Report

EPGH – Construction Water Supply Hydrogeological Assessment

Water Resources - Engineering

14 April 2025

AUSS0003-0000-HG-REP-0003

Rev: 1

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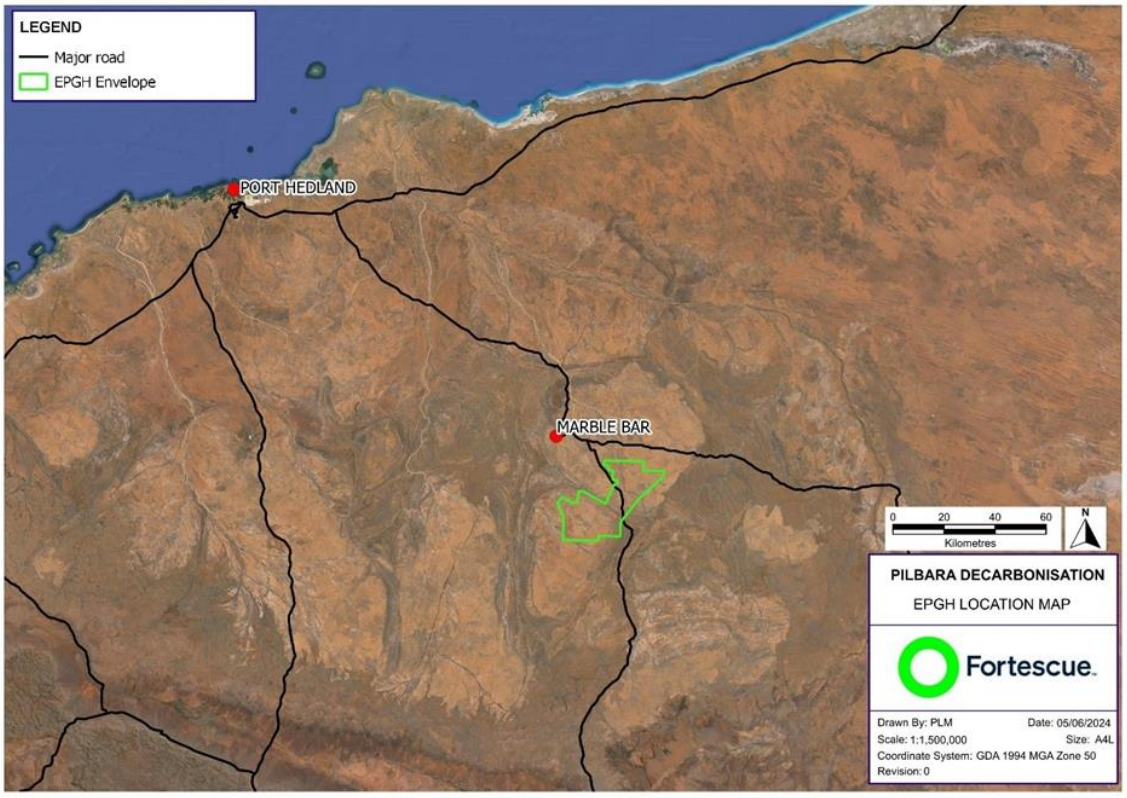
1 INTRODUCTION

The East Pilbara Generation Hub (EPGH) is a wind power generation project aiming to support decarbonisation of Fortescue Ltd (Fortescue) Iron Ore operations by supplying renewable energy to the Pilbara Energy Connect power system.

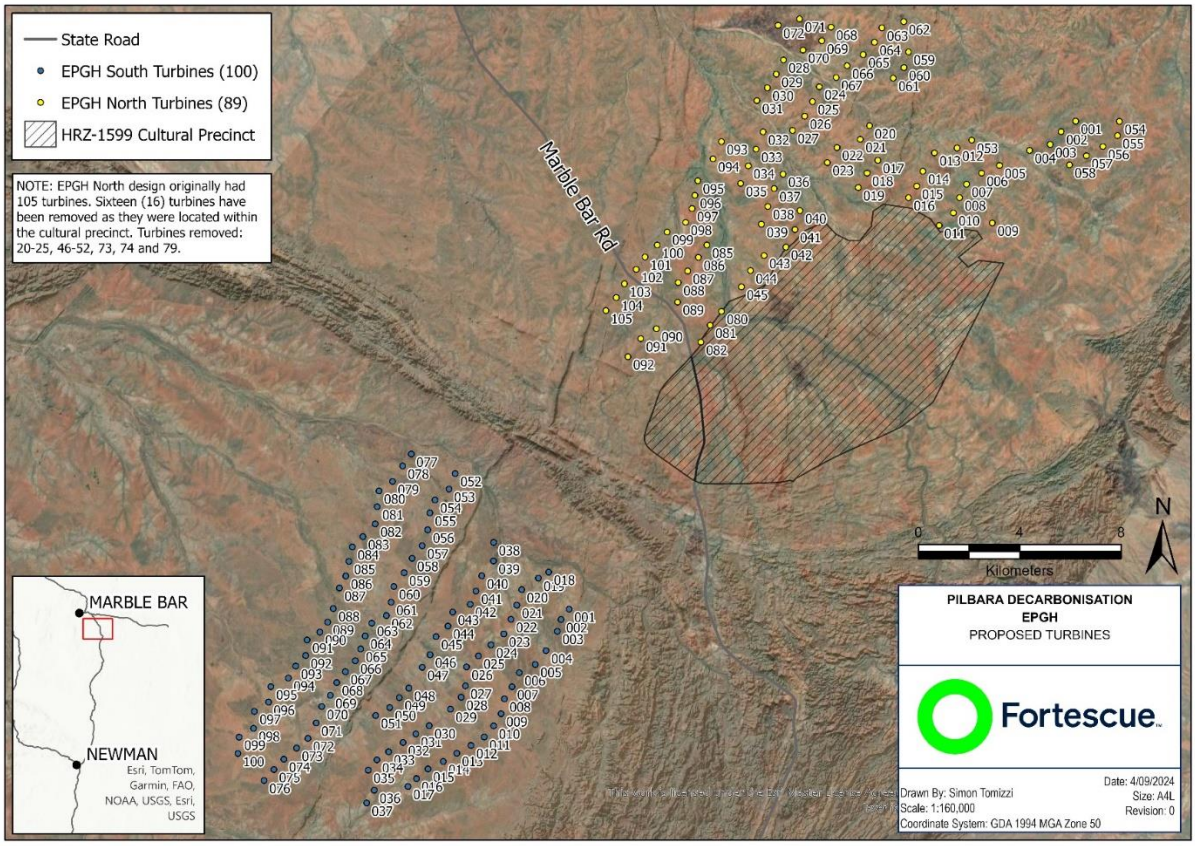
The proposed EPGH Generation Hub covers an area of 62,926 ha and is located approximately 40 km Southeast of Marble Bar and 190 km Southeast of Port Hedland as shown on Figure 1.

Figure 1: EPGH Location



A Pre-Feasibility (PFS) study has been undertaken by Fortescue to develop two specific wind turbine groups (Group 3, south of the Warrawoona Ridge divide; and Group 4, north of the divide) within the EPGH site. These proposed turbine groups are shown on Figure 2.

Figure 2: Group 3 (South) and Group 4 (North) Proposed Turbine Locations



The turbine groups have been selected based on land access and power generation potential. 100 turbines have been proposed for the Group 3 location, whilst 89 turbines have been proposed for Group 4. The energy produced by the selected turbines is to be fed into the Pilbara Energy Company (PEC) transmission network, a privately owned electrical network which connects to Fortescue's Pilbara based mine sites.

To enable construction of the EPGH, a secure water source is required. Provisional estimates indicate an annual water requirement of approximately 0.68 GL/yr (~22 L/s) for an estimated 22-month construction period. The annual usage is expected to reduce to less than 0.1 GL/yr for ongoing operations. The provisional water requirement estimates will be revised and updated prior to onsite work.

Water is intended to be sourced from aquifers at or near to the project site.

To support the environmental approvals process, a hydrogeological assessment of the project site is required to determine the potential impacts of abstraction of groundwater for project construction on surrounding environmental receptors and other groundwater users. This report presents the results of this assessment, including a description of the hydrogeological setting, results of drilling and testing and quantification of the abstraction impact. Site investigations were focussed only on the Group 3 region (Figure 2), with Group 4 investigations removed from the programme by the project team prior to site investigation commencement. Group 3 was considered the preferred location for water sourcing due to heritage constraints in the Group 4 region.

1.1 Objectives

The objectives of this assessment are to:

- Characterise the baseline hydrogeological setting in the Group 3 region, via information gathered through previous desktop assessments, regional hydrogeological data and specific onsite investigations.
- Assess the availability and sustainability of groundwater use from the onsite aquifer(s).
- Estimate the extent of groundwater drawdown (both vertically and laterally) via groundwater modelling and determine the impact of this drawdown on associated groundwater receptors and other groundwater users.
- Qualify the potential risk to the groundwater environment and groundwater receptors from any potential groundwater quality changes created as a result of the project.
- Develop a preliminary groundwater monitoring programme to measure and monitor the impacts of abstraction on the identified groundwater receptors.
- Provide a report which summarises the results of these objectives and meets the requirements of the Environmental Protection Authority's (EPA's) Part IV Environmental Impact Assessment criteria and other environmental approvals including the Rights in Water and Irrigation (RIWI) Act 5C Licence to Take Water.

1.2 Abbreviations

The following abbreviations are used in this report (Table 1).

Table 1: Abbreviations

Abbreviation	Description
BOM	Bureau of Meteorology
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EPGH	East Pilbara Generation Hub
GDE	Groundwater Dependent Ecosystem
GL/yr	Gigalitres per year
GSWA	Geological Society of Western Australia
ha	hectares
m	metres
m bgl	metres below ground level
m btoc	metres below top of collar
m/d	metres per day
mg/L	milligrams per litre
mm	millimetres
km	kilometres
L/s	Litres per second
PEC	Pilbara Energy Company
PFS	Pre-feasibility Study
RIWI	Rights in Water Irrigation
SWL	Static Water Level
uPVC	unplasticized polyvinyl chloride
µS/cm	Micro siemens per centimetre
°C	Degrees Celsius

2 BACKGROUND

2.1 Previous Studies

Three previous desktop assessments have been undertaken on the EPGH site.

