
2-Methylphenol	95-48-7	0.5	mg/kg		<0.5	----	<0.5	----	----
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg		<0.5	----	<0.5	----	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg		<0.5	----	<0.5	----	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg		<0.5	----	<0.5	----	----
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg		<0.5	----	<0.5	----	----
Pentachlorophenol	87-86-5	1	mg/kg		<1	----	<1	----	----
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	----	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	----	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	----	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	----	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	----	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	----	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	----	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	----	<0.5	----	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg		<1	----	<1	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	----	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	----	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	----	<0.5	----	----
^ Sum of PAHs	----	0.5	mg/kg		<0.5	----	<0.5	----	----
EP075C: Phthalate Esters									
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg		<5.0	----	<5.0	----	----
EP075E: Nitroaromatics and Ketones									
Nitrobenzene	98-95-3	0.5	mg/kg		<0.5	----	<0.5	----	----
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg		<1.0	----	<1.0	----	----
Pentachloronitrobenzene	82-68-8	0.5	mg/kg		<0.5	----	<0.5	----	----
EP075G: Chlorinated Hydrocarbons									

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_2.39-2.51	BH4B_6.40-6.52	BH4B_22.05-22.30	BH4B_39.74-39.91	BH4B_71.0-71.20
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-002	ES2230654-004	ES2230654-006	ES2230654-010
					Result	Result	Result	Result	Result
EP075G: Chlorinated Hydrocarbons - Continued									
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg		<0.5	----	<0.5	----	----
Pentachlorobenzene	608-93-5	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2.3.4-Tetrachlorobenzene	634-66-2	0.5	mg/kg		<1.5	----	<1.5	----	----
EP075K: Miscellaneous Compounds									
1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg		<0.5	----	<0.5	----	----
2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg		<0.5	----	<0.5	----	----
Isodrin	465-73-6	0.5	mg/kg		<0.5	----	<0.5	----	----
Di (2-ethylhexyl) adipate	103-23-1	0.5	mg/kg		<0.5	----	<0.5	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	----	<10	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	----	<10	----	----
EP132A: Phenolic Compounds									
Hexachlorophene	70-30-4	0.01	mg/kg		<0.01	----	<0.01	----	----
EP202A: Phenoxyacetic Acid Herbicides by LCMS									
2.4-D	94-75-7	0.02	mg/kg		<0.02	----	<0.02	----	----
Triclopyr	55335-06-3	0.02	mg/kg		<0.02	----	<0.02	----	----
2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg		<0.02	----	<0.02	----	----
2.4.5-T	93-76-5	0.02	mg/kg		<0.02	----	<0.02	----	----
Picloram	1918-02-1	0.02	mg/kg		<0.02	----	<0.02	----	----
Fluroxypyr	69377-81-7	0.02	mg/kg		<0.02	----	<0.02	----	----
NSW-CWG: Aggregate Organics for Guideline Evaluation									
^ øSum of Endosulfans (inc. sulfate)	----	0.05	mg/kg		<0.05	----	<0.05	----	----
ø Sum of Scheduled Chemicals	----	0.05	mg/kg		<10.0	----	<10.0	----	----
^ øSum of plasticisers	----	0.50	mg/kg		<5.00	----	<5.00	----	----
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		**82.8**	----	**77.2**	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**113**	----	**101**	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**89.7**	----	**73.2**	----	----

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_2.39-2.51	BH4B_6.40-6.52	BH4B_22.05-22.30	BH4B_39.74-39.91	BH4B_71.0-71.20
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-002	ES2230654-004	ES2230654-006	ES2230654-010
					Result	Result	Result	Result	Result
EP074S(SIM) : VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		104	----	106	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		108	----	105	----	----
Toluene-D8	2037-26-5	0.5	%		113	----	103	----	----
4-Bromofluorobenzene	460-00-4	0.5	%		118	----	108	----	----
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	0.5	%		84.5	----	78.5	----	----
Phenol-d6	13127-88-3	0.5	%		70.7	----	62.4	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		79.5	----	74.6	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		66.6	----	67.8	----	----
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	0.5	%		85.9	----	82.1	----	----
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%		78.4	----	80.2	----	----
2-Fluorobiphenyl	321-60-8	0.5	%		86.6	----	78.7	----	----
Anthracene-d10	1719-06-8	0.5	%		82.8	----	85.2	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		80.3	----	79.6	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		110	----	107	----	----
Toluene-D8	2037-26-5	0.2	%		112	----	102	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		121	----	111	----	----
EP202S: Phenoxyacetic Acid Herbicide Surrogate									
2.4-Dichlorophenyl Acetic Acid	19719-28-9	0.02	%		91.6	----	90.0	----	----

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Sample ID	BH4B_126.27-126.37	BH4B_148.17-148.36	BH4B_388.0-388.13	BH4B_419.0-419.14	----
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit	ES2230654-014	ES2230654-015	ES2230654-021	ES2230654-022	--------
				Result	Result	Result	Result	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	----	9.3	----	9.4	----
pH (Fox)	----	0.1	pH Unit	----	3.0	----	5.3	----
Reaction Rate	----	1	Reaction Unit	----	2	----	2	----
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	----	10.8	----	6.7	----
NAG (pH 4.5)	----	0.1	kg H2SO4/t	----	<0.1	----	<0.1	----
NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	<0.1	----	1.9	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	----	59.0	----	7.2	----
ANC as CaCO3	----	0.1	% CaCO3	----	6.0	----	0.7	----
Fizz Rating	----	0	Fizz Unit	----	2	----	0	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	<1.0	----	<1.0	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	----	0.91	----	<0.01	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	<5	----	----
Beryllium	7440-41-7	1	mg/kg	<1	----	<1	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	<1	----	----
Lead	7439-92-1	5	mg/kg	<5	----	<5	----	----
Molybdenum	7439-98-7	2	mg/kg	<2	----	<2	----	----
Nickel	7440-02-0	2	mg/kg	<2	----	2	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	<5	----	----
Silver	7440-22-4	2	mg/kg	<2	----	<2	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	<0.1	----	----
EG048: Hexavalent Chromium (Alkaline Digest)								
Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	----	<0.5	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	----	<1	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser								
Weak Acid Dissociable Cyanide	----	1	mg/kg	<1	----	<1	----	----
EK040T: Fluoride Total								

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Sample ID	BH4B_126.27-126.37	BH4B_148.17-148.36	BH4B_388.0-388.13	BH4B_419.0-419.14	----
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit	ES2230654-014	ES2230654-015	ES2230654-021	ES2230654-022	--------
				Result	Result	Result	Result	----
EK040T: Fluoride Total - Continued								
Fluoride	16984-48-8	40	mg/kg	**490**	----	**360**	----	----
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)								
Final pH	----	0.1	pH Unit	**9.4**	----	**9.3**	----	----
EN60Z: ASLP Leachate - ZHE								
Extraction Fluid pH	----	0.1	pH Unit	**9.4**	----	**9.3**	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	----	<0.02	----	<0.02	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	<0.05	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	<0.05	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	<0.2	----	----
EP068B: Organophosphorus Pesticides (OP)								
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	<0.05	----	----
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup								
>C10 - C16 Fraction	----	50	mg/kg	<50	----	<50	----	----

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_126.27-126.37	BH4B_148.17-148.36	BH4B_388.0-388.13	BH4B_419.0-419.14	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-014	ES2230654-015	ES2230654-021	ES2230654-022	--------
					Result	Result	Result	Result	----
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup - Continued									
>C16 - C34 Fraction	----	100	mg/kg		<100	----	<100	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	----	<100	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	----	<50	----	----
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup									
C10 - C14 Fraction	----	50	mg/kg		<50	----	<50	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	----	<100	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	----	<100	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	----	<50	----	----
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	<0.2	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	<0.5	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Styrene	100-42-5	0.5	mg/kg		<0.5	----	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	<0.5	----	----
EP074B: Oxygenated Compounds									
2-Butanone (MEK)	78-93-3	5	mg/kg		<5	----	<5	----	----
EP074E(SIM): Halogenated Aliphatic Compounds									
Vinyl chloride	75-01-4	0.2	mg/kg		<0.2	----	<0.2	----	----
EP074E: Halogenated Aliphatic Compounds									
Vinyl chloride	75-01-4	4	mg/kg		<4	----	<4	----	----
1.1-Dichloroethene	75-35-4	0.5	mg/kg		<0.5	----	<0.5	----	----
Methylene chloride	75-09-2	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.1-Trichloroethane	71-55-6	0.5	mg/kg		<0.5	----	<0.5	----	----
Carbon Tetrachloride	56-23-5	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2-Dichloroethane	107-06-2	0.5	mg/kg		<0.5	----	<0.5	----	----
Trichloroethene	79-01-6	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.2-Trichloroethane	79-00-5	0.5	mg/kg		<0.5	----	<0.5	----	----
Tetrachloroethene	127-18-4	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg		<0.5	----	<0.5	----	----
1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg		<0.5	----	<0.5	----	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	0.5	mg/kg		<0.5	----	<0.5	----	----
EP074G: Trihalomethanes									

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_126.27-126.37	BH4B_148.17-148.36	BH4B_388.0-388.13	BH4B_419.0-419.14	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-014	ES2230654-015	ES2230654-021	ES2230654-022	--------
					Result	Result	Result	Result	----
EP074G: Trihalomethanes - Continued									
Chloroform	67-66-3	0.5	mg/kg		<0.5	----	<0.5	----	----
EP075A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		<0.5	----	<0.5	----	----
2-Methylphenol	95-48-7	0.5	mg/kg		<0.5	----	<0.5	----	----
3- & 4-Methylphenol	1319-77-3	0.5	mg/kg		<0.5	----	<0.5	----	----
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg		<0.5	----	<0.5	----	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg		<0.5	----	<0.5	----	----
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg		<0.5	----	<0.5	----	----
Pentachlorophenol	87-86-5	1	mg/kg		<1	----	<1	----	----
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	----	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	----	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	----	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	----	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	----	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	----	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	----	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	----	<0.5	----	----
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg		<1	----	<1	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	----	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	----	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	----	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	----	<0.5	----	----
^ Sum of PAHs	----	0.5	mg/kg		<0.5	----	<0.5	----	----
EP075C: Phthalate Esters									
bis(2-ethylhexyl) phthalate	117-81-7	5.0	mg/kg		<5.0	----	<5.0	----	----
EP075E: Nitroaromatics and Ketones									
Nitrobenzene	98-95-3	0.5	mg/kg		<0.5	----	<0.5	----	----
2.4-Dinitrotoluene	121-14-2	1.0	mg/kg		<1.0	----	<1.0	----	----
Pentachloronitrobenzene	82-68-8	0.5	mg/kg		<0.5	----	<0.5	----	----
EP075G: Chlorinated Hydrocarbons									

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_126.27-126.37	BH4B_148.17-148.36	BH4B_388.0-388.13	BH4B_419.0-419.14	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-014	ES2230654-015	ES2230654-021	ES2230654-022	--------
					Result	Result	Result	Result	----
EP075G: Chlorinated Hydrocarbons - Continued									
1.4-Dichlorobenzene	106-46-7	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2-Dichlorobenzene	95-50-1	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg		<0.5	----	<0.5	----	----
Pentachlorobenzene	608-93-5	0.5	mg/kg		<0.5	----	<0.5	----	----
1.2.3.4-Tetrachlorobenzene	634-66-2	0.5	mg/kg		<1.5	----	<1.5	----	----
EP075K: Miscellaneous Compounds									
1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg		<0.5	----	<0.5	----	----
2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg		<0.5	----	<0.5	----	----
Isodrin	465-73-6	0.5	mg/kg		<0.5	----	<0.5	----	----
Di (2-ethylhexyl) adipate	103-23-1	0.5	mg/kg		<0.5	----	<0.5	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	----	<10	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	----	<10	----	----
EP132A: Phenolic Compounds									
Hexachlorophene	70-30-4	0.01	mg/kg		<0.01	----	<0.01	----	----
EP202A: Phenoxyacetic Acid Herbicides by LCMS									
2.4-D	94-75-7	0.02	mg/kg		<0.02	----	<0.02	----	----
Triclopyr	55335-06-3	0.02	mg/kg		<0.02	----	<0.02	----	----
2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg		<0.02	----	<0.02	----	----
2.4.5-T	93-76-5	0.02	mg/kg		<0.02	----	<0.02	----	----
Picloram	1918-02-1	0.02	mg/kg		<0.02	----	<0.02	----	----
Fluroxypyr	69377-81-7	0.02	mg/kg		<0.02	----	<0.02	----	----
NSW-CWG: Aggregate Organics for Guideline Evaluation									
^ øSum of Endosulfans (inc. sulfate)	----	0.05	mg/kg		<0.05	----	<0.05	----	----
ø Sum of Scheduled Chemicals	----	0.05	mg/kg		<10.0	----	<10.0	----	----
^ øSum of plasticisers	----	0.50	mg/kg		<5.00	----	<5.00	----	----
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		**85.3**	----	**94.8**	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**95.6**	----	**103**	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**71.6**	----	**66.8**	----	----

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)				Sample ID	BH4B_126.27-126.37	BH4B_148.17-148.36	BH4B_388.0-388.13	BH4B_419.0-419.14	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-014	ES2230654-015	ES2230654-021	ES2230654-022	--------
					Result	Result	Result	Result	----
EP074S(SIM) : VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		103	----	112	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		111	----	106	----	----
Toluene-D8	2037-26-5	0.5	%		114	----	101	----	----
4-Bromofluorobenzene	460-00-4	0.5	%		116	----	101	----	----
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	0.5	%		87.4	----	78.3	----	----
Phenol-d6	13127-88-3	0.5	%		71.4	----	60.8	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		81.9	----	80.0	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		66.5	----	64.6	----	----
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	0.5	%		87.3	----	79.0	----	----
1.2-Dichlorobenzene-D4	2199-69-1	0.5	%		81.0	----	77.5	----	----
2-Fluorobiphenyl	321-60-8	0.5	%		91.8	----	83.4	----	----
Anthracene-d10	1719-06-8	0.5	%		84.9	----	83.8	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		79.0	----	74.8	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		113	----	106	----	----
Toluene-D8	2037-26-5	0.2	%		112	----	100	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		118	----	103	----	----
EP202S: Phenoxyacetic Acid Herbicide Surrogate									
2.4-Dichlorophenyl Acetic Acid	19719-28-9	0.02	%		97.6	----	81.4	----	----