In June 2022, a preliminary desktop assessment and site reconnaissance was undertaken to investigate groundwater supply potential for meeting construction and potable water demands associated the EPGH project (AUS0311-0000-HG-MEM-0001). The assessment identified the key risks associated with the use of groundwater to meet project requirements, and identified the limited superficial aquifer extent and limited prospectivity of underlying fractured rock aquifers as the key risk to the project in terms of obtaining a water supply.

In November 2022, a desktop groundwater assessment on the East Pilbara region (AUSS0003-0000-WM-MEM-0001) was completed which expanded on this preliminary

assessment. This assessment provided further characterisation of the hydrogeological setting, expanded upon the preliminary risk assessment performed in the June 2022 report and provided preliminary details for undertaking onsite groundwater investigations.

In December 2022, the desktop assessment was expanded upon again with potential drawdown impacts estimated using analytical solutions and broad estimates of hydraulic parameters (AUSS0003-0000-CI-MEM-0001). The assessment predicted the indicative extent of drawdown from abstraction using these solutions, and the subsequent estimated drawdown at key receptor locations. Additionally, the assessment highlighted the risks of abstraction in a low yielding groundwater environment.

Information from the studies described above has been used to assist in the development of this assessment.

2.2 Groundwater Allocation and Nearby 5C Licenses

To abstract groundwater for use during project construction and operations, a 5C groundwater licence must be granted by the Department of Water and Environmental Regulation (DWER), in accordance with the requirements of the RIWI Act 1914.

Groundwater allocations surrounding the EPGH site have been granted to mining companies and State-owned agencies (Water Corporation, Main Roads). Table 2 shows the current surrounding 5C licences according to DWER's online Water Register. (https://maps.water.wa.gov.au/#/webmap/register).

Table 2: Existing Nearby 5C Licenses

Water Licence Holder	Allocation (kL/yr)	Licence Number	Expiry Date	Aquifer
Keras (Pilbara) Gold Pty Ltd	2,100,000	204411	2032/9	Fractured Rock
Atlas Iron Pty Ltd	1,100,000	176960	2030/4	Fractured Rock
Nimble Resources Pty Ltd	250	204507	2030/7	Fractured Rock
Main Roads	1,000	203581	2029/11	Fractured Rock
Atlas Iron Pty Ltd	135,000	179423	2024/7	Hamersley-Fractured Rock
Atlas Iron Pty Ltd	95,000	175352	2027/2	Fractured Rock
Water Corporation	80,000	65335	2027/11	Fractured Rock

DWER have granted a 5C licence to Fortescue to allow 15,000 kL/yr to be taken for dust suppression and exploratory drilling purposes (GWL 210644(1)) at the project site. This licence allowed for groundwater use during the hydrogeological site investigations (Chapter 5) undertaken for this assessment, and will also accommodate groundwater use during a proposed future geotechnical drilling programme.

The EPGH site is located within the larger Pilbara Groundwater Management Area which consists of a mix of alluvial, sedimentary and fractured rock aquifers. The site itself is characterised as 'Fractured Rock'. Allocation limits have not been set for fractured rock aquifers as water availability is assessed on a case-by-case basis through the licensing process.

2.3 Heritage

The proposed activities lie within the Nyamal People #1 Native Title Claim Application area (WAD20/2019). Fortescue works with the Nyamal Aboriginal Corporation (NAC) to conduct heritage surveys (i.e., ethnographic, and archaeological) to identify places and items of cultural significance, and how to manage these, before any ground disturbance activity is conducted. In line with Fortescue's obligations under the Aboriginal Heritage Act (1972), all sites recorded during heritage surveys will be avoided. If after a complete heritage survey, additional potential heritage sites are identified (e.g., surface scatter), the sites are reported to the Heritage team and the areas are avoided until they can be assessed.

It is Fortescue's standard approach that, if a site of suspected or actual Aboriginal heritage significance is identified prior to or during a heritage survey being conducted or completed, the proposed activity will be adjusted to avoid the site. The risk averse approach has been discussed with the Department of Planning, Lands and Heritage (DPLH) and endorsed, as it provides a high level of protection for heritage sites.

All works will be undertaken in line with current statutory regulations including the requirements of the Aboriginal Heritage Act (1972). Fortescue confirms that engagement with NAC has been undertaken to identify places and items of cultural significance in the proposed activities and Fortescue will continue to engage with the NAC regarding future surveys and approvals.

Investigations in the Group 4 region were removed from the programme due to heritage constraints.

3 REGIONAL SETTING

3.1 Climate

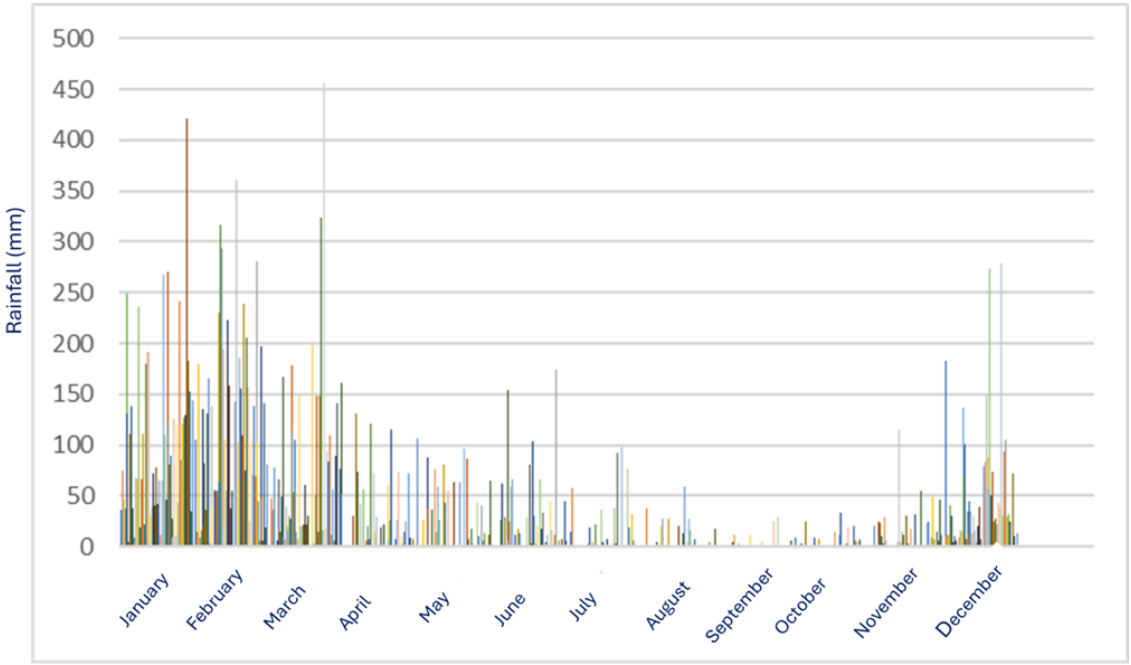
The Pilbara region is a semi-arid to arid environment characterised by hot summers and warm winters. The region experiences climate extremes, where severe droughts and major floods can follow in close succession.

Average annual rainfall is 375 mm per year (1957-2023) with a range of 200 to 630 mm per year. Rainfall is highly seasonal with approximately 70 % of the annual total occurring between December and March. It is typically associated with tropical low-pressure systems and thunderstorm activities from the monsoonal trough that develops over northern Australia during summer. Winters are typically dry and mild though winter rain events can occur in June and July as a result of tropical cloud bands that intermittently affect the area.

The mean annual Class A pan evaporation estimated for the area (from BoM gridded data, 1975 to 2000) is approximately 3,365 mm, which exceeds the mean annual rainfall keeping the landscape typically dry.

Monthly rainfall data for the period 1957-2003 at the nearby Warrawagine station is shown in Figure 3.

Figure 3: SILO Point Data for Warrawagine Meteorological Station During 1957-2023

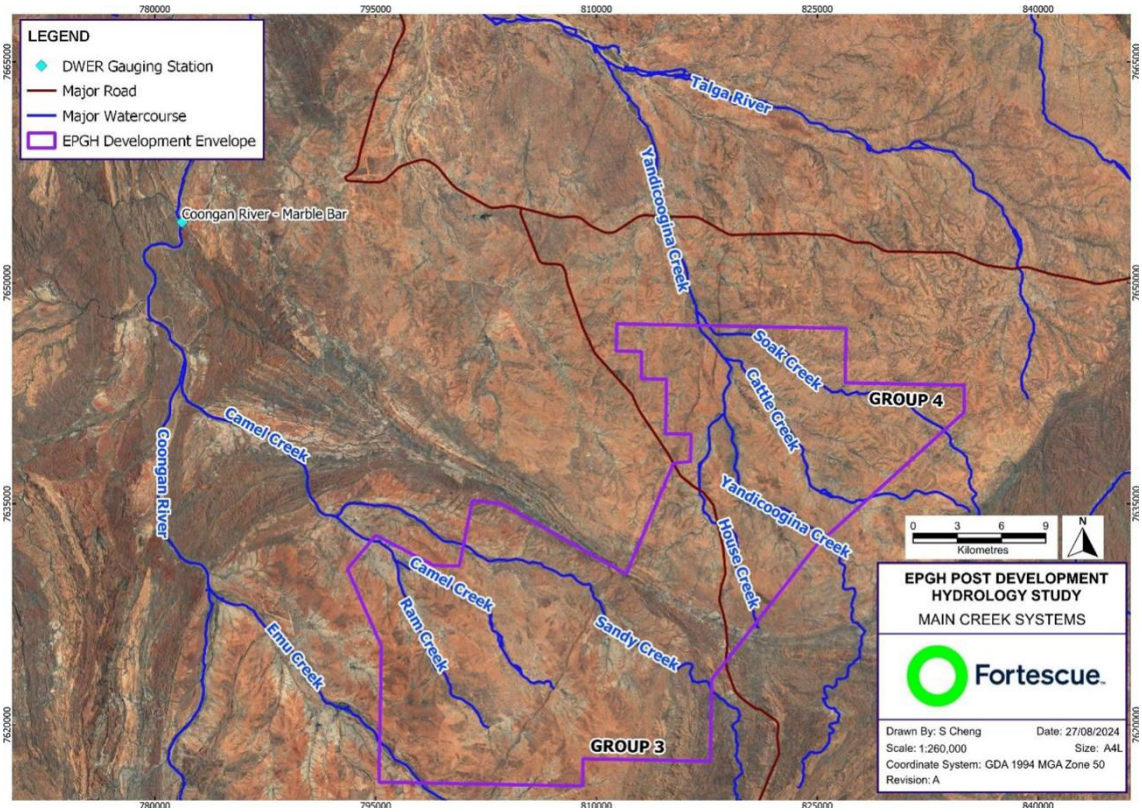


3.2 Hydrology

The EPGH development area is located within the Coongan River catchment, which has a total area of approximately 7,090 km^2. The headwaters of the Coongan River rise from the Chichester Range. The river flows in a northerly direction past Marble Bar then through the Gorge Range before discharging into the De Grey River, approximately 115 km downstream of EPGH. Major tributaries of the Coongan River include Camel Creek, Talga River and Emu Creek.

The main creek systems of the EPGH area are presented in Figure 4. The contributing catchments of the development area (Camel Creek catchment for Group 3 in the south and Yandicoogina Creek catchment for Group 4 in the north) generally drain in a north-westerly direction towards the Coongan/Talga Rivers.

Figure 4: Sub Catchment Areas Crossing the EPGH Area (and Associated Tenements) (Source: AUSS0003-0000-HG-REP-0002_0_IFU_03)



Inspection of the 1:250,000 topography maps and Fortescue's internal environmental datasets within these river basins show no permanent pools within these sub-catchments.

Flow gauging data across the region indicates the Coongan River (and creeks nearby) are ephemeral with runoff limited to significant rainfall events. Typically, over three quarters of the annual streamflow occurs during January, February and March with local rivers usually drying up around July or August. The closest flow gauging station is on the Coongan River at Marble Bar. The station covers a catchment area of 3,750 km^2. Surface flow data indicates variable annual and monthly flows with several order of magnitude differences between minimum and maximum values. The Coongan River median annual flow at Marble Bar is in the order of 144 GL/year which represents an average runoff yield of about 11% (Calidus 2019).

3.3 Geology

The project lies in the East Pilbara terrain of the Pilbara Craton, which consists of a series of granitic complexes intruding greenstone belts formed by metamorphosed volcanic and sedimentary units. More than half of the East Pilbara envelope towards the east is covered by granodiorites to monzodiorites and their weathered products (GSWA 1:100k Geology Map). In contrast, the area to the west is dominated by metamorphosed volcanic sequences including the Kylena Formation and Mount Roe Basalt (massive, amygdaloidal and vesicular basalt and andesites with local komatiitic basalt).

The surface geology consists of Colluvium, formed by scree, gravel, sand and silt and form dissected talus and sheetwash aprons that flank elevated areas of exposed rocks. Younger colluvial and alluvial material form extensive areas of floodplain further north.

Alluvial deposits occupy the present drainage channels, and they have also formed on the floodplains and deltas of major rivers (Ferguson and Ruddock, 2001). They consist of unconsolidated or partly consolidated clay, silt, sand, and gravel. In many floodplains areas clayey silt forms an irregular rough surface called ‘gilgai’ (or crabhole) country characterized by numerous cracks and small sinkholes.

The thickness of the colluvial and alluvial deposits is variable across the site, but generally between 3 and 10m.

Bisecting the Group 3 site area is a northeast-southwest trending dyke ridge line consisting of Dolerite, Basalt and Quartz. The ridge line shows relief up to 50m and is generally of moderately inclined slope.

Site geology is shown in Figure 5, which shows:

- East Pilbara granitic complex represented in shades of pink (A-Embo-gmap (Carbana Monzogranite), A-Embo-mgmz (Munganbrina Monzogranite))
- Metasediments and greenstone belt shown in green/orange (Panorama Formation and Euro Basalt units)
- Alluvial sediments in yellow (A1c).

The distribution of alluvial and colluvial sediments is further detailed in Figure 6.

Figure 5: Site Geology (Modified from 1:100k State Map Interpreted Bedrock Geology)

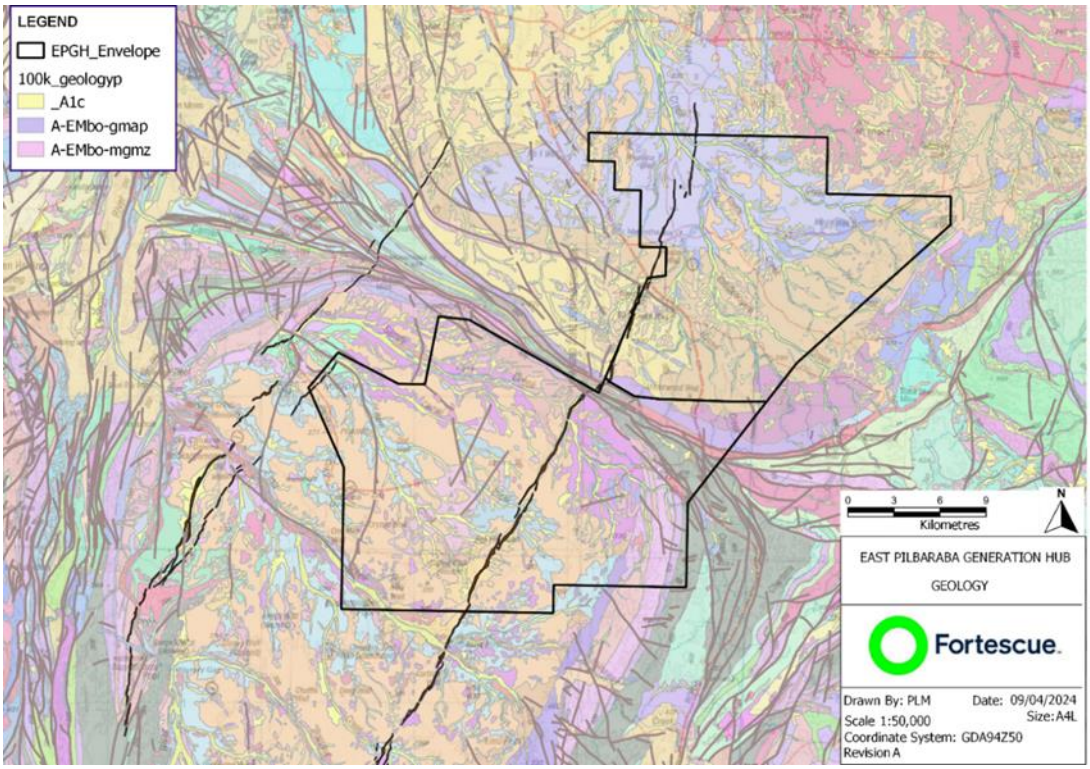
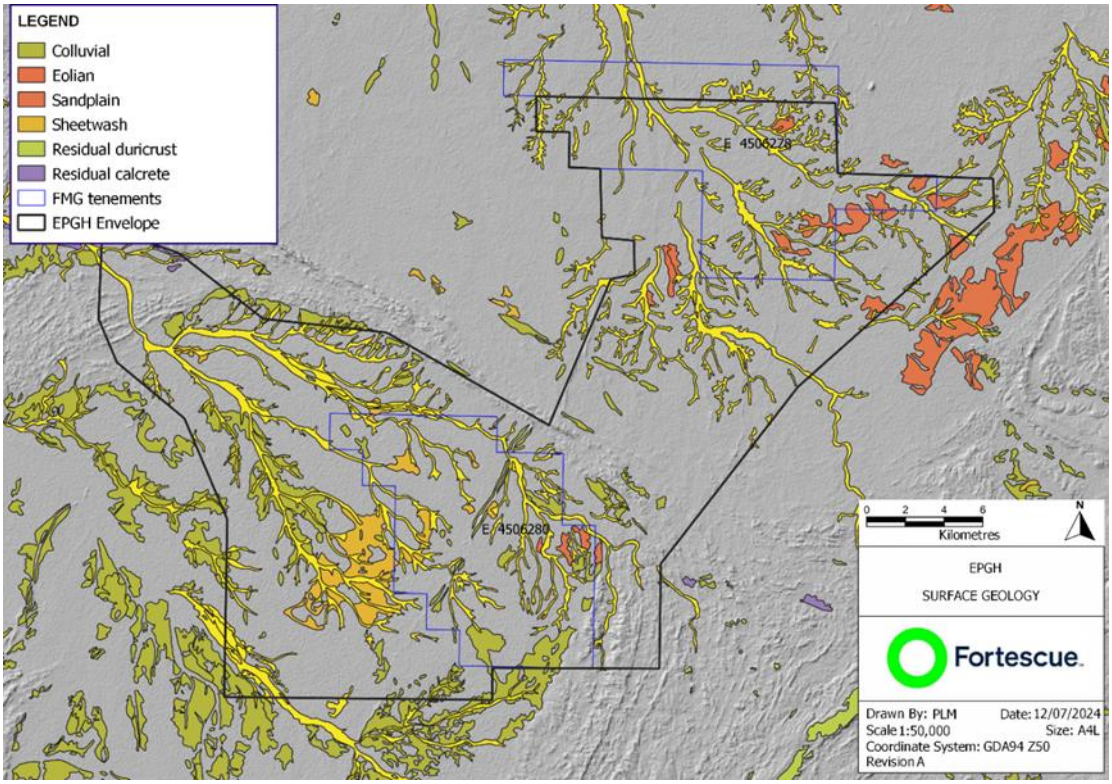


Figure 6: Surface Geology at EPGH



3.4 Hydrogeology

The Project site is situated within the regional Pilbara groundwater proclaimed area. Potential groundwater resources in this region include:

- Tertiary Alluvials and Superficial sediments, that follow minor drainage lines and large river systems.
- Fractured/weathered bedrock, primarily within BIF formations within the Hamersley Basin and within lesser explored granitic terrain in the East Pilbara.
- Intermediate depth sheared zones, within the greenstone belt that host metallic mineralization (e.g., Warrawoona).

There is limited data related to groundwater resources around the Project area. The nearby Corunna pastoral station contains several bores for pastoral supply, which provide some information. Although bore construction details are unknown, it is expected they are screened in the shallow alluvial aquifer.

The site is expected to feature a superficial aquifer of limited thickness (approximately 3-10m) hosted in the alluvial sequence, overlying potential weathered and fractured rock aquifers linked to faults and fractures in the Granite basement. The site is bisected in the south by a major dyke striking southwest-northeast, which may compartmentalise the aquifer systems, and/or potentially facilitate groundwater flow across its margins. The northern and southern areas of the site are separated by a greenstone belt which likely host aquifers associated with shearing (Figure 5).