Analytical Results

Sub-Matrix: ZHE LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	**0.024**	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser									
Weak Acid Dissociable Cyanide	----	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	----
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	----
Styrene	100-42-5	5	µg/L		<5	<5	<5	<5	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	----
Isopropylbenzene	98-82-8	5	µg/L		<5	<5	<5	<5	----
n-Propylbenzene	103-65-1	5	µg/L		<5	<5	<5	<5	----
1.3.5-Trimethylbenzene	108-67-8	5	µg/L		<5	<5	<5	<5	----
sec-Butylbenzene	135-98-8	5	µg/L		<5	<5	<5	<5	----
1.2.4-Trimethylbenzene	95-63-6	5	µg/L		<5	<5	<5	<5	----
tert-Butylbenzene	98-06-6	5	µg/L		<5	<5	<5	<5	----
p-Isopropyltoluene	99-87-6	5	µg/L		<5	<5	<5	<5	----
n-Butylbenzene	104-51-8	5	µg/L		<5	<5	<5	<5	----
EP074B: Oxygenated Compounds									
2-Propanone (Acetone)	67-64-1	50	µg/L		<50	<50	<50	<50	----
Vinyl Acetate	108-05-4	50	µg/L		<50	<50	<50	<50	----
2-Butanone (MEK)	78-93-3	50	µg/L		<50	<50	<50	<50	----
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L		<50	<50	<50	<50	----
2-Hexanone (MBK)	591-78-6	50	µg/L		<50	<50	<50	<50	----
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L		<5	<5	<5	<5	----
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5	<5	<5	----
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5	<5	<5	----
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5	<5	<5	----
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	<5	<5	----
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	<5	<5	----
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	<50	<50	----

Analytical Results

Sub-Matrix: ZHE LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP074E: Halogenated Aliphatic Compounds - Continued									
Chloromethane	74-87-3	50	µg/L		<50	<50	<50	<50	----
Vinyl chloride	75-01-4	50	µg/L		<50	<50	<50	<50	----
Bromomethane	74-83-9	50	µg/L		<50	<50	<50	<50	----
Chloroethane	75-00-3	50	µg/L		<50	<50	<50	<50	----
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	<50	<50	----
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5	<5	<5	----
Iodomethane	74-88-4	5	µg/L		<5	<5	<5	<5	----
Methylene chloride	75-09-2	5	µg/L		<5	<5	<5	<5	----
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5	<5	<5	----
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5	<5	<5	----
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5	<5	<5	----
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5	<5	<5	----
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	<5	<5	----
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	<5	<5	----
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5	<5	<5	----
Trichloroethene	79-01-6	5	µg/L		<5	<5	<5	<5	----
Dibromomethane	74-95-3	5	µg/L		<5	<5	<5	<5	----
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5	<5	<5	----
1.3-Dichloropropane	142-28-9	5	µg/L		<5	<5	<5	<5	----
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	<5	<5	----
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	<5	<5	----
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	<5	<5	----
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	<5	<5	----
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	<5	<5	----
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	<5	<5	<5	----
Pentachloroethane	76-01-7	5	µg/L		<5	<5	<5	<5	----
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	<5	<5	----
Hexachlorobutadiene	87-68-3	5	µg/L		<5	<5	<5	<5	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	<5	<5	----
Bromobenzene	108-86-1	5	µg/L		<5	<5	<5	<5	----
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5	<5	<5	----
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5	<5	<5	----
1.3-Dichlorobenzene	541-73-1	5	µg/L		<5	<5	<5	<5	----
1.4-Dichlorobenzene	106-46-7	5	µg/L		<5	<5	<5	<5	----

Analytical Results

Sub-Matrix: ZHE LEACHATE (Matrix: WATER)				Sample ID	BH4B_2.39-2.51	BH4B_22.05-22.30	BH4B_126.27-126.37	BH4B_388.0-388.13	----
				Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2230654-001	ES2230654-004	ES2230654-014	ES2230654-021	--------
					Result	Result	Result	Result	----
EP074F: Halogenated Aromatic Compounds - Continued									
1.2-Dichlorobenzene	95-50-1	5	µg/L		<5	<5	<5	<5	----
1.2.4-Trichlorobenzene	120-82-1	5	µg/L		<5	<5	<5	<5	----
1.2.3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5	<5	<5	----
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5	<5	<5	----
Bromodichloromethane	75-27-4	5	µg/L		<5	<5	<5	<5	----
Dibromochloromethane	124-48-1	5	µg/L		<5	<5	<5	<5	----
Bromoform	75-25-2	5	µg/L		<5	<5	<5	<5	----
EP074H: Naphthalene									
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	5	%		**97.0**	**88.0**	**103**	**104**	----
Toluene-D8	2037-26-5	5	%		**99.8**	**90.0**	**106**	**106**	----
4-Bromofluorobenzene	460-00-4	5	%		**90.7**	**82.2**	**97.1**	**95.6**	----

Surrogate Control Limits

Sub-Matrix: DI WATER LEACHATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	67	111
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	67	111
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	10	117
Phenol-d6	13127-88-3	10	69
2-Chlorophenol-D4	93951-73-6	21	130
2.4.6-Tribromophenol	118-79-6	10	151
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	29	142
1.2-Dichlorobenzene-D4	2199-69-1	24	121
2-Fluorobiphenyl	321-60-8	27	135
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	21	123

Sub-Matrix: ROCK		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP074S(SIM) : VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	131
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	64	130
Toluene-D8	2037-26-5	66	136
4-Bromofluorobenzene	460-00-4	60	122
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	29	149
Phenol-d6	13127-88-3	32	128
2-Chlorophenol-D4	93951-73-6	32	128
2.4.6-Tribromophenol	118-79-6	13	121
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	33	125
1.2-Dichlorobenzene-D4	2199-69-1	34	108
2-Fluorobiphenyl	321-60-8	35	121

Sub-Matrix: ROCK		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075T: Base/Neutral Extractable Surrogates - Continued			
Anthracene-d10	1719-06-8	35	123
4-Terphenyl-d14	1718-51-0	33	125
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP202S: Phenoxyacetic Acid Herbicide Surrogate			
2.4-Dichlorophenyl Acetic Acid	19719-28-9	45	139

Sub-Matrix: ZHE LEACHATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	78	133
Toluene-D8	2037-26-5	79	129
4-Bromofluorobenzene	460-00-4	81	124

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EA013: Acid Neutralising Capacity

(SOIL) EA003 :pH (field/fox)

(SOIL) ED042T: Total Sulfur by LECO

(SOIL) EA011: Net Acid Generation

(SOIL) EP003: Total Organic Carbon (TOC) in Soil

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EK040T: Fluoride Total

QUALITY CONTROL REPORT

Work Order	: **ES2230654**	Page	: 1 of 27
Amendment	: **(Preliminary Report)**		
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 26-Aug-2022
Order number	: J200096	Date Analysis Commenced	: 26-Sep-2022
C-O-C number	: ----	Issue Date	: 11-Oct-2022
Sampler	: KB		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 22		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
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Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4621224)									
ES2230654-001	BH4B_2.39-2.51	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	3	<2	53.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	6	<5	25.1	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
ES2234814-011	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	29	28	0.0	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
EA003 :pH (field/fox) (QC Lot: 4612025)									
EM2217957-001	Anonymous	EA003: pH (F)	----	0.1	pH Unit	6.8	6.8	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.4	3.5	0.0	0% - 20%
EM2218038-001	Anonymous	EA003: pH (F)	----	0.1	pH Unit	5.8	5.8	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	2.9	2.9	0.0	0% - 20%
EA003 :pH (field/fox) (QC Lot: 4612026)									
ES2230654-022	BH4B_419.0-419.14	EA003: pH (F)	----	0.1	pH Unit	9.4	9.4	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	5.3	5.4	0.0	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA011: Net Acid Generation (QC Lot: 4621904)									
EM2218112-001	Anonymous	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	4.0	3.8	5.5	0% - 20%
		EA011: pH (OX)	----	0.1	pH Unit	6.2	6.2	0.0	0% - 20%
ES2230654-022	BH4B_419.0-419.14	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	1.9	1.6	18.0	0% - 50%
		EA011: pH (OX)	----	0.1	pH Unit	6.7	6.7	0.0	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 4621905)									
EM2218112-001	Anonymous	EA013: ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	3.8	4.0	7.4	No Limit
ES2230654-022	BH4B_419.0-419.14	EA013: ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	7.2	7.1	0.0	0% - 50%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4600771)									
ES2230654-014	BH4B_126.27-126.37	EA055: Moisture Content	----	0.1	%	<1.0	<1.0	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 4617862)									
ES2230654-002	BH4B_6.40-6.52	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.03	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4621223)									
ES2230654-001	BH4B_2.39-2.51	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES2234814-011	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 4610058)									
ES2230654-004	BH4B_22.05-22.30	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
ES2234636-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 4600770)									
ES2230654-001	BH4B_2.39-2.51	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.0	No Limit
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QC Lot: 4600769)									
ES2230654-001	BH4B_2.39-2.51	EK028SF: Weak Acid Dissociable Cyanide	----	1	mg/kg	<1	<1	0.0	No Limit
EK040T: Fluoride Total (QC Lot: 4601823)									
ES2230654-001	BH4B_2.39-2.51	EK040T: Fluoride	16984-48-8	40	mg/kg	500	520	3.7	0% - 50%
ES2233994-007	Anonymous	EK040T: Fluoride	16984-48-8	40	mg/kg	50	50	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 4617861)									
EB2227789-010	Anonymous	EP003: Total Organic Carbon	----	0.02	%	0.36	0.35	0.0	0% - 50%
EP2212387-001	Anonymous	EP003: Total Organic Carbon	----	0.02	%	2.48	2.44	1.4	0% - 20%
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 4597635)									
ES2230654-001	BH4B_2.39-2.51	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 4597633)									
ES2230654-001	BH4B_2.39-2.51	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 4597633) - continued									
ES2230654-001	BH4B_2.39-2.51	EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 4597633)									
ES2230654-001	BH4B_2.39-2.51	EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QC Lot: 4597634)									
ES2230654-001	BH4B_2.39-2.51	EP071SG-S: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
		EP071SG-S: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	0.0	No Limit
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QC Lot: 4597634)									
ES2230654-001	BH4B_2.39-2.51	EP071SG-S: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071SG-S: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 4605667)									
ES2234505-001	Anonymous	EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 4605667)									
ES2234505-001	Anonymous	EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	<5	0.0	No Limit
EP074E(SIM): Halogenated Aliphatic Compounds (QC Lot: 4605666)									
ES2234505-001	Anonymous	EP074E(SIM): Vinyl chloride	75-01-4	0.2	mg/kg	<0.4	<0.4	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 4605667)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 4605667) - continued									
ES2234505-001	Anonymous	EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Methylene chloride	75-09-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	<5	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 4605667)									
ES2234505-001	Anonymous	EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 4605667)									
ES2234505-001	Anonymous	EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075A: Phenolic Compounds (QC Lot: 4597632)									
ES2230654-001	BH4B_2.39-2.51	EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	<1	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4597632)									
ES2230654-001	BH4B_2.39-2.51	EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4597632) - continued									
ES2230654-001	BH4B_2.39-2.51	EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	<1	0.0	No Limit
EP075E: Nitroaromatics and Ketones (QC Lot: 4597632)									
ES2230654-001	BH4B_2.39-2.51	EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075G: Chlorinated Hydrocarbons (QC Lot: 4597632)									
ES2230654-001	BH4B_2.39-2.51	EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075K: Miscellaneous Compounds (QC Lot: 4597632)									
ES2230654-001	BH4B_2.39-2.51	EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4605665)									
ES2234505-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4605665)									
ES2234505-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP132A: Phenolic Compounds (QC Lot: 4597586)									
ES2230654-004	BH4B_22.05-22.30	EP132: Hexachlorophene	70-30-4	10	µg/kg	<0.01 mg/kg	<10	0.0	No Limit
EP202A: Phenoxyacetic Acid Herbicides by LCMS (QC Lot: 4604346)									
EB2227467-015	Anonymous	EP202: 2.4-D	94-75-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Triclopyr	55335-06-3	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: 2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: 2.4.5-T	93-76-5	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Picloram	1918-02-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Fluroxypyr	69377-81-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
ES2230654-021	BH4B_388.0-388.13	EP202: 2.4-D	94-75-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Triclopyr	55335-06-3	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: 2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: 2.4.5-T	93-76-5	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Picloram	1918-02-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP202: Fluroxypyr	69377-81-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)C: Leachable Metals by ICPAES (QC Lot: 4605788)									
ES2230654-001	BH4B_2.39-2.51	EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG005(ED093)C: Leachable Metals by ICPAES (QC Lot: 4605788) - continued									
ES2230654-001	BH4B_2.39-2.51	EG005C: Aluminium	7429-90-5	0.1	mg/L	4.1	4.1	0.0	0% - 20%
		EG005C: Antimony	7440-36-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Iron	7439-89-6	0.1	mg/L	2.6	2.7	0.0	0% - 20%
		EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Manganese	7439-96-5	0.1	mg/L	0.1	0.1	0.0	No Limit
		EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Silver	7440-22-4	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Molybdenum	7439-98-7	0.1	mg/L	<0.1	<0.1	0.0	No Limit
ES2232715-006	Anonymous	EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG005C: Aluminium	7429-90-5	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Antimony	7440-36-0	0.1	mg/L	0.2	0.2	0.0	No Limit
		EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Boron	7440-42-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Iron	7439-89-6	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Manganese	7439-96-5	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Silver	7440-22-4	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Molybdenum	7439-98-7	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EA005P: pH by PC Titrator (QC Lot: 4606370)									
ES2233838-006	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.92	6.91	0.1	0% - 20%
ES2230654-001	BH4B_2.39-2.51	EA005-P: pH Value	----	0.01	pH Unit	7.21	7.07	2.0	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 4606371)									
ES2233838-006	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	917	917	0.0	0% - 20%
ES2234452-008	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	158	157	0.0	0% - 20%
ES2230654-001	BH4B_2.39-2.51	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	19	18	5.4	0% - 50%
ED037P: Alkalinity by PC Titrator (QC Lot: 4606372)									
ES2233838-006	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	90	90	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	90	90	0.0	0% - 20%
ES2230654-001	BH4B_2.39-2.51	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	7	7	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED037P: Alkalinity by PC Titrator (QC Lot: 4606372) - continued									
ES2230654-001	BH4B_2.39-2.51	ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	7	7	0.0	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4608256)									
ES2234575-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1	1	0.0	No Limit
ES2230654-001	BH4B_2.39-2.51	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 4608257)									
ES2230654-004	BH4B_22.05-22.30	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
ES2230654-001	BH4B_2.39-2.51	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
EG035C: Leachable Mercury by FIMS (QC Lot: 4614888)									
ES2230654-001	BH4B_2.39-2.51	EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0010	<0.0010	0.0	No Limit
ES2234907-007	Anonymous	EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0010	<0.0010	0.0	No Limit
EG050G: Hexavalent Chromium by Discrete Analyser (QC Lot: 4610168)									
ES2230654-001	BH4B_2.39-2.51	EG050G-C: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.10	<0.10	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 4610715)									
ES2230654-001	BH4B_2.39-2.51	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QC Lot: 4610714)									
ES2230654-001	BH4B_2.39-2.51	EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4606373)									
ES2230654-001	BH4B_2.39-2.51	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP074: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP074: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
ES2234420-007	Anonymous	EP074: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP074: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP074: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 4619697) - continued									
ES2234420-007	Anonymous	EP074: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: 2-Propanone (Acetone)	67-64-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
ES2234420-007	Anonymous	EP074: 2-Propanone (Acetone)	67-64-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
ES2234420-007	Anonymous	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
EP074D: Fumigants (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
ES2234420-007	Anonymous	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Methylene chloride	75-09-2	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 4619697) - continued									
ES2234420-001	Anonymous	EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
ES2234420-007	Anonymous	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Methylene chloride	75-09-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 4619697) - continued									
ES2234420-007	Anonymous	EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
ES2234420-007	Anonymous	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
ES2234420-007	Anonymous	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP074G: Trihalomethanes (QC Lot: 4619697) - continued									
ES2234420-007	Anonymous	EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
EP074H: Naphthalene (QC Lot: 4619697)									
ES2234420-001	Anonymous	EP074: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2234420-007	Anonymous	EP074: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4621224)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	96.1	88.0	113
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	0.5 mg/kg	109	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	99.2	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	60.8 mg/kg	98.0	82.0	119
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	2.3 mg/kg	110	77.0	119
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.3 mg/kg	98.3	80.0	120
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.3 mg/kg	108	42.0	158
EA011: Net Acid Generation (QCLot: 4621904)								
EA011: NAG (pH 7.0)	----	----	kg H2SO4/t	----	22.83 kg H2SO4/t	111	70.0	130
EA013: Acid Neutralising Capacity (QCLot: 4621905)								
EA013: ANC as H2SO4	----	----	kg H2SO4 equiv./t	----	9.9 kg H2SO4 equiv./t	108	82.0	120
ED042T: Total Sulfur by LECO (QCLot: 4617862)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.16 %	101	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4621223)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	109	70.0	125
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 4610058)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	20 mg/kg	102	68.0	114
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4600770)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	96.1	81.0	129
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4600769)								
EK028SF: Weak Acid Dissociable Cyanide	----	1	mg/kg	<1	40 mg/kg	101	70.0	130
EK040T: Fluoride Total (QCLot: 4601823)								
EK040T: Fluoride	16984-48-8	40	mg/kg	<40	400 mg/kg	73.8	67.2	96.3
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 4617861)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.55 %	99.4	80.0	120
				<0.02	27.5 %	98.7	80.0	120
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 4597635)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	82.3	62.0	126
EP068A: Organochlorine Pesticides (OC) (QCLot: 4597633)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	84.6	69.0	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	84.7	65.0	117
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	85.9	67.0	119

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 4597633) - continued								
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	86.8	68.0	116
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	80.9	65.0	117
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	84.5	67.0	115
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	85.0	69.0	115
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	87.7	62.0	118
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	84.9	63.0	117
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	87.5	66.0	116
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	85.4	64.0	116
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	82.7	66.0	116
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	82.5	67.0	115
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.1	67.0	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	84.7	69.0	115
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	88.3	69.0	121
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	88.6	56.0	120
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	89.5	62.0	124
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	94.0	66.0	120
EP068B: Organophosphorus Pesticides (OP) (QCLot: 4597633)								
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	83.8	76.0	118
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QCLot: 4597634)								
EP071SG-S: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	96.5	80.0	116
EP071SG-S: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	101	85.0	115
EP071SG-S: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	98.0	75.0	123
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QCLot: 4597634)								
EP071SG-S: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	99.3	89.0	109
EP071SG-S: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	96.2	84.0	112
EP071SG-S: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	100	71.0	119
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4605667)								
EP074: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	94.4	71.0	121
EP074: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	98.1	65.0	131
EP074: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	98.8	72.0	114
EP074: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	99.5	70.0	116
EP074: Styrene	100-42-5	0.5	mg/kg	<0.5	1 mg/kg	102	67.0	113
EP074: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	102	75.0	115
EP074B: Oxygenated Compounds (QCLot: 4605667)								
EP074: 2-Butanone (MEK)	78-93-3	5	mg/kg	<5	10 mg/kg	127	58.0	136
EP074E(SIM): Halogenated Aliphatic Compounds (QCLot: 4605666)								
EP074E(SIM): Vinyl chloride	75-01-4	0.2	mg/kg	<0.2	1 mg/kg	95.0	73.0	124

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 4605667)								
EP074: Vinyl chloride	75-01-4	5	mg/kg	<5	10 mg/kg	87.4	43.0	147
EP074: 1.1-Dichloroethene	75-35-4	0.5	mg/kg	<0.5	1 mg/kg	96.0	54.0	126
EP074: Methylene chloride	75-09-2	0.5	mg/kg	<0.5	1 mg/kg	108	58.0	148
EP074: 1.1.1-Trichloroethane	71-55-6	0.5	mg/kg	<0.5	1 mg/kg	97.0	65.0	117
EP074: Carbon Tetrachloride	56-23-5	0.5	mg/kg	<0.5	1 mg/kg	90.2	59.0	125
EP074: 1.2-Dichloroethane	107-06-2	0.5	mg/kg	<0.5	1 mg/kg	107	65.0	125
EP074: Trichloroethene	79-01-6	0.5	mg/kg	<0.5	1 mg/kg	95.7	70.0	118
EP074: 1.1.2-Trichloroethane	79-00-5	0.5	mg/kg	<0.5	1 mg/kg	108	64.0	126
EP074: Tetrachloroethene	127-18-4	0.5	mg/kg	<0.5	1 mg/kg	82.4	67.0	143
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	0.5	mg/kg	<0.5	1 mg/kg	99.4	62.0	122
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	mg/kg	<0.5	1 mg/kg	118	65.0	121
EP074F: Halogenated Aromatic Compounds (QCLot: 4605667)								
EP074: Chlorobenzene	108-90-7	0.5	mg/kg	<0.5	1 mg/kg	100	68.0	116
EP074G: Trihalomethanes (QCLot: 4605667)								
EP074: Chloroform	67-66-3	0.5	mg/kg	<0.5	1 mg/kg	103	66.0	124
EP075A: Phenolic Compounds (QCLot: 4597632)								
EP075: Phenol	108-95-2	0.5	mg/kg	<0.5	1.5 mg/kg	93.8	64.0	114
EP075: 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	1.5 mg/kg	95.0	55.0	117
EP075: 3- & 4-Methylphenol	1319-77-3	0.5	mg/kg	<0.5	1.5 mg/kg	97.1	46.0	122
EP075: 4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	1.5 mg/kg	99.0	57.0	113
EP075: 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	1.5 mg/kg	88.9	49.0	109
EP075: 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	1.5 mg/kg	86.3	49.0	107
EP075: Pentachlorophenol	87-86-5	1	mg/kg	<1	3 mg/kg	52.1	12.0	76.0
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4597632)								
EP075: Naphthalene	91-20-3	0.5	mg/kg	<0.5	1.5 mg/kg	88.8	62.0	118
EP075: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	1.5 mg/kg	95.0	56.0	114
EP075: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	1.5 mg/kg	87.0	62.0	112
EP075: Fluorene	86-73-7	0.5	mg/kg	<0.5	1.5 mg/kg	91.7	59.0	115
EP075: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5 mg/kg	89.2	63.0	113
EP075: Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	89.7	57.0	111
EP075: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	1.5 mg/kg	90.2	58.0	114
EP075: Pyrene	129-00-0	0.5	mg/kg	<0.5	1.5 mg/kg	93.6	57.0	117
EP075: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	1.5 mg/kg	92.7	59.0	115
EP075: Chrysene	218-01-9	0.5	mg/kg	<0.5	1.5 mg/kg	94.1	61.0	117
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1	3 mg/kg	86.0	57.0	119
EP075: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	1.5 mg/kg	83.8	56.0	116
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5 mg/kg	80.9	55.0	117

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4597632) - continued								
EP075: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	1.5 mg/kg	78.4	53.0	119
EP075: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	1.5 mg/kg	81.2	56.0	120
EP075C: Phthalate Esters (QCLot: 4597632)								
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	mg/kg	----	1.5 mg/kg	84.7	69.0	133
EP075E: Nitroaromatics and Ketones (QCLot: 4597632)								
EP075: Nitrobenzene	98-95-3	0.5	mg/kg	<0.5	1.5 mg/kg	95.4	65.0	119
EP075: 2.4-Dinitrotoluene	121-14-2	0.5	mg/kg	<0.5	1.5 mg/kg	89.2	59.0	115
EP075: Pentachloronitrobenzene	82-68-8	0.5	mg/kg	<0.5	1.5 mg/kg	86.9	56.0	110
EP075G: Chlorinated Hydrocarbons (QCLot: 4597632)								
EP075: 1.4-Dichlorobenzene	106-46-7	0.5	mg/kg	<0.5	1.5 mg/kg	88.6	58.0	116
EP075: 1.2-Dichlorobenzene	95-50-1	0.5	mg/kg	<0.5	1.5 mg/kg	92.1	57.0	115
EP075: 1.2.4-Trichlorobenzene	120-82-1	0.5	mg/kg	<0.5	1.5 mg/kg	90.6	62.9	108
EP075: Pentachlorobenzene	608-93-5	0.5	mg/kg	<0.5	1.5 mg/kg	89.6	57.0	109
EP075: 1.2.3.4-Tetrachlorobenzene	634-66-2	0.5	mg/kg	<1.5	----	----	----	----
EP075K: Miscellaneous Compounds (QCLot: 4597632)								
EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	0.5	mg/kg	<0.5	1.5 mg/kg	92.0	54.0	120
EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	0.5	mg/kg	<0.5	----	----	----	----
EP075: Isodrin	465-73-6	0.5	mg/kg	<0.5	----	----	----	----
EP075: Di (2-ethylhexyl) adipate	103-23-1	0.5	mg/kg	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4605665)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	109	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4605665)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	106	68.4	128
EP132A: Phenolic Compounds (QCLot: 4597586)								
EP132: Hexachlorophene	70-30-4	10	µg/kg	<10	100 µg/kg	18.2	15.6	94.0
EP202A: Phenoxyacetic Acid Herbicides by LCMS (QCLot: 4604346)								
EP202: 2.4-D	94-75-7	0.02	mg/kg	<0.02	0.1 mg/kg	95.0	68.5	131
EP202: Triclopyr	55335-06-3	0.02	mg/kg	<0.02	0.1 mg/kg	95.9	50.8	141
EP202: 2.4.5-TP (Silvex)	93-72-1	0.02	mg/kg	<0.02	0.1 mg/kg	94.1	40.8	126
EP202: 2.4.5-T	93-76-5	0.02	mg/kg	<0.02	0.1 mg/kg	94.3	57.4	139
EP202: Picloram	1918-02-1	0.02	mg/kg	<0.02	0.1 mg/kg	70.2	48.7	129
EP202: Fluroxypyr	69377-81-7	0.02	mg/kg	<0.02	0.1 mg/kg	90.0	53.2	128

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4605788)								
EG005C: Aluminium	7429-90-5	0.1	mg/L	<0.1	0.5 mg/L	100	80.0	122