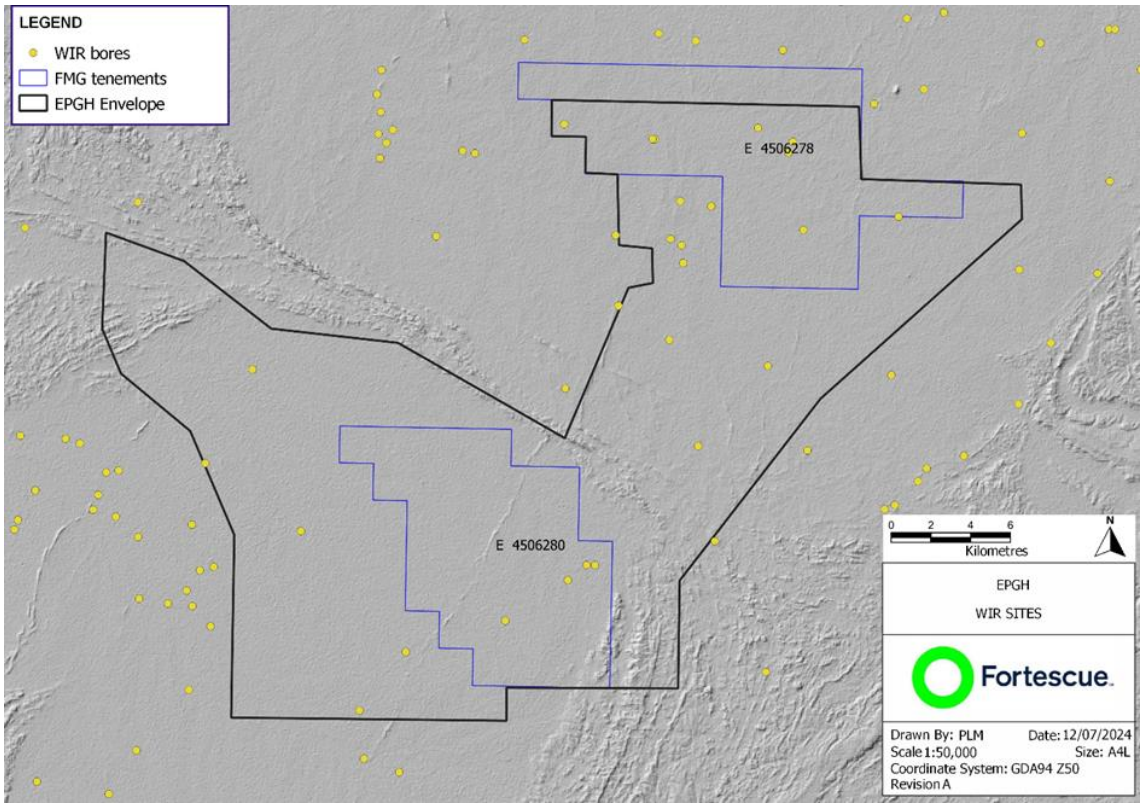
The underlying fresh granitic bedrock likely has little to no storage and permeability in absence of secondary features.

An inspection of the Water Information Reporting database from the Department of Water website (DWER, 2024) indicates the existence of 25 bores within the EPGH envelope (Figure 7). Unfortunately, data from these bores is limited since many bores have been destroyed or abandoned. From those bores with water level records, most show Static Water Levels (SWL) within 0-5 mbgl and fewer, within 5-10 mbgl. Groundwater levels measured from pastoral bores range from about 2 to 7m bgl.

Salinity ranges from 500 to 1,000 mg/L for bores with shallow groundwater levels, whereas an increase in salinity is generally observed for bores with a deeper groundwater level (1,000-2,000 mg/L), and generally towards the west of the East Pilbara envelope. Recent groundwater sampling conducted by Fortescue (AUSS0003-0000-WM-MEM-0009) on nearby pastoral wells indicated electrical conductivity values between 950 and 2,082 µS/cm, with pH ranging from 7.8 to 8.4, and water chemistry indicating a bicarbonate-sodium, bicarbonate-chloride-sodium type.

Indicatively, and as shown in Figure 7, the absence of bores in the southern area of the project envelope (Group 3), where water sourcing is proposed, could point to limited prospectivity for groundwater yields in this area.

Figure 7: Regional Bore Locations (from DWER Water Information Reporting (WIR) Database)



Little information is available on aquifer permeability at the site and surrounding areas. Pastoral bores are believed to provide low yields. Drilling programmes at the neighbouring Warrawoona Project, approximately 10km northwest of the Group 3 site, targeting fractured and sheared bedrock aquifers, were unable to identify significant groundwater yields. Out of a total of 24 bores completed during the hydrogeological investigations, 16 (67%) exhibited airlift yields less than 1 L/s with the remaining six (25%) being dry. A hydrogeological numerical model from the Warrawoona Project indicated hydraulic conductivity values of (Groundwater Resource Management, 2019):

- 0.03 m/d (Weathering zone/saprolite)
- 0.02 m/d (upper bedrock)
- 0.005 m/d (lower bedrock)
- 0.3 m/d (shear zones)
- 1.0 m/d (high permeability structures).

The groundwater system within the project area is likely limited in storage and is highly dependent on direct rainfall recharge to the local aquifers. The project area receives limited groundwater throughflow due to its location within the upper part of the catchment.

4 EXISTING GROUNDWATER USE AND RECEPTORS

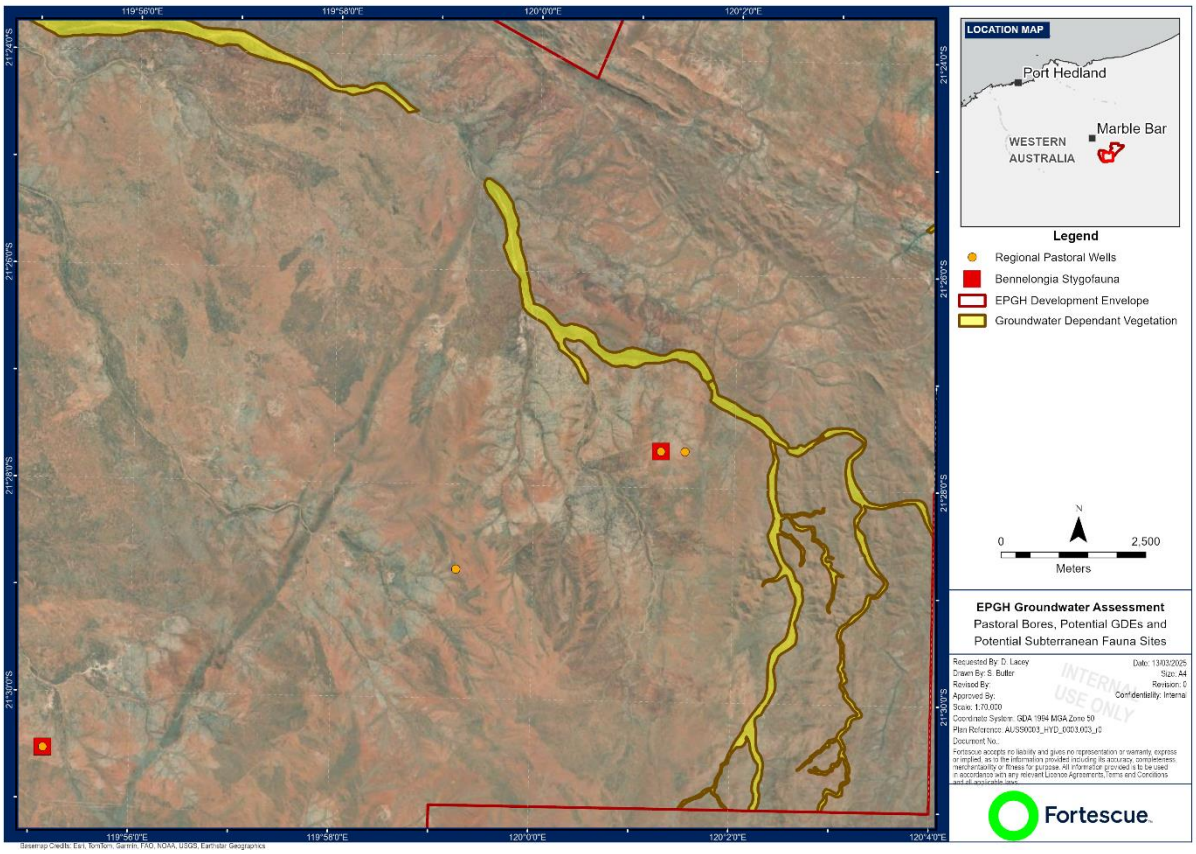
4.1 Other Groundwater Users

The Project area is partially covered by the Corunna Downs Pastoral Lease Station. The station has 24 stock bores (likely shallow) which constitute the only users of groundwater within the EPGH envelope. Two of these bores, Links Well and Tony's Well, lie within the proposed Group 3 area where groundwater for project needs is intended to be sourced. Depths of these bores were measured in 2023 (AUSS0003-0000-WM-MEM-0009) at 10.0 and 10.85 m bgl respectively, indicating likely screening in the shallow alluvial/colluvial sediments. Additional information collected from these bores during the 2023 sampling trip included:

- Groundwater levels: (Links Well – 7.21 m btoc; Tony's Well 8.30 m btoc)
- Electrical Conductivity: (Links Well – 950 µS/cm; Tony's Well 1,741 µS/cm)
- pH: (Links Well – 7.47; Tony's Well 7.31).

Locations of Links Well and Tony's Well are provided in Figure 8.

Figure 8: Pastoral Bores, Potential GDEs and Potential Subterranean Fauna Sites



Beyond the Corunna Downs Pastoral Station, there are two mining projects within a 20 km radius from EPGH. The Warrawoona Gold Project (Calidus 2019) is located within the

Brockman Hay Cutting Creek Catchment, to the north and west from the Project envelope and ~ 10 km away.

The McPhee Creek Project (Atlas Iron) located ~17 km southeast from EPGH Project area is due to start construction in late 2025.

There are no other significant groundwater users or stakeholders around the EPGH Project area.

4.2 Groundwater Dependent Ecosystems (GDE)

The Bureau of Meteorology cadastre defines the distribution of Groundwater Dependant Ecosystems (GDEs) in Australia. The area falls within a low potential GDE zone according to the BOM's national assessment (BOM, 2024).

Recent flora mapping identified areas of groundwater dependent vegetation or potential groundwater dependent vegetation. Preliminary areas identified as groundwater dependent vegetation (or potentially dependent) are shown on Figure 8.