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4605788) - continued								
EG005C: Antimony	7440-36-0	0.1	mg/L	<0.1	0.02 mg/L	120	70.0	130
EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	0.1 mg/L	97.0	80.0	124
EG005C: Beryllium	7440-41-7	0.05	mg/L	<0.05	0.1 mg/L	103	87.0	117
EG005C: Boron	7440-42-8	0.1	mg/L	<0.1	0.5 mg/L	110	80.0	130
EG005C: Cadmium	7440-43-9	0.05	mg/L	<0.05	0.1 mg/L	97.6	80.0	118
EG005C: Chromium	7440-47-3	0.1	mg/L	<0.1	0.1 mg/L	97.3	88.0	114
EG005C: Iron	7439-89-6	0.1	mg/L	<0.1	0.5 mg/L	100	83.0	123
EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	0.1 mg/L	92.9	80.0	118
EG005C: Manganese	7439-96-5	0.1	mg/L	<0.1	0.1 mg/L	96.6	81.0	111
EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	0.1 mg/L	94.6	83.0	115
EG005C: Selenium	7782-49-2	0.05	mg/L	<0.05	0.1 mg/L	94.1	77.0	125
EG005C: Silver	7440-22-4	0.1	mg/L	<0.1	----	----	----	----
EG005C: Molybdenum	7439-98-7	0.1	mg/L	<0.1	0.1 mg/L	108	86.0	122
EA005P: pH by PC Titrator (QCLot: 4606370)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.8	101
				----	7 pH Unit	100	99.2	101
EA010P: Conductivity by PC Titrator (QCLot: 4606371)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	97.1	89.9	110
				<1	2100 µS/cm	99.3	90.2	111
ED037P: Alkalinity by PC Titrator (QCLot: 4606372)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	109	81.0	111
				----	50 mg/L	113	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4608256)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	98.0	82.0	122
				<1	500 mg/L	99.5	82.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 4608257)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	96.4	80.9	127
				<1	1000 mg/L	95.4	80.9	127
EG035C: Leachable Mercury by FIMS (QCLot: 4614888)								
EG035C: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.7	79.0	109
EG050G: Hexavalent Chromium by Discrete Analyser (QCLot: 4610168)								
EG050G-C: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.05 mg/L	97.5	83.0	117
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4610715)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	93.8	73.0	133
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4610714)								
EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	105	93.0	127
EK040P: Fluoride by PC Titrator (QCLot: 4606373)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EK040P: Fluoride by PC Titrator (QCLot: 4606373) - continued								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	100	82.0	116
EP068A: Organochlorine Pesticides (OC) (QCLot: 4605552)								
EP068: alpha-BHC	319-84-6	0.5	µg/L	<0.5	5 µg/L	97.7	64.9	107
EP068: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L	<0.5	5 µg/L	79.1	58.3	111
EP068: beta-BHC	319-85-7	0.5	µg/L	<0.5	5 µg/L	103	69.0	117
EP068: gamma-BHC	58-89-9	0.5	µg/L	<0.5	5 µg/L	106	70.0	112
EP068: delta-BHC	319-86-8	0.5	µg/L	<0.5	5 µg/L	108	68.9	110
EP068: Heptachlor	76-44-8	0.5	µg/L	<0.5	5 µg/L	93.0	65.2	108
EP068: Aldrin	309-00-2	0.5	µg/L	<0.5	5 µg/L	91.4	65.8	109
EP068: Heptachlor epoxide	1024-57-3	0.5	µg/L	<0.5	5 µg/L	92.0	67.1	107
EP068: trans-Chlordane	5103-74-2	0.5	µg/L	<0.5	5 µg/L	89.5	64.1	110
EP068: alpha-Endosulfan	959-98-8	0.5	µg/L	<0.5	5 µg/L	98.2	66.7	112
EP068: cis-Chlordane	5103-71-9	0.5	µg/L	<0.5	5 µg/L	89.8	63.2	111
EP068: Dieldrin	60-57-1	0.5	µg/L	<0.5	5 µg/L	101	65.2	113
EP068: 4.4`-DDE	72-55-9	0.5	µg/L	<0.5	5 µg/L	98.0	66.0	112
EP068: Endrin	72-20-8	0.5	µg/L	<0.5	5 µg/L	98.3	65.2	113
EP068: beta-Endosulfan	33213-65-9	0.5	µg/L	<0.5	5 µg/L	99.4	67.3	114
EP068: 4.4`-DDD	72-54-8	0.5	µg/L	<0.5	5 µg/L	101	72.0	122
EP068: Endrin aldehyde	7421-93-4	0.5	µg/L	<0.5	5 µg/L	84.8	66.9	109
EP068: Endosulfan sulfate	1031-07-8	0.5	µg/L	<0.5	5 µg/L	94.6	65.2	112
EP068: 4.4`-DDT	50-29-3	2	µg/L	<2.0	5 µg/L	96.7	65.2	112
EP068: Endrin ketone	53494-70-5	0.5	µg/L	<0.5	5 µg/L	91.1	63.8	110
EP068: Methoxychlor	72-43-5	2	µg/L	<2.0	5 µg/L	96.4	61.1	114
EP068B: Organophosphorus Pesticides (OP) (QCLot: 4605552)								
EP068: Dichlorvos	62-73-7	0.5	µg/L	<0.5	5 µg/L	104	65.6	114
EP068: Demeton-S-methyl	919-86-8	0.5	µg/L	<0.5	5 µg/L	100	63.7	113
EP068: Monocrotophos	6923-22-4	2	µg/L	<2.0	5 µg/L	25.0	19.7	48.0
EP068: Dimethoate	60-51-5	0.5	µg/L	<0.5	5 µg/L	86.6	69.5	110
EP068: Diazinon	333-41-5	0.5	µg/L	<0.5	5 µg/L	97.1	71.1	110
EP068: Chlorpyrifos-methyl	5598-13-0	0.5	µg/L	<0.5	5 µg/L	102	77.0	119
EP068: Parathion-methyl	298-00-0	2	µg/L	<2.0	5 µg/L	106	70.0	124
EP068: Malathion	121-75-5	0.5	µg/L	<0.5	5 µg/L	104	68.4	116
EP068: Fenthion	55-38-9	0.5	µg/L	<0.5	5 µg/L	97.2	68.6	112
EP068: Chlorpyrifos	2921-88-2	0.5	µg/L	<0.5	5 µg/L	101	75.0	119
EP068: Parathion	56-38-2	2	µg/L	<2.0	5 µg/L	98.6	67.0	121
EP068: Pirimphos-ethyl	23505-41-1	0.5	µg/L	<0.5	5 µg/L	89.8	69.0	121
EP068: Chlorfenvinphos	470-90-6	0.5	µg/L	<0.5	5 µg/L	106	71.8	110
EP068: Bromophos-ethyl	4824-78-6	0.5	µg/L	<0.5	5 µg/L	93.0	67.5	112
EP068: Fenamiphos	22224-92-6	0.5	µg/L	<0.5	5 µg/L	105	64.1	116

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP068B: Organophosphorus Pesticides (OP) (QCLot: 4605552) - continued								
EP068: Prothiofos	34643-46-4	0.5	µg/L	<0.5	5 µg/L	96.8	67.8	114
EP068: Ethion	563-12-2	0.5	µg/L	<0.5	5 µg/L	107	74.0	120
EP068: Carbophenothion	786-19-6	0.5	µg/L	<0.5	5 µg/L	90.0	66.2	114
EP068: Azinphos Methyl	86-50-0	0.5	µg/L	<0.5	5 µg/L	98.9	51.6	128
EP068C: Triazines (QCLot: 4605552)								
EP068: Atrazine	1912-24-9	0.5	µg/L	<0.5	5 µg/L	92.5	69.3	113
EP068: Simazine	122-34-9	0.5	µg/L	<0.5	5 µg/L	105	62.6	118
EP068D: Pyrethroids (QCLot: 4605552)								
EP068: Cypermethrins	----	2	µg/L	<2.0	5 µg/L	87.6	64.2	113
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4619697)								
EP074: Benzene	71-43-2	1	µg/L	<1	10 µg/L	101	77.0	119
EP074: Toluene	108-88-3	2	µg/L	<2	10 µg/L	103	69.0	129
EP074: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	102	76.0	118
EP074: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	20 µg/L	101	77.0	119
EP074: Styrene	100-42-5	5	µg/L	<5	10 µg/L	100	73.0	119
EP074: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	102	79.0	117
EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	10 µg/L	102	76.0	118
EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	10 µg/L	102	69.0	119
EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	10 µg/L	101	74.0	116
EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	10 µg/L	101	73.0	119
EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	10 µg/L	101	74.0	116
EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	10 µg/L	102	72.0	116
EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	10 µg/L	101	71.0	119
EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	10 µg/L	102	65.0	123
EP074B: Oxygenated Compounds (QCLot: 4619697)								
EP074: 2-Propanone (Acetone)	67-64-1	50	µg/L	<50	100 µg/L	90.8	64.7	137
EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	100 µg/L	108	61.4	134
EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	100 µg/L	92.2	73.6	130
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	100 µg/L	97.6	66.0	132
EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	100 µg/L	94.4	65.0	137
EP074C: Sulfonated Compounds (QCLot: 4619697)								
EP074: Carbon disulfide	75-15-0	5	µg/L	<5	10 µg/L	94.9	72.8	127
EP074D: Fumigants (QCLot: 4619697)								
EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	10 µg/L	101	68.0	122
EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	10 µg/L	104	76.0	118
EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	10 µg/L	99.4	62.0	120
EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	10 µg/L	99.6	60.0	114

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074D: Fumigants (QCLot: 4619697) - continued								
EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	10 µg/L	104	69.0	117
EP074E: Halogenated Aliphatic Compounds (QCLot: 4619697)								
EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	100 µg/L	92.2	60.6	138
EP074: Chloromethane	74-87-3	50	µg/L	<50	100 µg/L	98.9	67.4	130
EP074: Vinyl chloride	75-01-4	50	µg/L	<50	100 µg/L	97.1	69.4	129
EP074: Bromomethane	74-83-9	50	µg/L	<50	100 µg/L	102	56.0	140
EP074: Chloroethane	75-00-3	50	µg/L	<50	100 µg/L	99.2	61.0	139
EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	100 µg/L	99.5	69.0	131
EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	10 µg/L	98.7	70.0	124
EP074: Iodomethane	74-88-4	5	µg/L	<5	10 µg/L	85.9	70.2	128
EP074: Methylene chloride	75-09-2	5	µg/L	<5	10 µg/L	114	69.3	133
EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	10 µg/L	102	74.0	118
EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	10 µg/L	103	74.0	120
EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	10 µg/L	101	77.0	119
EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	10 µg/L	101	67.0	119
EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	10 µg/L	101	73.0	119
EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	10 µg/L	98.8	62.0	120
EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	10 µg/L	104	73.0	123
EP074: Trichloroethene	79-01-6	5	µg/L	<5	10 µg/L	101	76.0	118
EP074: Dibromomethane	74-95-3	5	µg/L	<5	10 µg/L	103	73.0	119
EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	10 µg/L	105	72.0	126
EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	10 µg/L	104	71.0	129
EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	10 µg/L	93.4	72.0	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	10 µg/L	101	66.0	114
EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	10 µg/L	101	60.0	120
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	10 µg/L	100	70.6	128
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	10 µg/L	105	70.0	124
EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	10 µg/L	107	74.0	126
EP074: Pentachloroethane	76-01-7	5	µg/L	<5	10 µg/L	109	71.8	126
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	10 µg/L	99.6	66.4	136
EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	10 µg/L	105	58.0	130
EP074F: Halogenated Aromatic Compounds (QCLot: 4619697)								
EP074: Chlorobenzene	108-90-7	5	µg/L	<5	10 µg/L	103	79.0	117
EP074: Bromobenzene	108-86-1	5	µg/L	<5	10 µg/L	104	76.0	116
EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	10 µg/L	100	73.0	119
EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	10 µg/L	101	73.0	119
EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	10 µg/L	103	75.0	117
EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	10 µg/L	100	74.0	118
EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	10 µg/L	105	75.0	117

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP074F: Halogenated Aromatic Compounds (QCLot: 4619697) - continued								
EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	10 µg/L	107	61.0	125
EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	10 µg/L	109	67.0	123
EP074G: Trihalomethanes (QCLot: 4619697)								
EP074: Chloroform	67-66-3	5	µg/L	<5	10 µg/L	103	72.0	120
EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	10 µg/L	98.8	64.0	118
EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	10 µg/L	97.8	65.0	115
EP074: Bromoform	75-25-2	5	µg/L	<5	10 µg/L	96.0	73.5	126
EP074H: Naphthalene (QCLot: 4619697)								
EP074: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	109	72.0	122
EP075A: Phenolic Compounds (QCLot: 4605551)								
EP075: Phenol	108-95-2	2	µg/L	<2	10 µg/L	35.6	25.5	64.1
EP075: 2-Chlorophenol	95-57-8	2	µg/L	<2	10 µg/L	64.8	52.0	88.0
EP075: 2-Methylphenol	95-48-7	2	µg/L	<2	10 µg/L	61.0	50.0	94.0
EP075: 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	10 µg/L	59.4	45.0	96.2
EP075: 2-Nitrophenol	88-75-5	2	µg/L	<2	10 µg/L	76.2	48.0	98.0
EP075: 2.4-Dimethylphenol	105-67-9	2	µg/L	<2	10 µg/L	56.0	50.0	94.0
EP075: 2.4-Dichlorophenol	120-83-2	2	µg/L	<2	10 µg/L	76.0	61.9	109
EP075: 2.6-Dichlorophenol	87-65-0	2	µg/L	<2	10 µg/L	73.4	61.5	108
EP075: 4-Chloro-3-methylphenol	59-50-7	2	µg/L	<2	10 µg/L	79.9	61.4	107
EP075: 2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	10 µg/L	79.1	57.6	112
EP075: 2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	10 µg/L	77.4	58.0	110
EP075: Pentachlorophenol	87-86-5	4	µg/L	<4	20 µg/L	77.2	12.8	95.0
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4605551)								
EP075: Naphthalene	91-20-3	2	µg/L	<2	10 µg/L	70.0	51.0	95.0
EP075: 2-Methylnaphthalene	91-57-6	2	µg/L	<2	10 µg/L	73.1	59.0	108
EP075: 2-Chloronaphthalene	91-58-7	2	µg/L	<2	10 µg/L	79.4	60.6	106
EP075: Acenaphthylene	208-96-8	2	µg/L	<2	10 µg/L	78.0	64.0	108
EP075: Acenaphthene	83-32-9	2	µg/L	<2	10 µg/L	80.9	65.0	108
EP075: Fluorene	86-73-7	2	µg/L	<2	10 µg/L	86.0	65.2	107
EP075: Phenanthrene	85-01-8	2	µg/L	<2	10 µg/L	91.7	66.7	108
EP075: Anthracene	120-12-7	2	µg/L	<2	10 µg/L	90.3	65.8	108
EP075: Fluoranthene	206-44-0	2	µg/L	<2	10 µg/L	95.0	64.9	109
EP075: Pyrene	129-00-0	2	µg/L	<2	10 µg/L	96.0	60.1	111
EP075: N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	10 µg/L	96.5	59.7	110
EP075: Benz(a)anthracene	56-55-3	2	µg/L	<2	10 µg/L	91.8	62.2	112
EP075: Chrysene	218-01-9	2	µg/L	<2	10 µg/L	98.6	59.3	114
EP075: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	20 µg/L	98.0	60.1	111

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4605551) - continued								
EP075: 7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	10 µg/L	# 124	50.0	108
EP075: Benzo(a)pyrene	50-32-8	2	µg/L	<2	10 µg/L	101	59.2	112
EP075: 3-Methylcholanthrene	56-49-5	2	µg/L	<2	10 µg/L	97.7	60.1	110
EP075: Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	10 µg/L	99.1	59.6	110
EP075: Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	10 µg/L	95.8	57.2	109
EP075: Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	10 µg/L	98.6	60.6	110
EP075: Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	----	----	----	----
EP075C: Phthalate Esters (QCLot: 4605551)								
EP075: Dimethyl phthalate	131-11-3	2	µg/L	<2	10 µg/L	88.9	64.3	112
EP075: Diethyl phthalate	84-66-2	2	µg/L	<2	10 µg/L	94.6	67.3	111
EP075: Di-n-butyl phthalate	84-74-2	2	µg/L	<2	10 µg/L	98.7	68.4	122
EP075: Butyl benzyl phthalate	85-68-7	2	µg/L	<2	10 µg/L	98.4	61.2	114
EP075: bis(2-ethylhexyl) phthalate	117-81-7	----	µg/L	----	10 µg/L	105	60.0	132
EP075: Di-n-octylphthalate	117-84-0	2	µg/L	<2	10 µg/L	99.5	62.1	115
EP075D: Nitrosamines (QCLot: 4605551)								
EP075: N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	10 µg/L	56.9	46.0	110
EP075: N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	10 µg/L	69.0	60.6	113
EP075: N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	10 µg/L	63.2	45.0	91.0
EP075: N-Nitrosomorpholine	59-89-2	2	µg/L	<2	10 µg/L	59.7	42.0	100
EP075: N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	10 µg/L	81.1	63.5	108
EP075: N-Nitrosopiperidine	100-75-4	2	µg/L	<2	10 µg/L	76.8	61.7	107
EP075: N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	10 µg/L	102	62.5	108
EP075: N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L	<4	20 µg/L	88.9	64.6	112
EP075: Methapyrilene	91-80-5	2	µg/L	<2	10 µg/L	74.3	23.3	125
EP075E: Nitroaromatics and Ketones (QCLot: 4605551)								
EP075: 2-Picoline	109-06-8	2	µg/L	<2	10 µg/L	41.0	41.0	109
EP075: Acetophenone	98-86-2	2	µg/L	<2	10 µg/L	76.0	68.3	112
EP075: Nitrobenzene	98-95-3	2	µg/L	<2	10 µg/L	74.7	68.3	112
EP075: Isophorone	78-59-1	2	µg/L	<2	10 µg/L	81.2	67.6	111
EP075: 2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	10 µg/L	83.8	64.4	113
EP075: 2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	10 µg/L	90.6	59.5	109
EP075: 1-Naphthylamine	134-32-7	2	µg/L	<2	10 µg/L	93.5	46.8	102
EP075: 4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	10 µg/L	95.3	40.0	96.0
EP075: 5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	10 µg/L	93.1	58.3	106
EP075: Azobenzene	103-33-3	2	µg/L	<2	10 µg/L	90.0	66.0	112
EP075: 1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	10 µg/L	98.0	46.0	108
EP075: Phenacetin	62-44-2	2	µg/L	<2	10 µg/L	95.8	57.8	101

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075E: Nitroaromatics and Ketones (QCLot: 4605551) - continued								
EP075: 4-Aminobiphenyl	92-67-1	2	µg/L	<2	10 µg/L	90.0	60.1	112
EP075: Pentachloronitrobenzene	82-68-8	2	µg/L	<2	10 µg/L	88.7	59.0	109
EP075: Pronamide	23950-58-5	2	µg/L	<2	10 µg/L	98.3	62.7	109
EP075: Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	10 µg/L	86.9	59.4	108
EP075: Chlorobenzilate	510-15-6	2	µg/L	<2	10 µg/L	95.0	57.7	110
EP075F: Haloethers (QCLot: 4605551)								
EP075: Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	10 µg/L	# 68.1	69.1	112
EP075: Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	10 µg/L	79.8	66.2	111
EP075: 4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	10 µg/L	84.6	64.7	109
EP075: 4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	10 µg/L	88.0	61.6	108
EP075G: Chlorinated Hydrocarbons (QCLot: 4605551)								
EP075: 1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	10 µg/L	61.7	41.0	97.0
EP075: 1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	10 µg/L	62.2	40.0	96.0
EP075: 1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	10 µg/L	65.2	41.0	95.0
EP075: Hexachloroethane	67-72-1	2	µg/L	<2	10 µg/L	62.4	46.0	88.0
EP075: 1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	10 µg/L	65.3	46.0	96.0
EP075: Hexachloropropylene	1888-71-7	2	µg/L	<2	10 µg/L	65.4	34.0	96.0
EP075: Hexachlorobutadiene	87-68-3	2	µg/L	<2	10 µg/L	65.1	37.4	100
EP075: Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	10 µg/L	78.4	23.5	107
EP075: Pentachlorobenzene	608-93-5	2	µg/L	<2	10 µg/L	78.2	64.5	107
EP075: Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	10 µg/L	83.9	65.7	110
EP075H: Anilines and Benzidines (QCLot: 4605551)								
EP075: Aniline	62-53-3	2	µg/L	<2	10 µg/L	59.5	50.0	104
EP075: 4-Chloroaniline	106-47-8	2	µg/L	<2	10 µg/L	70.9	42.0	106
EP075: 2-Nitroaniline	88-74-4	4	µg/L	<4	10 µg/L	84.5	60.9	110
EP075: 3-Nitroaniline	99-09-2	4	µg/L	<4	10 µg/L	86.4	51.5	96.9
EP075: Dibenzofuran	132-64-9	2	µg/L	<2	10 µg/L	81.6	65.3	108
EP075: 4-Nitroaniline	100-01-6	2	µg/L	<2	10 µg/L	91.0	48.9	99.5
EP075: Carbazole	86-74-8	2	µg/L	<2	10 µg/L	97.8	64.3	107
EP075: 3.3`-Dichlorobenzidine	91-94-1	2	µg/L	<2	10 µg/L	95.4	60.3	119
EP075I: Organochlorine Pesticides (QCLot: 4605551)								
EP075: alpha-BHC	319-84-6	2	µg/L	<2	10 µg/L	93.9	64.3	110
EP075: beta-BHC	319-85-7	2	µg/L	<2	10 µg/L	98.4	53.0	107
EP075: gamma-BHC	58-89-9	2	µg/L	<2	10 µg/L	89.6	51.0	111
EP075: delta-BHC	319-86-8	2	µg/L	<2	10 µg/L	97.1	57.0	111
EP075: Heptachlor	76-44-8	2	µg/L	<2	10 µg/L	93.3	57.9	108
EP075: Aldrin	309-00-2	2	µg/L	<2	10 µg/L	93.2	56.0	112
EP075: Heptachlor epoxide	1024-57-3	2	µg/L	<2	10 µg/L	90.8	50.0	118

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075I: Organochlorine Pesticides (QCLot: 4605551) - continued								
EP075: alpha-Endosulfan	959-98-8	2	µg/L	<2	10 µg/L	97.7	59.0	111
EP075: 4.4`-DDE	72-55-9	2	µg/L	<2	10 µg/L	98.6	53.0	115
EP075: Dieldrin	60-57-1	2	µg/L	<2	10 µg/L	92.7	59.0	115
EP075: Endrin	72-20-8	2	µg/L	<2	10 µg/L	94.2	58.0	114
EP075: beta-Endosulfan	33213-65-9	2	µg/L	<2	10 µg/L	98.8	54.0	116
EP075: 4.4`-DDD	72-54-8	2	µg/L	<2	10 µg/L	97.4	55.0	115
EP075: Endosulfan sulfate	1031-07-8	2	µg/L	<2	10 µg/L	100	52.8	114
EP075: 4.4`-DDT	50-29-3	4	µg/L	<4	10 µg/L	96.7	56.0	114
EP075: Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L	<4	----	----	----	----
EP075: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	4	µg/L	<4	----	----	----	----
EP075J: Organophosphorus Pesticides (QCLot: 4605551)								
EP075: Dichlorvos	62-73-7	2	µg/L	<2	10 µg/L	84.6	51.0	113
EP075: Dimethoate	60-51-5	2	µg/L	<2	10 µg/L	90.6	43.0	109
EP075: Diazinon	333-41-5	2	µg/L	<2	10 µg/L	98.2	49.0	113
EP075: Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	10 µg/L	93.9	54.1	116
EP075: Malathion	121-75-5	2	µg/L	<2	10 µg/L	107	54.0	124
EP075: Fenthion	55-38-9	2	µg/L	<2	10 µg/L	97.5	57.0	115
EP075: Chlorpyrifos	2921-88-2	2	µg/L	<2	10 µg/L	94.4	53.0	109
EP075: Pirimphos-ethyl	23505-41-1	2	µg/L	<2	10 µg/L	97.2	55.0	111
EP075: Chlorfenvinphos	470-90-6	2	µg/L	<2	10 µg/L	79.9	50.0	116
EP075: Prothiofos	34643-46-4	2	µg/L	<2	10 µg/L	99.4	54.0	118
EP075: Ethion	563-12-2	2	µg/L	<2	10 µg/L	97.8	51.0	117
EP075K: Miscellaneous Compounds (QCLot: 4605551)								
EP075: 1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	10 µg/L	62.7	40.9	110
EP075: 1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	10 µg/L	67.9	52.5	109
EP075: Methanesulfonate methyl	66-27-3	2	µg/L	<2	10 µg/L	49.2	41.0	115
EP075: cis-Isosafrole	17627-76-8	2	µg/L	<2	10 µg/L	75.4	61.7	106
EP075: trans-Isosafrole	4043-71-4	2	µg/L	<2	10 µg/L	77.0	57.3	114
EP075: Safrole	94-59-7	2	µg/L	<2	10 µg/L	80.5	64.5	110
EP075: Diallate	2303-16-4	2	µg/L	<2	10 µg/L	95.4	53.0	111
EP075: 2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	10 µg/L	86.1	50.0	110

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Matrix Spike (MS) Report

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4621224)							
ES2230654-001	BH4B_2.39-2.51	EG005T: Arsenic	7440-38-2	50 mg/kg	102	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	94.4	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	94.8	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	100	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4621223)							
ES2230654-001	BH4B_2.39-2.51	EG035T: Mercury	7439-97-6	5 mg/kg	98.3	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 4610058)							
ES2230654-004	BH4B_22.05-22.30	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	77.7	70.0	130
ES2230654-004	BH4B_22.05-22.30	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	# 53.4	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4600770)							
ES2230654-001	BH4B_2.39-2.51	EK026SF: Total Cyanide	57-12-5	40 mg/kg	97.1	70.0	130
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4600769)							
ES2230654-001	BH4B_2.39-2.51	EK028SF: Weak Acid Dissociable Cyanide	----	40 mg/kg	95.5	70.0	130
EK040T: Fluoride Total (QCLot: 4601823)							
ES2230654-001	BH4B_2.39-2.51	EK040T: Fluoride	16984-48-8	400 mg/kg	79.6	70.0	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 4597635)							
ES2230654-001	BH4B_2.39-2.51	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	86.2	70.0	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 4597633)							
ES2230654-001	BH4B_2.39-2.51	EP068: gamma-BHC	58-89-9	0.5 mg/kg	84.5	70.0	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	85.3	70.0	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	85.9	70.0	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	94.1	70.0	130
		EP068: Endrin	72-20-8	2 mg/kg	84.4	70.0	130
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	83.1	70.0	130
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QCLot: 4597634)							
ES2230654-001	BH4B_2.39-2.51	EP071SG-S: C10 - C14 Fraction	----	480 mg/kg	107	43.0	139
		EP071SG-S: C15 - C28 Fraction	----	3100 mg/kg	104	49.0	131
		EP071SG-S: C29 - C36 Fraction	----	2060 mg/kg	126	64.0	158
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QCLot: 4597634)							
ES2230654-001	BH4B_2.39-2.51	EP071SG-S: >C10 - C16 Fraction	----	900 mg/kg	104	33.0	137
		EP071SG-S: >C16 - C34 Fraction	----	4320 mg/kg	118	40.0	137
		EP071SG-S: >C34 - C40 Fraction	----	890 mg/kg	117	30.0	190
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4605667)							
ES2234505-001	Anonymous	EP074: Benzene	71-43-2	2.5 mg/kg	110	70.0	130
		EP074: Toluene	108-88-3	2.5 mg/kg	111	70.0	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Acceptable Limits (%) Low	Matrix Spike (MS) Report: Acceptable Limits (%) High
EP074E(SIM): Halogenated Aliphatic Compounds (QCLot: 4605666)							
ES2234505-001	Anonymous	EP074E(SIM): Vinyl chloride	75-01-4	2.5 mg/kg	112	70.0	130
EP074E: Halogenated Aliphatic Compounds (QCLot: 4605667)							
ES2234505-001	Anonymous	EP074: 1.1-Dichloroethene	75-35-4	2.5 mg/kg	116	70.0	130
		EP074: Trichloroethene	79-01-6	2.5 mg/kg	105	70.0	130
EP074F: Halogenated Aromatic Compounds (QCLot: 4605667)							
ES2234505-001	Anonymous	EP074: Chlorobenzene	108-90-7	2.5 mg/kg	107	70.0	130
EP075A: Phenolic Compounds (QCLot: 4597632)							
ES2230654-001	BH4B_2.39-2.51	EP075: Phenol	108-95-2	10 mg/kg	91.0	60.0	130
		EP075: 4-Chloro-3-methylphenol	59-50-7	10 mg/kg	89.7	50.0	130
		EP075: Pentachlorophenol	87-86-5	10 mg/kg	55.0	10.0	130
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 4597632)							
ES2230654-001	BH4B_2.39-2.51	EP075: Acenaphthene	83-32-9	10 mg/kg	80.9	50.0	130
		EP075: Pyrene	129-00-0	10 mg/kg	85.3	50.0	130
EP075E: Nitroaromatics and Ketones (QCLot: 4597632)							
ES2230654-001	BH4B_2.39-2.51	EP075: 2.4-Dinitrotoluene	121-14-2	10 mg/kg	83.2	40.0	130
EP075G: Chlorinated Hydrocarbons (QCLot: 4597632)							
ES2230654-001	BH4B_2.39-2.51	EP075: 1.4-Dichlorobenzene	106-46-7	10 mg/kg	84.4	60.0	130
		EP075: 1.2.4-Trichlorobenzene	120-82-1	10 mg/kg	89.5	50.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4605665)							
ES2234505-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	117	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4605665)							
ES2234505-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	115	70.0	130
EP132A: Phenolic Compounds (QCLot: 4597586)							
ES2230654-004	BH4B_22.05-22.30	EP132: Hexachlorophene	70-30-4	100 µg/kg	67.5	6.80	91.0
EP202A: Phenoxyacetic Acid Herbicides by LCMS (QCLot: 4604346)							
EB2227467-015	Anonymous	EP202: 2.4-D	94-75-7	0.1 mg/kg	97.9	68.0	139
		EP202: Triclopyr	55335-06-3	0.1 mg/kg	98.4	51.0	145
		EP202: 2.4.5-T	93-76-5	0.1 mg/kg	89.0	57.0	142
		EP202: Picloram	1918-02-1	0.1 mg/kg	70.8	49.0	138

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Acceptable Limits (%) Low	Matrix Spike (MS) Report: Acceptable Limits (%) High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4605788)							
ES2230654-004	BH4B_22.05-22.30	EG005C: Arsenic	7440-38-2	1 mg/L	104	70.0	130
		EG005C: Beryllium	7440-41-7	1 mg/L	106	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 4605788) - continued							
ES2230654-004	BH4B_22.05-22.30	EG005C: Cadmium	7440-43-9	0.25 mg/L	106	70.0	130
		EG005C: Chromium	7440-47-3	1 mg/L	104	70.0	130
		EG005C: Lead	7439-92-1	1 mg/L	105	70.0	130
		EG005C: Manganese	7439-96-5	1 mg/L	103	70.0	130
		EG005C: Nickel	7440-02-0	1 mg/L	104	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4608256)							
ES2230654-001	BH4B_2.39-2.51	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	106	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4608257)							
ES2230654-001	BH4B_2.39-2.51	ED045G: Chloride	16887-00-6	50 mg/L	102	70.0	130
EG035C: Leachable Mercury by FIMS (QCLot: 4614888)							
ES2230654-004	BH4B_22.05-22.30	EG035C: Mercury	7439-97-6	0.01 mg/L	98.7	70.0	130
EG050G: Hexavalent Chromium by Discrete Analyser (QCLot: 4610168)							
ES2230654-001	BH4B_2.39-2.51	EG050G-C: Hexavalent Chromium	18540-29-9	0.5 mg/L	# 59.1	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4610715)							
ES2230654-001	BH4B_2.39-2.51	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	80.9	70.0	130
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 4610714)							
ES2230654-001	BH4B_2.39-2.51	EK028SF: Weak Acid Dissociable Cyanide	----	0.2 mg/L	87.6	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4606373)							
ES2234595-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	75.0	70.0	130
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 4619697)							
ES2234420-001	Anonymous	EP074: Benzene	71-43-2	25 µg/L	83.0	70.0	130
		EP074: Toluene	108-88-3	25 µg/L	82.4	70.0	130
EP074E: Halogenated Aliphatic Compounds (QCLot: 4619697)							
ES2234420-001	Anonymous	EP074: 1.1-Dichloroethene	75-35-4	25 µg/L	81.3	70.0	130
		EP074: Trichloroethene	79-01-6	25 µg/L	80.8	70.0	130
EP074F: Halogenated Aromatic Compounds (QCLot: 4619697)							
ES2234420-001	Anonymous	EP074: Chlorobenzene	108-90-7	25 µg/L	84.9	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2230654**	Page	: 1 of 22
Amendment	: **(Preliminary Report)**		
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 26-Aug-2022
Site	: ----	Issue Date	: 11-Oct-2022
Sampler	: KB	No. of samples received	: 22
Order number	: J200096	No. of samples analysed	: 9