Permanent, semi-permanent and intermittent pools may be associated with current day drainage lines. However, no pools were identified during an initial site reconnaissance trip in April 2022 (AUS0311-0000-HG-MEM-0001).

4.3 Subterranean Fauna

Subterranean fauna live below ground and consist mostly of small invertebrates that can be divided into two groups: aquatic stygofauna living in groundwater and air-breathing troglofauna living in the unsaturated zone between the water table and the lower layer of surface soil (Bennelongia, 2022).

Fortescue Energy engaged Bennelongia in 2022, to conduct a subterranean fauna assessment in the region to support environmental approval requirements. The results of the 2022 assessment showed (Bennelongia, 2022):

- A database search around the project area indicates the existence of a rich stygofauna distribution with 914 records, representing 167 species.
- The stygofauna community in the search area consists mainly of copepods, amphipods, and ostracods, which represents over 60% of the stygofauna recorded for the area.
- Regional scale modelling of stygofauna distribution in the Pilbara related to geology and other environmental factors suggest that suitable habitats for stygofauna are likely to be widespread in the project area, however, the current available biological and geological information is not detailed enough to quantify the stygofauna richness and distribution with confidence.
- Following the results of the desktop assessment and database search, a pilot stygofauna survey was completed to evaluate the community present.
- A relatively high abundance and diversity of stygofauna was collected, and it is likely that these animals occur throughout the Project area as all eight bores surveyed yielded stygofauna species.

- A total of 185 specimens of at least 19 stygofauna species were collected from the sampling area. Of these, four species are only known from the Project: Bogidiella `BAM216`, Paramelitidae `BAM214`, Paramelitidae Genus 2 `BAM215`, and the Harpacticoid copepod Parastenocaris `BHA331`. It is considered unlikely that these four species are restricted to the Project area as the same geological formations are found inside and outside of the boundaries, although further sampling will be required to determine the likely ranges of these species and their presence outside of the Project's development envelope.

The locations of stygofauna recorded from the Group 3 project area, where investigations are focussed, are shown on Figure 8.

5 GROUNDWATER SITE INVESTIGATIONS

Due to the absence of site-specific hydrogeological information and the subsequent gaps in hydrogeological understanding of the project site, a groundwater exploratory drilling investigation was developed. The investigation was intended to:

- Characterise the hydrogeological setting at the EPGH site (Group 3).
- Understand the sustainability of the resource, and the impact to the aquifer(s), environmental receptors and other groundwater users from abstraction of the groundwater volumes required for construction (to inform required environmental approvals).
- Provide production bores to meet or partially meet the groundwater abstraction requirements (Note: development of the full production borefield will be undertaken as part of a separate (and later) scope of work).

Specifically, the objectives of the investigation were to:

- Drill a series of investigation pilot holes to ascertain suitability for water supply.
- Convert pilot holes of suitable yield to production bores and complete test pumping.
- Drill and install a series of monitoring bores to characterise the baseline hydrogeological setting and provide key monitoring data to inform the environmental approvals associated with the project.

The investigation commenced in September 2024 and was completed in December 2024. Drilling was undertaken in accordance with the conditions of 26D Licence to Construct or Alter Well CAW210169(1) (**Appendix A**).

The results of the investigation are detailed in the following sections.

5.1 Drilling and Bore Construction

A series of locations were identified for pilot hole drilling, with selected locations based on:

- Interpreted prospective targets identified from geological and geophysical maps (particularly faults and lineaments identified in regional geophysics).
- Type and extent of geological units.

- Spatial distribution (to characterise the groundwater setting over the extent of the Group 3 site).

Drill sites were intended to be partially informed by geophysics surveys and permeability assessments of existing pastoral wells, however these surveys and assessments were not able to be undertaken due to landholder permissions and other constraints.

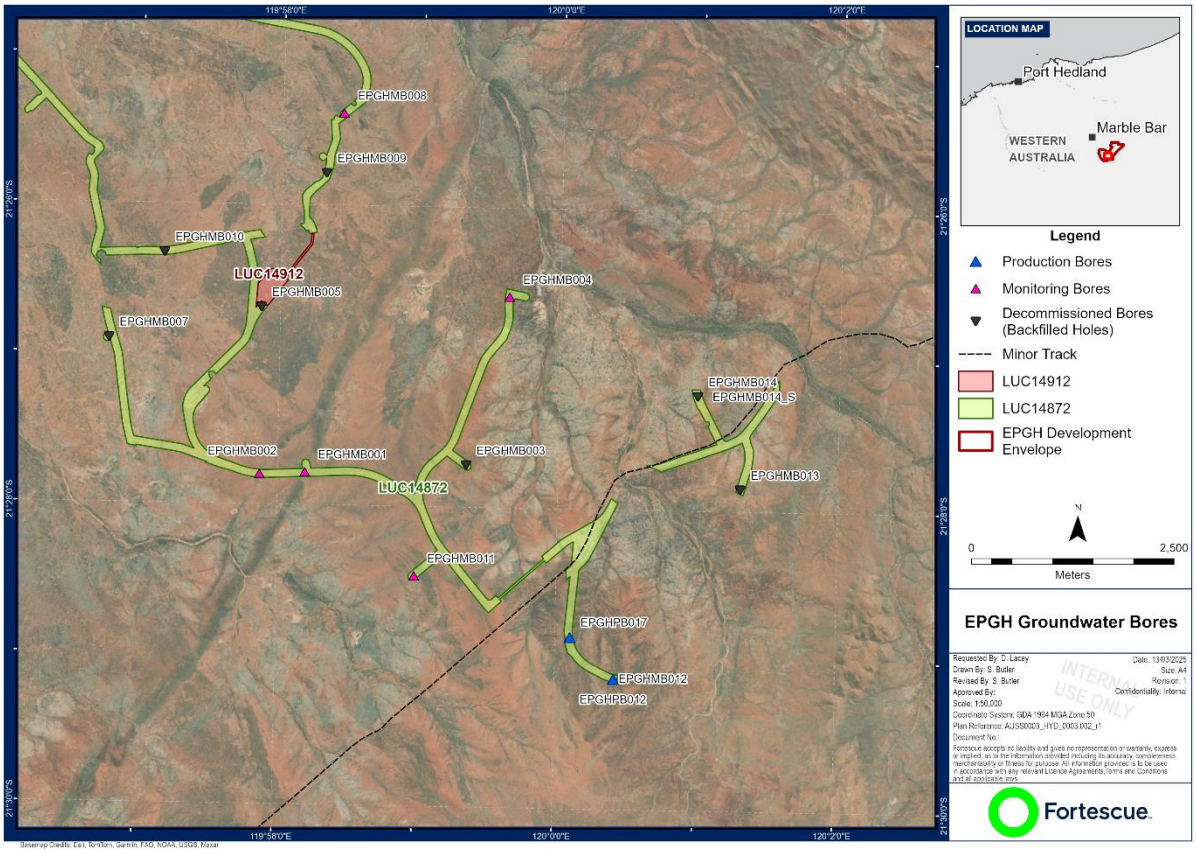
Locations were refined to allow for restrictions imposed by:

- Access constraints
- Identified heritage restriction zones (HRZs)
- Proximity to major creek lines (at least 400m distance)
- Proximity to existing bores (at least 400m distance).

Furthermore, all locations were restricted to the Group 3 area, due to the relative abundance of HRZs in the Group 4 area.

In total, 15 pilot holes were drilled as part of the programme. Pilot hole locations, including identification of final hole status (production bore, monitoring bore, decommissioned/backfilled hole) are displayed in Figure 9.

Figure 9: Drilling Locations



The drilling investigation commenced on 9th September 2024 and was completed on 11th December 2024. Details of the drilling and bore construction are provided in Table 3.

Table 3: Drilling and Bore Construction Summary

Site ID	Easting (MGA, Z50)	Northing (MGA, Z50)	Status	Drilled Depth (m bgl)	Cased Depth (m bgl)	Casing	Slotted Interval (m bgl)	PVC stick up (m agl)
EPGH-MB001	807,798	7,623,681	Monitoring Bore	19	19	50mm Class 12 PVC	7-19	0.36
EPGH-MB002	807,238	7,623,660	Monitoring Bore	75	25	50mm Class 12 PVC	15-25	0.38
EPGH-MB003	809,788	7,623,763	Pilot Hole only	20	N/A	N/A	N/A	N/A
EPGH-MB004	810,328	7,625,831	Monitoring Bore	8	8	50mm Class 12 PVC	5-8	0.44
EPGH-MB005	807,268	7,625,718	Pilot Hole only	19	N/A	N/A	N/A	N/A
EPGH-MB007	805,386	7,625,353	Pilot Hole only	8	N/A	N/A	N/A	N/A
EPGH-MB008	808,290	7,628,100	Monitoring Bore	20	17	50mm Class 12 PVC	5-17	0.31
EPGH-MB009	808,074	7,627,366	Pilot Hole only	12	N/A	N/A	N/A	N/A
EPGH-MB010	806,075	7,626,401	Pilot Hole only	15	N/A	N/A	N/A	N/A
EPGH-MB011	809,142	7,622,398	Monitoring Bore	22	17	50mm Class 12 PVC	11-17	0.41
EPGH-MB012	811,603	7,621,131	Monitoring Bore	27	24	50mm Class 12 PVC	18-24	0.42
EPGH-MB013	813,169	7,623,453	Pilot Hole only	17	N/A	N/A	N/A	N/A
EPGH-MB014	812,649	7,624,604	Pilot Hole only	40	N/A	N/A	N/A	N/A
EPGH-PB012	811,600	7,621,122	Production Bore	67	48	150mm Class 12 PVC	15-48	0.59
EPGH-PB017	811,064	7,621,637	Production Bore	86	84	150mm Class 12 PVC	24-84	0.45

Pilot hole drilling was undertaken using dual rotary methods, with the outer casing installed through surficial sediments, however once fresh bedrock was intersected, the hole was drilled via conventional open hole air drilling methods. Pilot holes were drilled at 200mm

diameter and reamed to 250mm for production bore installations, remained at 200mm for monitoring bore installations, or backfilled if dry.

The production bores were cased with 150mm Class 12 uPVC casing and slotted across the weathered and fractured granite zones. Monitoring bores were cased with 50mm Class 12 uPVC. All finished bores were gravel packed from the base of hole to 6m bgl, prior to placement of a 1m bentonite seal and 5m cement seal back to ground surface. For production bores, 200mm steel surface casing was installed to a depth of 6m bgl.