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG048: Hexavalent Chromium (Alkaline Digest)	ES2230654--004	BH4B_22.05-22.30	**Hexavalent Chromium**	18540-29-9	53.4 %	70.0-130%	**Recovery less than lower data quality objective**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EP075B: Polynuclear Aromatic Hydrocarbons	QC-4605551-002	----	**7.12-Dimethylbenz(a)anthracene**	57-97-6	124 %	50.0-108%	**Recovery greater than upper control limit**
EP075F: Haloethers	QC-4605551-002	----	**Bis(2-chloroethyl) ether**	111-44-4	68.1 %	69.1-112%	**Recovery less than lower control limit**
Matrix Spike (MS) Recoveries							
EG050G: Hexavalent Chromium by Discrete Analyser	ES2230654--001	BH4B_2.39-2.51	**Hexavalent Chromium**	18540-29-9	59.1 %	70.0-130%	**Recovery less than lower data quality objective**

Regular Sample Surrogates

Sub-Matrix: **ROCK**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP068S: Organochlorine Pesticide Surrogate	ES2230654-004	BH4B_22.05-22.30	**Dibromo-DDE**	21655-73-2	116 %	66.5-111 %	**Recovery greater than upper data quality objective**
EP075S: Acid Extractable Surrogates	ES2230654-004	BH4B_22.05-22.30	**2-Fluorophenol**	367-12-4	5.1 %	10.0-117 %	**Recovery less than lower data quality objective**
EP075S: Acid Extractable Surrogates	ES2230654-014	BH4B_126.27-126.37	**2-Fluorophenol**	367-12-4	7.5 %	10.0-117 %	**Recovery less than lower data quality objective**
EP075S: Acid Extractable Surrogates	ES2230654-021	BH4B_388.0-388.13	**2-Fluorophenol**	367-12-4	8.6 %	10.0-117 %	**Recovery less than lower data quality objective**
EP075S: Acid Extractable Surrogates	ES2230654-004	BH4B_22.05-22.30	**2-Chlorophenol-D4**	93951-73-6	13.9 %	20.9-130 %	**Recovery less than lower data quality objective**
EP075S: Acid Extractable Surrogates	ES2230654-004	BH4B_22.05-22.30	**2.4.6-Tribromophenol**	118-79-6	5.4 %	10.0-151 %	**Recovery less than lower data quality objective**
EP075S: Acid Extractable Surrogates	ES2230654-014	BH4B_126.27-126.37	**2.4.6-Tribromophenol**	118-79-6	7.9 %	10.0-151 %	**Recovery less than lower data quality objective**
EP075S: Acid Extractable Surrogates	ES2230654-021	BH4B_388.0-388.13	**2.4.6-Tribromophenol**	118-79-6	9.3 %	10.0-151 %	**Recovery less than lower data quality objective**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA003 :pH (field/fox)						

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA003 :pH (field/fox) - Analysis Holding Time Compliance						
Snap Lock Bag						
BH4B_6.40-6.52, BH4B_39.74-39.91, BH4B_71.0-71.20, BH4B_148.17-148.36, BH4B_419.0-419.14	04-Oct-2022	26-Aug-2022	**39**	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	----	----	----	26-Sep-2022	08-Sep-2022	**18**
ED042T: Total Sulfur by LECO						
Snap Lock Bag						
BH4B_71.0-71.20, BH4B_148.17-148.36, BH4B_419.0-419.14	05-Oct-2022	01-Sep-2022	**34**	----	----	----
EG035T: Total Recoverable Mercury by FIMS						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	06-Oct-2022	22-Sep-2022	**14**	07-Oct-2022	22-Sep-2022	**15**
EG048: Hexavalent Chromium (Alkaline Digest)						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	30-Sep-2022	22-Sep-2022	**8**	----	----	----
EK026SF: Total CN by Segmented Flow Analyser						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EK040T: Fluoride Total						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	27-Sep-2022	22-Sep-2022	**5**	27-Sep-2022	22-Sep-2022	**5**
EN60Z: ASLP Leachate - ZHE						
ZHE Leach: 14 day HT(e.g. CN, BTEX)						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP003: Total Organic Carbon (TOC) in Soil						
Pulp Bag						
BH4B_6.40-6.52, BH4B_39.74-39.91	05-Oct-2022	22-Sep-2022	**13**	05-Oct-2022	22-Sep-2022	**13**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EP003: Total Organic Carbon (TOC) in Soil - Analysis Holding Time Compliance						
Snap Lock Bag BH4B_71.0-71.20, BH4B_148.17-148.36, BH4B_419.0-419.14	05-Oct-2022	22-Sep-2022	**13**	05-Oct-2022	22-Sep-2022	**13**
EP066: Polychlorinated Biphenyls (PCB)						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP068A: Organochlorine Pesticides (OC)						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP068B: Organophosphorus Pesticides (OP)						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	01-Sep-2022	**27**	28-Sep-2022	01-Sep-2022	**27**
EP074B: Oxygenated Compounds						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	01-Sep-2022	**27**	28-Sep-2022	01-Sep-2022	**27**
EP074E(SIM): Halogenated Aliphatic Compounds						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	01-Sep-2022	**27**	28-Sep-2022	01-Sep-2022	**27**
EP074E: Halogenated Aliphatic Compounds						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	01-Sep-2022	**27**	28-Sep-2022	01-Sep-2022	**27**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EP074F: Halogenated Aromatic Compounds						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	01-Sep-2022	**27**	28-Sep-2022	01-Sep-2022	**27**
EP074G: Trihalomethanes						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	01-Sep-2022	**27**	28-Sep-2022	01-Sep-2022	**27**
EP075A: Phenolic Compounds						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP075B: Polynuclear Aromatic Hydrocarbons						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP075C: Phthalate Esters						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP075E: Nitroaromatics and Ketones						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP075G: Chlorinated Hydrocarbons						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP075K: Miscellaneous Compounds						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP080/071: Total Petroleum Hydrocarbons						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	08-Sep-2022	**20**	28-Sep-2022	08-Sep-2022	**20**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
Snap Lock Bag BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	08-Sep-2022	**20**	28-Sep-2022	08-Sep-2022	**20**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EP132A: Phenolic Compounds						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	26-Sep-2022	08-Sep-2022	**18**	----	----	----
EP202A: Phenoxyacetic Acid Herbicides by LCMS						
Snap Lock Bag						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	28-Sep-2022	08-Sep-2022	**20**	----	----	----

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	----	----	----	28-Sep-2022	27-Sep-2022	**1**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count: QC	Count: Regular	Rate (%): Actual	Rate (%): Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
Pesticides by GCMS	0	4	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	0	4	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Pesticides by GCMS	0	4	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	0	4	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation

(Preliminary Report)