Completed bores were finished with a cemented in steel riser to approximately 0.5m agl to protect the above ground PVC stick up.

Completed bores were developed using jetting and airlifting techniques to remove drilling fluid and sediment from inside the bore water column.

Upon completion of the investigation, all finished bores were surveyed for easting, northing and ground level elevation (Table 4).

5.2 Hydrostratigraphy

Drill cuttings were laid out on each respective drill pad in sequential order, to allow collection of washed lithological samples (in chip trays) and subsequent lithological logging of each pilot hole. The cuttings were laid out in 2m intervals.

Pilot hole drilling indicates relative consistency with respect to the stratigraphic profile, which consists of:

- A superficial sequence of alluvial and colluvial sediments, consisting of brown, silty and sandy, poorly sorted, sub rounded to sub angular gravels, generally 2m to 8m thick but potentially thicker to the east. The alluvial/colluvial sediments appear to be dry.
- An underlying unit of brown, pink and grey weathered granite, generally 2m to 16m thick. The weathered granite appears to host the water table and is saturated through the majority of its thickness.
- An underlying basement of fresh granite, with alternating dominance of biotite and/or amphibole minerals and pink orthoclase feldspar, with little to no fracturing. The fresh granite appears to be dry.

The exception to the above occurred at EPGH-PB017. Pilot hole drilling at this site indicated a thick zone of fracturing and clay infill, with fracturing initially intersected in the weathered-fresh transition zone at 26m bgl. A series of fractures were intersected down to 72m bgl, with clay infill zones predominantly between 26 and 42m bgl. The fractures were dry to a depth of 52m, where first groundwater intersection occurred.

Thickness of the alluvial and weathered layers vary, however appear to thicken towards the east and south of the Group 3 area.

Bore construction diagrams, including lithological logs, were prepared for each final production bore, monitoring bore and completed pilot hole. Construction diagrams are provided in **Appendix B**.

5.3 Hydrogeological Data

Key hydrogeological data was captured during the drilling and bore development stages of the investigation. First groundwater strike was recorded during pilot hole drilling, whilst flow rates and groundwater quality data were also recorded if yields were sufficiently high. At completion of development, a static water level (SWL) was measured.

A summary of hydrogeological data collected during the investigation is provided in Table 4.

Table 4: Hydrogeological Data Summary

Site ID	Status	Ground level (mAHD)	First Water Strike (m bgl)	Drilling Yield (L/s)	Development Yield (L/s)	EC (µS/cm)	pH	SWL (m bgl)	SWL (m AHD)
EPGH-MB001	Monitoring Bore	312.37	8	0.2	0.01	730	8.66	12.30	300.1
EPGH-MB002	Monitoring Bore	308.93	20	0.1	0.1	823	8.71	13.10	295.9
EPGH-MB003	Decommissioned Pilot Hole	317.93	Dry	N/A	N/A	N/A	N/A	N/A	N/A
EPGH-MB004	Monitoring Bore	307.99	Dry	N/A	N/A	N/A	N/A	6.96	301.0
EPGH-MB005	Decommissioned Pilot Hole	298.57	Dry	N/A	N/A	N/A	N/A	N/A	N/A
EPGH-MB007	Decommissioned Pilot Hole	291.47	Dry	N/A	N/A	N/A	N/A	N/A	N/A
EPGH-MB008	Monitoring Bore	291.61	Dry	N/A	N/A	N/A	N/A	11.69	279.9
EPGH-MB009	Decommissioned Pilot Hole	287.95	Dry	N/A	N/A	N/A	N/A	N/A	N/A
EPGH-MB010	Decommissioned Pilot Hole	293.98	Dry	N/A	N/A	N/A	N/A	N/A	N/A
EPGH-MB011	Monitoring Bore	319.77	15	0.1	0.1	670	8.88	12.59	307.2
EPGH-MB012	Monitoring Bore	329.03	19	1.8	0.4	810	8.42	13.61	315.4
EPGH-MB013	Decommissioned Pilot Hole	321.33	Dry	N/A	N/A	N/A	N/A	N/A	N/A
EPGH-MB014	Decommissioned Pilot Hole	313.73	6	0.2	N/A	N/A	N/A	N/A	N/A
EPGH-PB012	Production Bore	329.12	19	2.0	2.0	830	8.44	13.62	315.4
EPGH-PB017	Production Bore	326.08	52	1.0	0.5	764	8.58	12.22	313.9

Drilling and bore development results indicate a generally dry alluvial sequence at the time of drilling, with local, limited groundwater yields interested within or at the base of the weathered granite. The yields diminish upon intersection of the fresh granite, which appears

dry, however EPGH-PB017 intersected yields of 1 L/s from deeper weathered and fractured zones (from 52m to 72 m bgl).

The results of drilling indicate limited groundwater sources at the site, with many holes dry at the completion of pilot hole drilling. Furthermore, drilling yields on pilot holes that did intersect groundwater indicate low yielding aquifers, with yields generally less than 0.2 L/s. However, results at EPGH-MB004 and EPGH-MB008 indicate that although many pilot holes may be dry during drilling, gradual seepage may enter the holes over time, with both pilot holes indicating dry conditions during drilling yet recording groundwater levels of 6.96 and 11.69m bgl respectively post monitoring bore construction. This gradual seepage is further evidence of a low yielding, low permeability aquifer.

Bore development yields range from 0.01 to 2 L/s. Higher yielding pilot holes appear located to the south-east of the site, and appear to coincide with a thicker alluvial and weathered bedrock sequence. Pilot holes with yields in excess of 1 L/s were converted to production bores (EPGH-PB012 and EPGH-PB017). Groundwater yields at some holes (EPGH-PH014 and EPGH-MB002) diminished over time, indicating that groundwater storage may be limited in the local weathered bedrock unit.

Groundwater levels range from 6.96 to 13.62m bgl, equating to an elevation range of 279.9 to 315.4m AHD, decreasing to the northwest. Due to time constraints, only a post programme ‘snapshot’ of groundwater levels could be obtained, and it is expected that these elevations represent likely seasonal lows as drilling occurred prior to significant storm events. Groundwater recharge from storm events in the Pilbara region is known to rapidly impact groundwater levels, with variations (increases) by as much as 5m.

Groundwater quality is fresh to brackish and slightly alkaline, with electrical conductivity (EC) ranging from 670 to 830 µS/cm and pH from 8.42 to 8.71. Groundwater levels are consistent to this point, in the range of 13.1 to 13.6m bgl.

5.4 Aquifer Testing

Upon completion of the drilling investigation, Aquifer testing was undertaken on all completed bores to determine aquifer properties and hydrogeological relationships between units. Aquifer testing included slug tests on all monitoring bores and pumping tests on production bores. Slug tests are discussed further in Section 5.4.3. This section discusses the completion of pumping tests on EPGH-PB012 and EPGH-PB017.

Short-term pumping tests were undertaken on completed production bores EPGH-PB012 and EPGH-PB017 at the completion of the drilling and bore construction. The tests included a constant rate test (CRT) and a subsequent recovery test.

A CRT involves the pumping of a bore at a constant discharge rate and monitoring the responses in the pumped bore and in the adjacent aquifers via monitoring bores. A CRT is performed to provide aquifer parameters (Transmissivity, hydraulic conductivity and storativity) and to show expected drawdowns as a result of long-term pumping in the surrounding aquifers. Potential changes in groundwater chemistry can also be determined through the CRT.

At the cessation of the CRT, a recovery test is performed, whereby the recovery in water levels in the pumped bore is measured. A recovery test allows confirmation of the aquifer

parameters obtained during the CRT, and provides general indications of how quickly an aquifer will recover when pumping ceases.

CRT and recovery tests were undertaken between the 2nd and 5th of December 2024. The CRT at EPGH-PB012 was conducted for a period of 10 hours, with recovery measured for a period of 14 hours (overnight via data logger) following the completion of the CRT. The bore was pumped at a rate of 2.2 L/s from a pump inlet depth of 33m.

The CRT at EPGH-PB017 was conducted for a period of 54 minutes, prior to the pump being switched off due to the water level inside the bore reaching close to the pump inlet and the flow rate not able to be adjusted on the pump. Recovery was measured for a period of 270 minutes.

Pumped water was discharged into the nearby sump dug on the drill pad during the CRTs. Flow rates were measured using a flow meter, with water levels logged using data loggers and measured manually via an electronic water level meter. Levels were measured in both EPGH-PB012 and the nearby monitoring bore EPGH-MB012 (approximately 10m away) during the EPGH-PB012 CRT. Similarly, EPGH-MB012 was used as a monitoring bore for the EPGH-PB017 test, however no groundwater level response was recorded in this bore.

Field readings of EC, pH and temperature were measured during the CRT to monitor potential groundwater quality changes. A sample was collected during the first and last hours' of each CRT and submitted to ALS Laboratories for groundwater quality analysis.

5.4.1 Results

Results of the CRTs are presented in Table 5 and Table 6. Time Vs Drawdown curves for the CRTs are presented in Figure 10 and Figure 11. Recovery test graphs are provided in **Appendix C**. Laboraotry analysis certificates are provided in **Appendix D**.

Figure 10: EPGH-PB012 CRT Time Vs Drawdown Curve

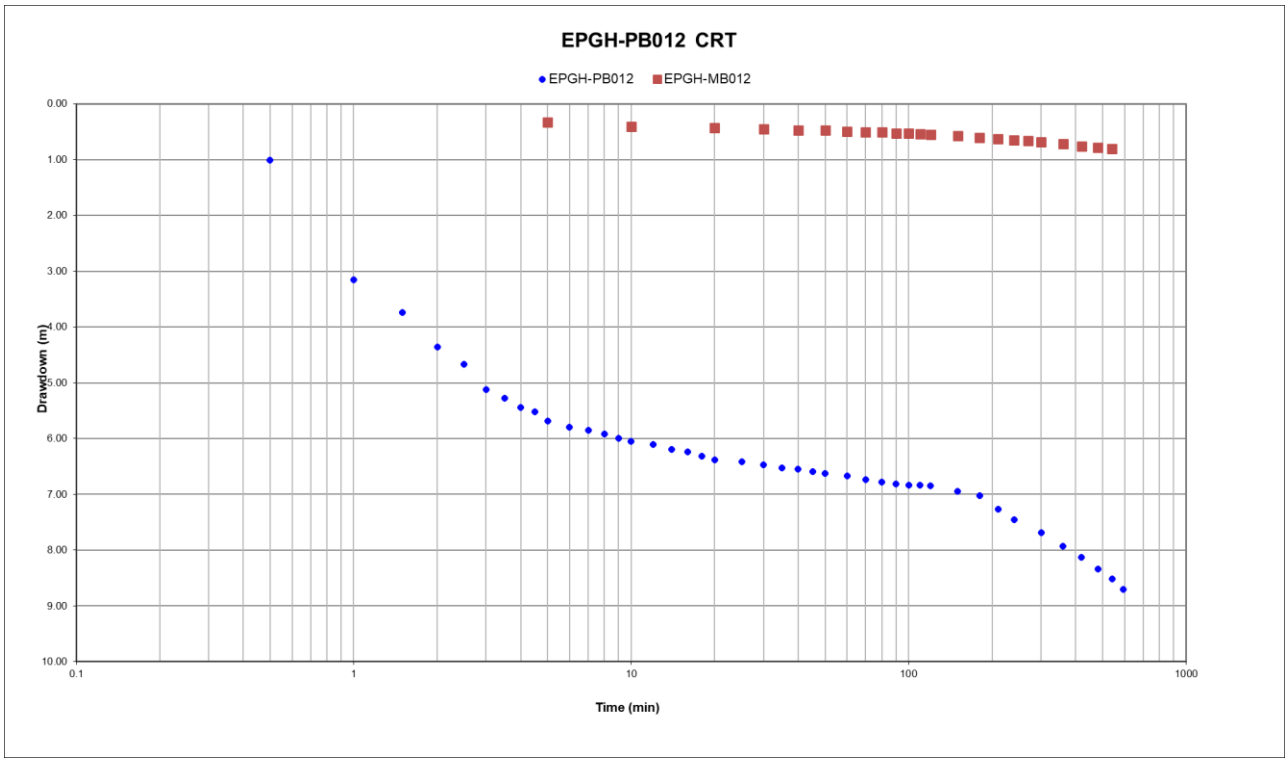


Figure 11: EPGH-PB017 CRT Time Vs Drawdown Curve

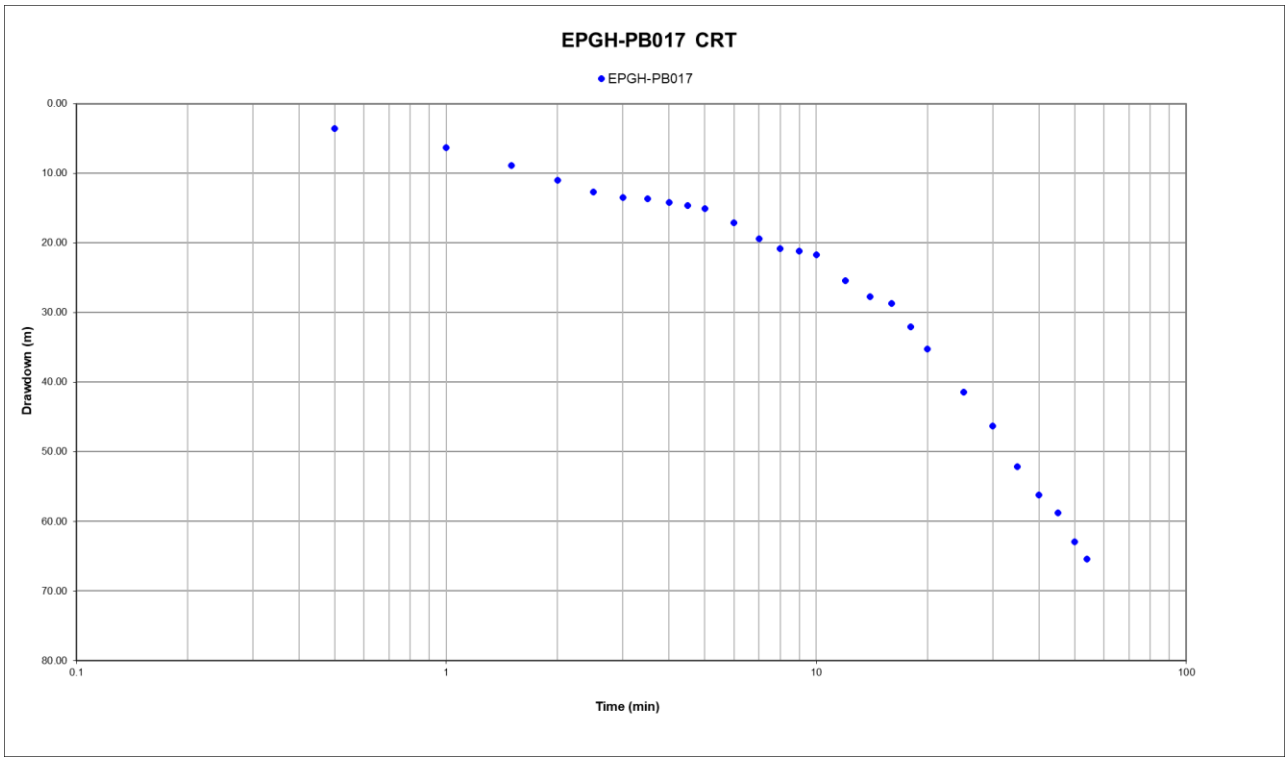


Table 5: CRT Results

CRT Site	Bore	Type	Aquifer	Flow Rate (L/s)	Duration (mins)	Distance from Pumped Bore (m)	Maximum Drawdown (m)
EPGH-PB012	EPGH-PB012	Pumped bore	Weathered Bedrock	2.2	593	0	8.70
	EPGH-MB012	Observation bore	Weathered Bedrock	N/A		10	0.81
EPGH-PB017	EPGH-PB012	Pumped bore	Fractured Bedrock	2.0	54	0	65.41

Table 6: CRT - Groundwater Quality Changes During CRTs

Time (mins)	EC µS/cm	pH	Temp (°C)
EPGH-PB012			
20	732	8.09	30.8
593	728	7.95	30.9
EPGH-PB017			
20	731	8.39	31.2

Pumping test results indicate:

EPGH-PB012

- Drawdown in the pumped bore is relatively rapid initially, before steadying during the middle part of the test (between the 7 and 150 minute marks), then increasing again towards the end of the test.
- The drawdown response is likely representative of a delayed yield response, typical of superficial aquifers.
- Drawdown extends laterally, as indicated by the response in monitoring bore EPGH-MB012, however these responses are perhaps indicative of an aquifer system that is of relatively low transmissivity (permeability), with relatively steep drawdown cones produced in the vicinity of the pumped bore that do not extend far laterally.
- Recovery is relatively rapid once pumping finishes, with the groundwater level at EPGH-PB012 recovering by 96% within 10 minutes of pumping being ceased.
- Groundwater EC and pH in EPGH-PB012 remained relatively steady, with consistent readings between the beginning and end of the test.

EPGH-PB017

- Drawdown in the pumped bore is steady initially, before decreasing rapidly from the 10 minute mark until the end of the test.
- The rapid increase in drawdown occurs once the water level drops to approximately 32 mbgl, and likely represents a boundary whereby the local weathered bedrock has been dewatered and inflow to the bore is only provided by local fractures of low storage.

- The response indicates that the weathered bedrock aquifer at the bore site is likely of low storage, and fracture flow is the dominant flow mechanism, with fractures local and also of low storage.
- The test could not be completed at lower rate that could be sustained for the intended duration (10 hours), as the flow rate could not be altered on the pump.
- Recovery is somewhat slower than in EPGH-PB017, with 90% groundwater level recovery occurring 90 minutes after pumping ceased.
- Groundwater quality changes were not able to be monitored due to the abrupt ending of the test, however quality parameters were similar to those produced in the EPGH-PB012 test.

5.4.2 Analysis

Analysis of the CRT and recovery tests was conducted to estimate key hydrogeological properties of the aquifer, which informs numerical groundwater modelling and dewatering drawdown predictions. The key properties determined through the analysis are Transmissivity (T), Hydraulic Conductivity (K) and Storativity (S).

Transmissivity and hydraulic conductivity are measures of a material's capacity to transmit water. Transmissivity is the rate of flow under a unit hydraulic gradient through a unit width of aquifer of given saturated thickness. Hydraulic conductivity is the rate of flow under a unit hydraulic gradient through a unit cross-sectional area of aquifer. Essentially, the hydraulic conductivity is equal to the transmissivity divided by the aquifer thickness.

Storativity is essentially a measure of the volume of water stored within an aquifer, and is defined as the volume of water released from storage by a confined aquifer per unit surface area of aquifer per unit decline in hydraulic head.

Analysis of the CRTs and recovery tests produced the following values for these properties:

EPGH-PB012:

- **An average transmissivity of 35 m^2/day**, based on drawdown results from EPGH-PB012 and EPGH-MB012 from both the CRT and recovery test.
- **An average hydraulic conductivity of 2.9 m/day**, based on an estimated weathered granite aquifer thickness of 12m.
- **A storage value of approximately 0.03**, based on the drawdown response in monitoring bore EPGH-MB012.

EPGH-PB017:

- **An average transmissivity of 2.9 m^2/day**, based on drawdown results from EPGH-PB017 from both the CRT and recovery test.
- **An average hydraulic conductivity of 0.15 m/day**, based on an estimated aquifer zone thickness (saturated fracture zone) of 20m.
- Storage could not be determined due to the absence of monitoring bore response during the test.

Analysis of the pumping tests primarily centred on the Cooper-Jacob (1946) straight line analysis method (late time data), with greater emphasis on the monitoring bore (EPGH-MB012) in the CRT analysis due to likely well losses in the pumped bore.

5.4.3 Slug Tests

Slug tests involve the addition of a known volume of water or an object of known volume into a bore, and monitoring the groundwater level response, which provides information on the hydraulic conductivity of the aquifer immediately surrounding the bore.

Slug tests were conducted using the displacement method or the bail out method. The displacement method involves introducing a solid cylinder of 1m to 3 into the bore (varied according to length of water column), which through displacement caused the groundwater level within the bore to rise rapidly before slowly recovering to the static level. Once recovered, the cylinder is then rapidly removed from the bore causing the groundwater level to drop rapidly, prior to slowly rising back to the static level. Effectively, two slug tests are preformed through the addition and removal of the displacing cylinder.