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA003 :pH (field/fox)							
Snap Lock Bag (EA003)							
BH4B_6.40-6.52, BH4B_71.0-71.20, BH4B_419.0-419.14 / BH4B_39.74-39.91, BH4B_148.17-148.36,	**25-Aug-2022**	**04-Oct-2022**	26-Aug-2022	×	**04-Oct-2022**	02-Jan-2023	✓
EA011: Net Acid Generation							
Snap Lock Bag (EA011)							
BH4B_6.40-6.52, BH4B_71.0-71.20, BH4B_419.0-419.14 / BH4B_39.74-39.91, BH4B_148.17-148.36,	**25-Aug-2022**	**07-Oct-2022**	25-Aug-2023	✓	**07-Oct-2022**	05-Apr-2023	✓
EA013: Acid Neutralising Capacity							
Snap Lock Bag (EA013)							
BH4B_6.40-6.52, BH4B_71.0-71.20, BH4B_419.0-419.14 / BH4B_39.74-39.91, BH4B_148.17-148.36,	**25-Aug-2022**	**07-Oct-2022**	25-Aug-2023	✓	**07-Oct-2022**	05-Apr-2023	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Snap Lock Bag (EA055)							
BH4B_2.39-2.51, BH4B_126.27-126.37, / BH4B_22.05-22.30, BH4B_388.0-388.13	**25-Aug-2022**	**----**	----	----	**26-Sep-2022**	08-Sep-2022	×
ED042T: Total Sulfur by LECO							
Pulp Bag (ED042T)							
BH4B_6.40-6.52, / BH4B_39.74-39.91	**25-Aug-2022**	**05-Oct-2022**	21-Feb-2023	✓	**05-Oct-2022**	21-Feb-2023	✓
Snap Lock Bag (ED042T)							
BH4B_71.0-71.20, BH4B_419.0-419.14 / BH4B_148.17-148.36,	**25-Aug-2022**	**05-Oct-2022**	01-Sep-2022	×	**05-Oct-2022**	03-Apr-2023	✓
EG005(ED093)T: Total Metals by ICP-AES							
Snap Lock Bag (EG005T)							
BH4B_2.39-2.51, BH4B_126.27-126.37, / BH4B_22.05-22.30, BH4B_388.0-388.13	**25-Aug-2022**	**06-Oct-2022**	21-Feb-2023	✓	**07-Oct-2022**	21-Feb-2023	✓
EG035T: Total Recoverable Mercury by FIMS							
Snap Lock Bag (EG035T)							
BH4B_2.39-2.51, BH4B_126.27-126.37, / BH4B_22.05-22.30, BH4B_388.0-388.13	**25-Aug-2022**	**06-Oct-2022**	22-Sep-2022	×	**07-Oct-2022**	22-Sep-2022	×
EG048: Hexavalent Chromium (Alkaline Digest)							
Snap Lock Bag (EG048G)							
BH4B_2.39-2.51, BH4B_126.27-126.37, / BH4B_22.05-22.30, BH4B_388.0-388.13	**25-Aug-2022**	**30-Sep-2022**	22-Sep-2022	×	**30-Sep-2022**	07-Oct-2022	✓
EK026SF: Total CN by Segmented Flow Analyser							
Snap Lock Bag (EK026SF)							
BH4B_2.39-2.51, BH4B_126.27-126.37, / BH4B_22.05-22.30, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**27-Sep-2022**	10-Oct-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser							
Snap Lock Bag (EK028SF)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**27-Sep-2022**	10-Oct-2022	✓
EK040T: Fluoride Total							
Snap Lock Bag (EK040T)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**27-Sep-2022**	22-Sep-2022	×	**27-Sep-2022**	22-Sep-2022	×
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)							
Non-Volatile Leach: 180 day HT (e.g. PFAS, metals ex.Hg) (EN60-Dla-G)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**27-Sep-2022**	21-Feb-2023	✓	**----**	----	----
EN60Z: ASLP Leachate - ZHE							
ZHE Leach: 14 day HT(e.g. CN, BTEX) (EN60Za)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**----**	----	----
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag (EP003)							
BH4B_6.40-6.52, BH4B_39.74-39.91	**25-Aug-2022**	**05-Oct-2022**	22-Sep-2022	×	**05-Oct-2022**	22-Sep-2022	×
Snap Lock Bag (EP003)							
BH4B_71.0-71.20, BH4B_148.17-148.36, BH4B_419.0-419.14	**25-Aug-2022**	**05-Oct-2022**	22-Sep-2022	×	**05-Oct-2022**	22-Sep-2022	×
EP066: Polychlorinated Biphenyls (PCB)							
Snap Lock Bag (EP066)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**28-Sep-2022**	05-Nov-2022	✓
EP068A: Organochlorine Pesticides (OC)							
Snap Lock Bag (EP068)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**28-Sep-2022**	05-Nov-2022	✓
EP068B: Organophosphorus Pesticides (OP)							
Snap Lock Bag (EP068)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**28-Sep-2022**	05-Nov-2022	✓
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup							
Snap Lock Bag (EP071SG-S)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup							
Snap Lock Bag (EP071SG-S)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074A: Monocyclic Aromatic Hydrocarbons							
Snap Lock Bag (EP074) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	01-Sep-2022	×	**28-Sep-2022**	01-Sep-2022	×
EP074B: Oxygenated Compounds							
Snap Lock Bag (EP074) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	01-Sep-2022	×	**28-Sep-2022**	01-Sep-2022	×
EP074E(SIM): Halogenated Aliphatic Compounds							
Snap Lock Bag (EP074E(SIM)) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	01-Sep-2022	×	**28-Sep-2022**	01-Sep-2022	×
EP074E: Halogenated Aliphatic Compounds							
Snap Lock Bag (EP074) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	01-Sep-2022	×	**28-Sep-2022**	01-Sep-2022	×
EP074F: Halogenated Aromatic Compounds							
Snap Lock Bag (EP074) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	01-Sep-2022	×	**28-Sep-2022**	01-Sep-2022	×
EP074G: Trihalomethanes							
Snap Lock Bag (EP074) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	01-Sep-2022	×	**28-Sep-2022**	01-Sep-2022	×
EP075A: Phenolic Compounds							
Snap Lock Bag (EP075) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓
EP075B: Polynuclear Aromatic Hydrocarbons							
Snap Lock Bag (EP075) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓
EP075C: Phthalate Esters							
Snap Lock Bag (EP075) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓
EP075E: Nitroaromatics and Ketones							
Snap Lock Bag (EP075) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075G: Chlorinated Hydrocarbons							
Snap Lock Bag (EP075) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓
EP075K: Miscellaneous Compounds							
Snap Lock Bag (EP075) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓
EP080/071: Total Petroleum Hydrocarbons							
Snap Lock Bag (EP080) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	08-Sep-2022	×	**28-Sep-2022**	08-Sep-2022	×
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Snap Lock Bag (EP080) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	08-Sep-2022	×	**28-Sep-2022**	08-Sep-2022	×
EP132A: Phenolic Compounds							
Snap Lock Bag (EP132) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**26-Sep-2022**	08-Sep-2022	×	**29-Sep-2022**	05-Nov-2022	✓
EP202A: Phenoxyacetic Acid Herbicides by LCMS							
Snap Lock Bag (EP202) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**25-Aug-2022**	**28-Sep-2022**	08-Sep-2022	×	**28-Sep-2022**	07-Nov-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**28-Sep-2022**	27-Sep-2022	×
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**28-Sep-2022**	25-Oct-2022	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**28-Sep-2022**	11-Oct-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**29-Sep-2022**	25-Oct-2022	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**29-Sep-2022**	25-Oct-2022	✓
EG005(ED093)C: Leachable Metals by ICPAES							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG005C)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	26-Mar-2023	✓	**28-Sep-2022**	26-Mar-2023	✓
EG035C: Leachable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035C)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**04-Oct-2022**	25-Oct-2022	✓
EG050G: Hexavalent Chromium by Discrete Analyser							
Clear Plastic Bottle - NaOH (EG050G-C)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**30-Sep-2022**	25-Oct-2022	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**----**	----	----	**30-Sep-2022**	10-Oct-2022	✓
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK028SF)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**----**	----	----	**30-Sep-2022**	10-Oct-2022	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**----**	----	----	**28-Sep-2022**	25-Oct-2022	✓
EP068A: Organochlorine Pesticides (OC)							
Amber Glass Bottle - Unpreserved (EP068)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP068B: Organophosphorus Pesticides (OP)							
Amber Glass Bottle - Unpreserved (EP068)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP068C: Triazines							
Amber Glass Bottle - Unpreserved (EP068)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP068D: Cypermethrins							
Amber Glass Bottle - Unpreserved (EP068)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP068E: Other Pesticides							
Amber Glass Bottle - Unpreserved (EP068)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓
EP074B: Oxygenated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓
EP074C: Sulfonated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓
EP074D: Fumigants							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓
EP074E: Halogenated Aliphatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓
EP074F: Halogenated Aromatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓
EP074G: Trihalomethanes							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074H: Naphthalene							
Amber VOC Vial - Sulfuric Acid (EP074)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**26-Sep-2022**	**06-Oct-2022**	10-Oct-2022	✓	**06-Oct-2022**	10-Oct-2022	✓
EP075A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075C: Phthalate Esters							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075D: Nitrosamines							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075E: Nitroaromatics and Ketones							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075F: Haloethers							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075G: Chlorinated Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075H: Anilines and Benzidines							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075I: Organochlorine Pesticides							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075J: Organophosphorus Pesticides							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓
EP075K: Miscellaneous Compounds							
Amber Glass Bottle - Unpreserved (EP075)							
BH4B_2.39-2.51, BH4B_22.05-22.30, BH4B_126.27-126.37, BH4B_388.0-388.13	**27-Sep-2022**	**28-Sep-2022**	04-Oct-2022	✓	**29-Sep-2022**	07-Nov-2022	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation	EA011	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH field/fox	EA003	3	21	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation	EA011	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Total Organic Carbon	EP003	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low level CHC (SIM)	EP074E(SIM)	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
WAD Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	3	27	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Leachable	EG050G-C	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	0	4	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	0	4	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	3	27	**11.11**	**8.33**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Leachable	EG050G-C	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	27	**3.70**	**1.67**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Leachable	EG050G-C	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Leachable	EG050G-C	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Mercury by FIMS	EG035C	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Leachable Metals by ICPAES	EG005C	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	0	4	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds	EP075	0	4	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH field/fox	EA003	SOIL	In house: Referenced to Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.
pH by Auto Titrator	EA005-P	SOIL	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by Auto Titrator	EA010-P	SOIL	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Net Acid Generation	EA011	SOIL	In house: Referenced to Miller (1998) Titremetric procedure determines net acidity in a soil following peroxide oxidation. Titrations to both pH 4.5 and pH 7 are reported.
Acid Neutralising Capacity (ANC)	EA013	SOIL	In house: Referenced to USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Alkalinity by Auto Titrator	ED037-P	SOIL	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	SOIL	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Sulfur - Total as S (LECO)	ED042T	SOIL	In house: Dried and pulverised sample is combusted in a high temperature furnace in the presence of strong oxidants / catalysts. The evolved S (as SO2) is measured by infra-red detector
Chloride by Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Leachable Metals by ICPAES	EG005C	SOIL	In house: referenced to APHA 3120; USEPA SW 846 - 6010: The ICPAES technique ionises leachate sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Leachable Mercury by FIMS	EG035C	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Leachable	EG050G-C	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on leachate samples by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
WAD Cyanide by Segmented Flow Analyser	EK028SF	SOIL	In house: Referenced to APHA 4500-CN C&O / ISO 14403. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Hydrogen cyanide is liberated from a slightly acidified (pH 4.5) and is dialysed. Tight cyanide complexes that would not be amenable to oxidation by chlorine are not converted. Iron cyanide complexes are precipitated with zinc acetate. Liberated HCN diffuses through a membrane into a stream of sodium hydroxide where it is carried as CN- The cyanide in caustic solution is buffered to pH 5.2 and further converted to cyanogen chloride by reaction with chloramine-T. Cyanogen chloride subsequently reacts with 4 ¿pyridine carboxylic and 1,3 - dimethylbarbituric acids to give a red colour complex. This colour is measured at 600 nm. This method is compliant with NEPM Schedule B(3).
Fluoride by Auto Titrator	EK040P	SOIL	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Total Fluoride	EK040T	SOIL	(In-house) Total fluoride is determined by ion specific electrode (ISE) in a solution obtained after a Sodium Carbonate / Potassium Carbonate fusion dissolution.
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
Polychlorinated Biphenyls (PCB)	EP066	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction (Silica Gel Clean Up)	EP071SG-S	SOIL	In house: Referenced to USEPA SW 846 - 8015. Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
Volatile Organic Compounds	EP074	SOIL	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
Low level CHC (SIM)	EP074E(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).
Semivolatile Organic Compounds	EP075	SOIL	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Semivolatile Compounds by GCMS(SIM - Ultra-trace)	EP132	SOIL	In house: Referenced to USEPA 8270 GCMS Capiliary column, SIM mode.
Phenoxyacetic Acid Herbicides (LCMS - Standard DL)	EP202	SOIL	In house: LCMS (Electrospray in negative mode). Residues of acid herbicides are extracted from soil samples under the alkaline condition. An aliquot of the alkaline aqueous phase is taken and acidified before a SPE cleanup. After eluting off from the SPE cartridge, residues of acid herbicides are dissolved in HPLC mobile phase prior to instrument analysis.
NSW Waste Classification Guidelines - Aggregate Sums	* NSW-WCG	SOIL	In house: This method provides rounded sums for diverse trace organics to suit NSW Waste Classification Guidelines.

Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
Total Fluoride	EK040T-PR	SOIL	In house: Samples are fused with Sodium Carbonate / Potassium Carbonate flux.
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
Digestion for Total Recoverable Metals in TCLP Leachate	EN25C	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Deionised Water Leach - Glass Leaching Vessel	EN60-Dla-G	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
ASLP for Volatile Analytes (Zero Headspace Extraction)	EN60Za	SOIL	In house QWI-EN/60 referenced to AS4439.2 Preparation of Leachates

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Extraction for Phenoxy Acid Herbicides in Soils.	EP202-PR	SOIL	In-House: Alkaline extract followed by SPE clean up of acidified portion of the sample extract.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
Separatory Funnel Extraction of Liquids	ORG14	SOIL	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Volatiles Water Preparation	ORG16-W	SOIL	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids/ Acetylation	ORG17A-AC	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to 1 mL with exchange into cyclohexane. Phenolic compounds are reacted with acetic anhydride to yield phenyl acetates suitable for ultra-trace analysis.

Fadi Soro

Rec: 1 CD 01/11/22 1530

From: Helen Simpson
Sent: Wednesday, 26 October 2022 6:12 PM
To: Cez Bautista; rebatches.sydney
Cc: Wisam Marassa
Subject: RE: ES2233009 + ES2230654 - EMM - Standard

Cez,

Please organise for samples to be returned to ES from EB and Minerals for highlighted samples.

	Sample	Volume
1	ES2233009-001	80.00g
2	ES2233009-004	70.00g
3	ES2230654-002	20.70g
4	ES2230654-006	21.80g
5	ES2230654-010	26.30g
6	ES2230654-015	31.90g
7	ES2230654-022	28.90g

Environmental Division
Sydney
Work Order Reference
ES2239415

Telephone : +61-2-8784 9555

Kind Regards,

Helen Simpson
Sample Receipt Coordinator, Environmental
Sydney, NSW

O: +61 2 8784 8555
D: +61 2 8784 8535
Helen.Simpson@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 AUSTRALIA

alsglobal.com

From: Cez Bautista <cez.bautista@ALSGlobal.com>
Sent: Wednesday, 26 October 2022 5:45 PM
To: rebatches.sydney <rebatches.sydney@ALSGlobal.com>
Cc: Helen Simpson <helen.simpson@alsglobal.com>; Wisam Marassa <Wisam.Marassa@alsglobal.com>
Subject: ES2233009 + ES2230654 - EMM - Standard

Hi Team!

Could we please organise for an ASLP Di leach for the below samples to undergo metals testing stipulated below, I have also included volumes that we currently have for these samples. I have attached the original email chain for reference.

I have confirmed with Wisam that we will be able to conduct the ASLP leach with Di with this limited volume amount and have confirmed with Magnus Skold that they are happy to proceed noting the method deviation breach.

Sample	Volume
ES2233009-001	80.00g
ES2233009-004	70.00g
ES2230654-~~001~~ 2	20.70g
ES2230654-~~002~~ 6	21.80g
ES2230654-~~003~~ 10	26.30g
ES2230654-~~004~~ 15	31.90g

ES2230654-005 ?2	28.90g

Metals required for testing: Al, Sb, As, Ba, B, Cd, Cr, Co, Cu, Ga, Fe, Ph, Mn, Mo, Ni, Se, Ag, Sr, Tl, Th, Sn, Ti, W, U, V, and Zn.

Thank you so much everyone! Please let me know if there is anything that requires clarification ☺

Kind regards,

Cez Bautista
Client Services Officer
Sydney, NSW

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D: +61 2 8784 8531
cez.bautista@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 AUSTRALIA

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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2239415**	Page	: 1 of 6
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 01-Nov-2022 15:30
Order number	: J200096	Date Analysis Commenced	: 03-Nov-2022
C-O-C number	: ----	Issue Date	: 08-Nov-2022 17:39
Sampler	: ----		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 7		
No. of samples analysed	: 7		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **DI WATER LEACHATE** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	MB01A_26-36.5	MB03B_7-20	BH4B_6.40-6.52	BH4B_39.74-39.91	BH4B_71.0-71.20
				Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
					ES2239415-001	ES2239415-002	ES2239415-003	ES2239415-004	ES2239415-005
					Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**2.39**	**3.97**	**4.88**	**3.82**	**4.30**
Antimony	7440-36-0	0.001	mg/L		**0.016**	<0.001	<0.001	**0.004**	**0.003**
Arsenic	7440-38-2	0.001	mg/L		**0.019**	**0.003**	**0.008**	**0.004**	**0.008**
Barium	7440-39-3	0.001	mg/L		**0.015**	**0.024**	**0.032**	**0.026**	**0.025**
Cadmium	7440-43-9	0.0001	mg/L		**0.0003**	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		**0.002**	**0.003**	**0.002**	**0.002**	**0.002**
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Gallium	7440-55-3	0.001	mg/L		**0.002**	**0.001**	**0.002**	**0.002**	**0.001**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	**0.001**	<0.001	**0.005**
Manganese	7439-96-5	0.001	mg/L		**0.041**	**0.088**	**0.068**	**0.044**	**0.121**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	**0.001**	<0.001	**0.015**
Nickel	7440-02-0	0.001	mg/L		**0.001**	**0.006**	**0.004**	**0.003**	**0.005**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L		**0.016**	**0.028**	**0.015**	**0.008**	**0.025**
Thallium	7440-28-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Thorium	7440-29-1	0.001	mg/L		**0.001**	<0.001	<0.001	<0.001	<0.001
Tin	7440-31-5	0.001	mg/L		**0.002**	**0.005**	**0.006**	**0.008**	**0.002**
Titanium	7440-32-6	0.01	mg/L		**0.10**	**0.25**	**0.34**	**0.30**	**0.21**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	**0.01**	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.019**	**0.016**	<0.005	**0.029**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**2.06**	**3.20**	**4.96**	**3.09**	**5.14**
Tungsten	7440-33-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Sample ID	BH4B_148.17-148.36	BH4B_419.0-419.14	----	----	----
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2239415-006	ES2239415-007	--------	--------	--------
				Result	Result	----	----	----
EG020W: Water Leachable Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.79**	**3.38**	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.005**	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.002**	**0.033**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	**0.003**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	**0.001**	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	----	----
Gallium	7440-55-3	0.001	mg/L	**0.001**	**0.001**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	**0.001**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.005**	**0.051**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.002**	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	----	----	----
Strontium	7440-24-6	0.001	mg/L	**0.021**	**0.005**	----	----	----
Thallium	7440-28-0	0.001	mg/L	<0.001	<0.001	----	----	----
Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	----	----	----
Tin	7440-31-5	0.001	mg/L	<0.001	**0.006**	----	----	----
Titanium	7440-32-6	0.01	mg/L	<0.01	**0.44**	----	----	----
Uranium	7440-61-1	0.001	mg/L	**0.001**	**0.002**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	**0.011**	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L	**0.38**	**4.11**	----	----	----
Tungsten	7440-33-7	0.001	mg/L	**0.032**	**0.002**	----	----	----

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Sample ID	BH4B_6.40-6.52	BH4B_39.74-39.91	BH4B_71.0-71.20	BH4B_148.17-148.36	BH4B_419.0-419.14
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00	25-Aug-2022 00:00
Compound	CAS Number	LOR	Unit	ES2239415-003	ES2239415-004	ES2239415-005	ES2239415-006	ES2239415-007
				Result	Result	Result	Result	Result
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)								
Final pH	----	0.1	pH Unit	**7.8**	**7.9**	**7.9**	**8.7**	**8.6**

Analytical Results

Sub-Matrix: **SOLID** (Matrix: **SOIL**)			Sample ID	**MB01A_26-36.5**	**MB03B_7-20**	**----**	**----**	**----**
			Sampling date / time	12-Sep-2022 15:00	12-Sep-2022 15:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2239415-001**	**ES2239415-002**	**--------**	**--------**	**--------**
				Result	Result	----	----	----
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)								
Final pH	----	0.1	pH Unit	**8.7**	**8.0**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: **ES2239415**	Page	: 1 of 6
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 01-Nov-2022 15:30
Order number	: J200096	Date Analysis Commenced	: 03-Nov-2022
C-O-C number	: ----	Issue Date	: 08-Nov-2022 17:38
Sampler	: ----		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 7		
No. of samples analysed	: 7		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to Assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty **must be** considered. Refer to the ALS Contract Terms and Conditions for details, and EnviroMail 53 for a guide on how to interpret the measurement of uncertainty (MU).

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	MB01A_26-36.5	MB03B_7-20	BH4B_6.40-6.52	BH4B_39.74-39.91	BH4B_71.0-71.20
Sample ID										
Sampling date/time						12-Sep-2022 15:00	12-Sep-2022 15:00	25-Aug-2022 15:00	25-Aug-2022 15:00	25-Aug-2022 15:00
						ES2239415-001 MU	ES2239415-002 MU	ES2239415-003 MU	ES2239415-004 MU	ES2239415-005 MU
EG020W: Water Leachable Metals by ICP-MS										
Aluminium	EG020A-W	0.01	mg/L	----	----	**2.39**	**3.97**	**4.88**	**3.82**	**4.30**
Antimony	EG020A-W	0.001	mg/L	----	----	**0.016**	<0.001	<0.001	**0.004**	**0.003**
Arsenic	EG020A-W	0.001	mg/L	----	----	**0.019**	**0.003**	**0.008**	**0.004**	**0.008**
Barium	EG020A-W	0.001	mg/L	----	----	**0.015**	**0.024**	**0.032**	**0.026**	**0.025**
Cadmium	EG020A-W	0.0001	mg/L	----	----	**0.0003**	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	EG020A-W	0.001	mg/L	----	----	**0.002**	**0.003**	**0.002**	**0.002**	**0.002**
Copper	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	<0.001	<0.001	<0.001
Gallium	EG020D-W	0.001	mg/L	----	----	**0.002**	**0.001**	**0.002**	**0.002**	**0.001**
Lead	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	**0.001**	<0.001	**0.005**
Manganese	EG020A-W	0.001	mg/L	----	----	**0.041**	**0.088**	**0.068**	**0.044**	**0.121**
Molybdenum	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	**0.001**	<0.001	**0.015**
Nickel	EG020A-W	0.001	mg/L	----	----	**0.001**	**0.006**	**0.004**	**0.003**	**0.005**
Selenium	EG020A-W	0.01	mg/L	----	----	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	EG020B-W	0.001	mg/L	----	----	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	EG020B-W	0.001	mg/L	----	----	**0.016**	**0.028**	**0.015**	**0.008**	**0.025**
Thallium	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	<0.001	<0.001	<0.001
Thorium	EG020B-W	0.001	mg/L	----	----	**0.001**	<0.001	<0.001	<0.001	<0.001
Tin	EG020A-W	0.001	mg/L	----	----	**0.002**	**0.005**	**0.006**	**0.008**	**0.002**
Titanium	EG020B-W	0.01	mg/L	----	----	**0.10**	**0.25**	**0.34**	**0.30**	**0.21**
Uranium	EG020B-W	0.001	mg/L	----	----	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	EG020A-W	0.01	mg/L	----	----	<0.01	<0.01	**0.01**	<0.01	<0.01
Zinc	EG020A-W	0.005	mg/L	----	----	<0.005	**0.019**	**0.016**	<0.005	**0.029**
Boron	EG020A-W	0.05	mg/L	----	----	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	EG020A-W	0.05	mg/L	----	----	**2.06**	**3.20**	**4.96**	**3.09**	**5.14**
Tungsten	EG020E-W	0.001	mg/L	----	----	<0.001	<0.001	<0.001	<0.001	<0.001

No Guideline Evaluation Required

Sub-Matrix: **DI WATER LEACHATE**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	Sample ID: BH4B_148.17-148.36	BH4B_419.0-419.14	----	----	----
						Sampling date/time: 25-Aug-2022 15:00	25-Aug-2022 15:00	----	----	----
						ES2239415-006 MU	ES2239415-007 MU	-------- MU	-------- MU	-------- MU
EG020W: Water Leachable Metals by ICP-MS										
Aluminium	EG020A-W	0.01	mg/L	----	----	**0.79**	**3.38**	----	----	----
Antimony	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	----	----	----
Arsenic	EG020A-W	0.001	mg/L	----	----	**0.005**	<0.001	----	----	----
Barium	EG020A-W	0.001	mg/L	----	----	**0.002**	**0.033**	----	----	----
Cadmium	EG020A-W	0.0001	mg/L	----	----	<0.0001	<0.0001	----	----	----
Chromium	EG020A-W	0.001	mg/L	----	----	<0.001	**0.003**	----	----	----
Cobalt	EG020A-W	0.001	mg/L	----	----	<0.001	**0.001**	----	----	----
Copper	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	----	----	----
Gallium	EG020D-W	0.001	mg/L	----	----	**0.001**	**0.001**	----	----	----
Lead	EG020A-W	0.001	mg/L	----	----	<0.001	**0.001**	----	----	----
Manganese	EG020A-W	0.001	mg/L	----	----	**0.005**	**0.051**	----	----	----
Molybdenum	EG020A-W	0.001	mg/L	----	----	**0.002**	<0.001	----	----	----
Nickel	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	----	----	----
Selenium	EG020A-W	0.01	mg/L	----	----	<0.01	<0.01	----	----	----
Silver	EG020B-W	0.001	mg/L	----	----	<0.001	<0.001	----	----	----
Strontium	EG020B-W	0.001	mg/L	----	----	**0.021**	**0.005**	----	----	----
Thallium	EG020A-W	0.001	mg/L	----	----	<0.001	<0.001	----	----	----
Thorium	EG020B-W	0.001	mg/L	----	----	<0.001	<0.001	----	----	----
Tin	EG020A-W	0.001	mg/L	----	----	<0.001	**0.006**	----	----	----
Titanium	EG020B-W	0.01	mg/L	----	----	<0.01	**0.44**	----	----	----
Uranium	EG020B-W	0.001	mg/L	----	----	**0.001**	**0.002**	----	----	----
Vanadium	EG020A-W	0.01	mg/L	----	----	<0.01	<0.01	----	----	----
Zinc	EG020A-W	0.005	mg/L	----	----	<0.005	**0.011**	----	----	----
Boron	EG020A-W	0.05	mg/L	----	----	<0.05	<0.05	----	----	----
Iron	EG020A-W	0.05	mg/L	----	----	**0.38**	**4.11**	----	----	----
Tungsten	EG020E-W	0.001	mg/L	----	----	**0.032**	**0.002**	----	----	----

No Guideline Evaluation Required

Sub-Matrix: **ROCK**

Compound	Method	LOR	Unit	Lower Limit	Upper Limit	Sample ID: BH4B_6.40-6.52	BH4B_39.74-39.91	BH4B_71.0-71.20	BH4B_148.17-148.36	BH4B_419.0-419.14
						Sampling date/time: 25-Aug-2022 15:00	25-Aug-2022 15:00	25-Aug-2022 15:00	25-Aug-2022 15:00	25-Aug-2022 15:00
						ES2239415-003 MU	ES2239415-004 MU	ES2239415-005 MU	ES2239415-006 MU	ES2239415-007 MU
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)										
Final pH	EN60-DIa-G	0.1	pH Unit	----	----	**7.8**	**7.9**	**7.9**	**8.7**	**8.6**

No Guideline Evaluation Required

Sub-Matrix: **SOLID**

Compound	*Method*	*LOR*	*Unit*	*Sample ID*	Lower Limit	Upper Limit	**MB01A_26-36.5**	**MB03B_7-20**	**----**	**----**	**----**
				Sampling date/time			12-Sep-2022 15:00	12-Sep-2022 15:00	----	----	----
							ES2239415-001 MU	**ES2239415-002 MU**	**-------- MU**	**-------- MU**	**-------- MU**
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)											
Final pH	EN60-DIa-G	0.1	pH Unit		----	----	**8.7**	**8.0**	**----**	**----**	**----**

No guidelines available for this workorder

QUALITY CONTROL REPORT

Work Order	: **ES2239415**	Page	: 1 of 5
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 01-Nov-2022
Order number	: J200096	Date Analysis Commenced	: 03-Nov-2022
C-O-C number	: ----	Issue Date	: 08-Nov-2022
Sampler	: ----		
Site	: ----		
Quote number	: SY/284/22		
No. of samples received	: 7		
No. of samples analysed	: 7		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 4681728)									
ES2239415-001	MB01A_26-36.5	EG020B-W: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-W: Strontium	7440-24-6	0.001	mg/L	0.016	0.018	13.0	0% - 50%
		EG020B-W: Thorium	7440-29-1	0.001	mg/L	0.001	<0.001	0.0	No Limit
		EG020B-W: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-W: Titanium	7440-32-6	0.01	mg/L	0.10	0.11	15.1	0% - 50%
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 4681729)									
ES2239415-001	MB01A_26-36.5	EG020D-W: Gallium	7440-55-3	0.001	mg/L	0.002	0.001	0.0	No Limit
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 4681730)									
ES2239415-001	MB01A_26-36.5	EG020E-W: Tungsten	7440-33-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 4681731)									
ES2239415-001	MB01A_26-36.5	EG020A-W: Aluminium	7429-90-5	0.01	mg/L	2.39	2.46	2.6	0% - 20%
ES2239415-001	MB01A_26-36.5	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	0.0003	0.0003	0.0	No Limit
		EG020A-W: Antimony	7440-36-0	0.001	mg/L	0.016	0.016	0.0	0% - 50%
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.019	0.020	0.0	0% - 50%
		EG020A-W: Barium	7440-39-3	0.001	mg/L	0.015	0.019	23.4	0% - 50%
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	0.002	0.003	0.0	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	0.041	0.044	7.0	0% - 20%
		EG020A-W: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.001	0.003	66.5	No Limit
		EG020A-W: Thallium	7440-28-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 4681731) - continued									
ES2239415-001	MB01A_26-36.5	EG020A-W: Tin	7440-31-5	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-W: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-W: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	2.06	2.37	14.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 4681728)								
EG020B-W: Silver	7440-22-4	0.001	mg/L	<0.001	----	----	----	----
EG020B-W: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	97.9	70.0	130
EG020B-W: Thorium	7440-29-1	0.001	mg/L	<0.001	0.1 mg/L	107	85.0	115
EG020B-W: Titanium	7440-32-6	0.01	mg/L	<0.01	0.1 mg/L	93.8	70.0	130
EG020B-W: Uranium	7440-61-1	0.001	mg/L	<0.001	0.1 mg/L	101	85.0	115
EG020W: Water Leachable Metals by ICP-MS (QCLot: 4681729)								
EG020D-W: Gallium	7440-55-3	0.001	mg/L	<0.001	0.1 mg/L	106	70.0	130
EG020W: Water Leachable Metals by ICP-MS (QCLot: 4681730)								
EG020E-W: Tungsten	7440-33-7	0.001	mg/L	<0.001	0.1 mg/L	108	70.0	130
EG020W: Water Leachable Metals by ICP-MS (QCLot: 4681731)								
EG020A-W: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	87.2	81.0	121
EG020A-W: Antimony	7440-36-0	----	mg/L	----	0.02 mg/L	107	70.0	130
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	101	79.0	119
EG020A-W: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	99.5	88.0	108
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	99.6	84.0	108
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	88.7	84.0	114
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	100	81.0	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	99.0	81.0	117
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.1	83.0	115
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	88.0	84.0	112
EG020A-W: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	102	81.0	121
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	110	80.0	116
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	96.5	74.0	122
EG020A-W: Thallium	7440-28-0	0.001	mg/L	<0.001	0.1 mg/L	97.4	85.0	117
EG020A-W: Tin	7440-31-5	0.001	mg/L	<0.001	0.1 mg/L	112	81.0	121
EG020A-W: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	97.5	83.0	113
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	87.5	80.0	114
EG020A-W: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	88.6	74.0	128
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	90.8	83.0	117

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 4681731)							
ES2239415-002	MB03B_7-20	EG020A-W: Arsenic	7440-38-2	1 mg/L	96.6	70.0	130
		EG020A-W: Barium	7440-39-3	1 mg/L	98.1	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	99.8	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	96.1	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	97.2	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	102	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	87.2	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	96.7	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	103	70.0	130
		EG020A-W: Vanadium	7440-62-2	1 mg/L	94.9	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	98.8	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2239415**	Page	: 1 of 4
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: HENRY NOAKES	Telephone	: +61-2-8784 8555
Project	: J200096 Oven Mountain Pumped Storage Project	Date Samples Received	: 01-Nov-2022
Site	: ----	Issue Date	: 08-Nov-2022
Sampler	: ----	No. of samples received	: 7
Order number	: J200096	No. of samples analysed	: 7

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN60-DI: Bottle Leaching Procedure - Inorganics/Non-Volatile Organics (Glass Vessel)							
Non-Volatile Leach: 180 day HT (e.g. PFAS, metals ex.Hg) (EN60-Dla-G)							
MB01A_26-36.5, MB03B_7-20	**12-Sep-2022**	**03-Nov-2022**	11-Mar-2023	✓	**----**	----	----
Non-Volatile Leach: 180 day HT (e.g. PFAS, metals ex.Hg) (EN60-Dla-G)							
BH4B_6.40-6.52, BH4B_39.74-39.91, BH4B_71.0-71.20, BH4B_148.17-148.36, BH4B_419.0-419.14	**25-Aug-2022**	**03-Nov-2022**	21-Feb-2023	✓	**----**	----	----

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020W: Water Leachable Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020E-W)							
MB01A_26-36.5, MB03B_7-20, BH4B_6.40-6.52, BH4B_39.74-39.91, BH4B_71.0-71.20, BH4B_148.17-148.36, BH4B_419.0-419.14	**03-Nov-2022**	**04-Nov-2022**	02-May-2023	✓	**04-Nov-2022**	02-May-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite C	EG020D-W	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite E	EG020E-W	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite C	EG020D-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite E	EG020E-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite C	EG020D-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite E	EG020E-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Water Leachable Metals by ICP-MS - Suite C	EG020D-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Water Leachable Metals by ICP-MS - Suite E	EG020E-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Deionised Water Leach - Glass Leaching Vessel	EN60-DIa-G	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates

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