The bail out method was used where the available water column is not sufficient to lower a cylinder into the bore without hitting the base (i.e. the depth from groundwater level to the base of the bore is too low). The bail out method also causes the groundwater level to drop rapidly, prior to slowly rising back to the static level.

Slug tests were completed on all six monitoring bores in December 2024, once groundwater levels had stabilised following completion of drilling and airlift development. Results are provided in Table 7 in context with the bore airlift yields.

Table 7: Slug Test Results

Site ID	Status	SWL (mbgl)	First Water Strike (m bgl)	Development Yield (L/s)	Hydraulic Conductivity (m/day)
EPGH-MB001	Monitoring Bore	12.30	8	0.01	N/A
EPGH-MB002	Monitoring Bore	13.10	20	0.1	0.21
EPGH-MB004	Monitoring Bore	6.96	Dry	N/A	0.02
EPGH-MB008	Monitoring Bore	11.69	Dry	N/A	0.23
EPGH-MB011	Monitoring Bore	12.59	15	0.1	0.10
EPGH-MB012	Monitoring Bore	13.61	19	0.4	2.66

It should be noted that due to limited displacement during the tests, the test results should be treated with some caution regarding accuracy of results. The tests do however provide indicative K values for the weathered bedrock aquifer.

6 GROUNDWATER MODELLING

The results of the site investigations have been used to develop a conceptual hydrogeological model of the site, which in turn has been used to develop a high level numerical hydrogeological model, to allow assessment of groundwater abstraction impacts during project construction and operation.

The model is discussed in the sections below.

6.1 Conceptual Hydrogeological Model

Figure 12 presents a hydrogeological cross section through the southern portion of the Group 3 area, showing the major aspects of the conceptual hydrogeological model and interpreted unit thicknesses in this area. A plan view of the cross section location is shown on Figure 13.

Key aspects of the conceptual model are as detailed in the sections below.

6.1.1 Hydrostratigraphy

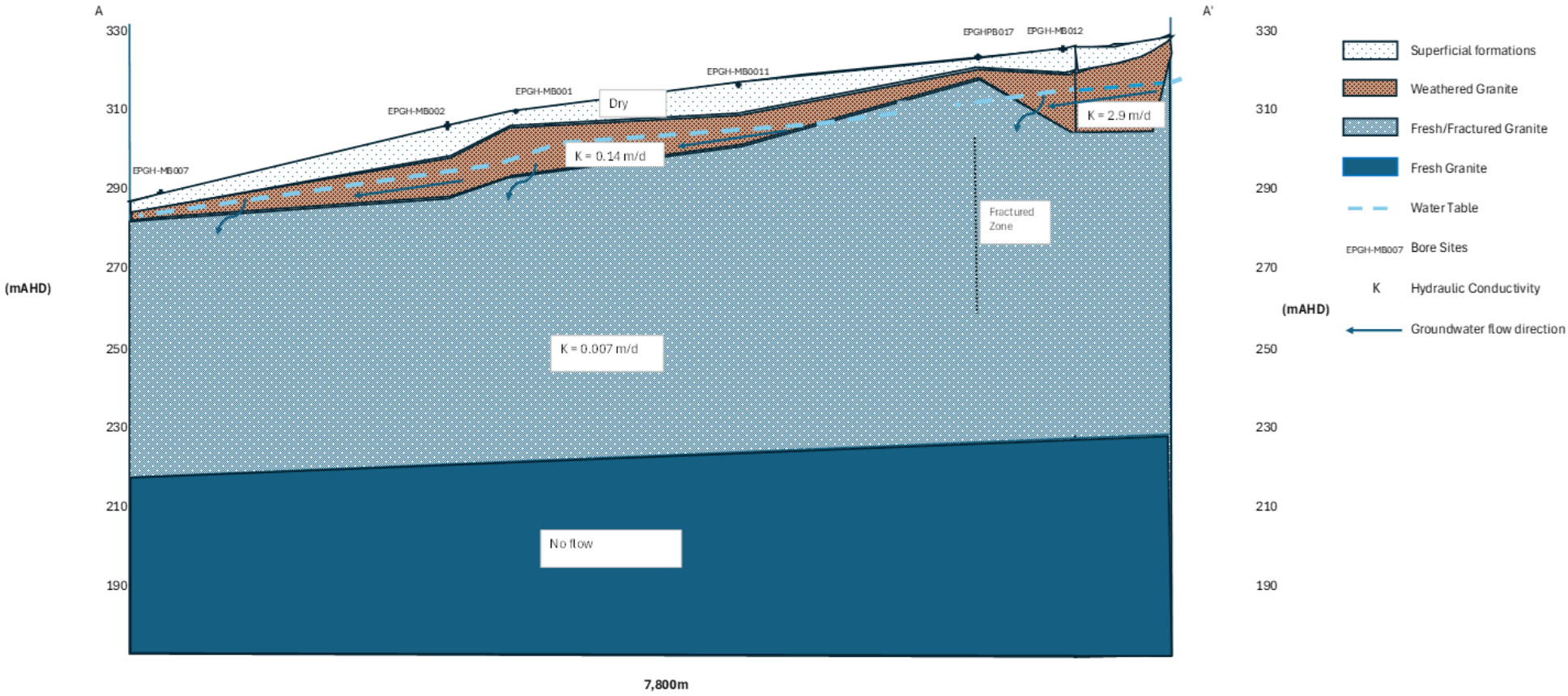
The site conceptual model features four hydrostratigraphic layers, which from surface to base include:

- A surficial layer of alluvial and colluvial sediments, approximately 6m thick, which are considered generally dry. However, these sediments can become partially saturated following groundwater level increases associated with seasonal recharge events. The alluvial/colluvial sediments may thicken towards the east of the project area (based on drilling results from EPGH-PB012 and the presence of several alluvial channels).
- An underlying weathered granite unit which generally hosts the water table. The unit ranges in thickness from 2 to 20m, of which the bottom 12m on average is saturated. However, thickness variations result in a large range in saturated thickness, and it is interpreted that some areas to the north and southeast are unsaturated (the latter of which is indicated in Figure 12.
- An underlying fractured granite bedrock unit which contains sparse local fractures of low storage value.
- An underlying fresh granite bedrock unit which does not transmit groundwater from the fractured unit above (dry) as it is interpreted that fractures close at this depth.

There appears to be no confining layers between hydrostratigraphic units, with aquifers believed to be in hydraulic connection and behaving as an unconfined aquifer.

It is likely that alluvial sequences associated with main drainage channels are deeper and of higher permeability than the surrounding areas, and are likely to become saturated more rapidly following storm events. Classification of these alluvial channel deposits was not possible during the investigation, due to the exclusion zone imposed on the works (at least 400m from major creek lines). These deposits are therefore not differentiated in the conceptual or numerical model, providing an additional layer of conservatism to the model.

Figure 12: Conceptual Hydrogeological Cross-Section

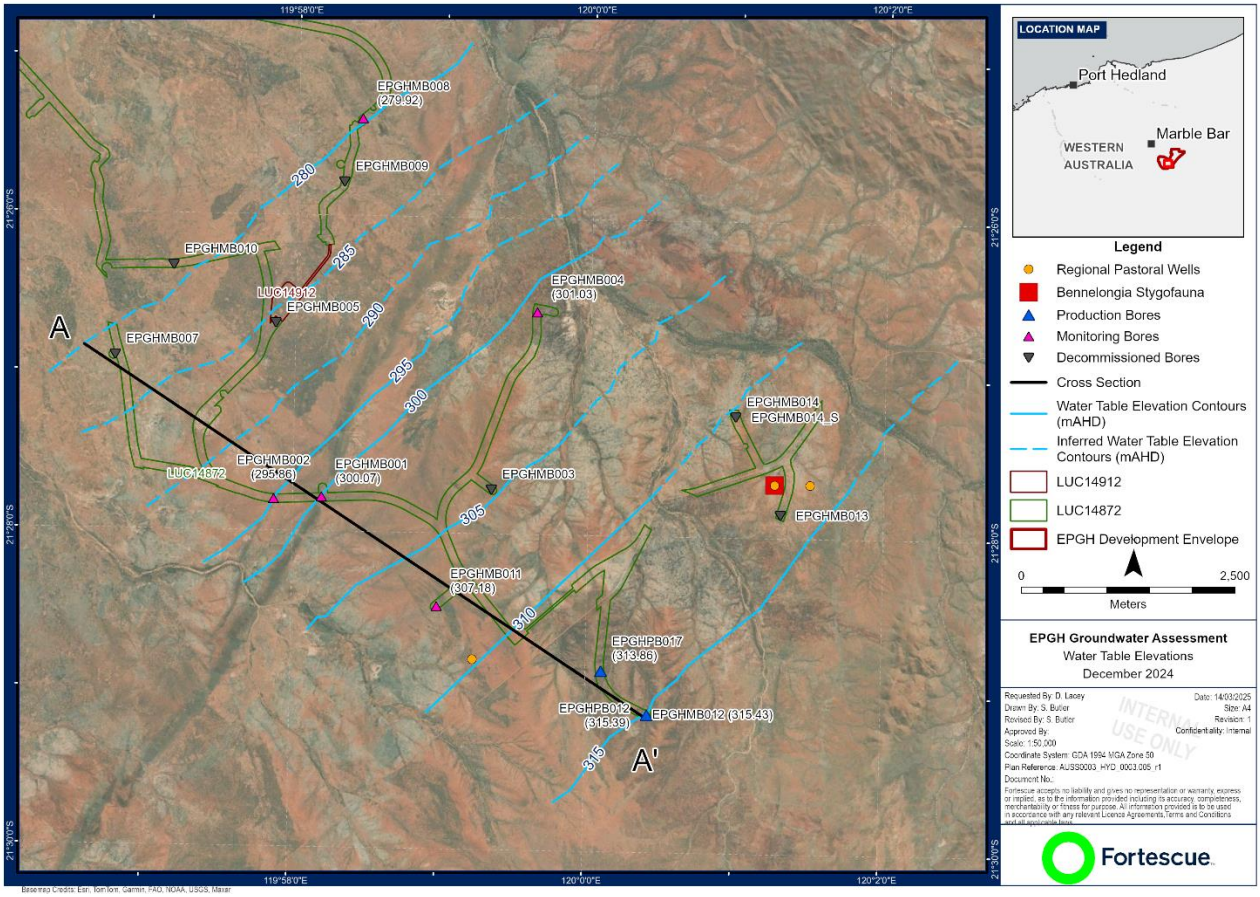


6.1.2 Groundwater Levels and Flow

Groundwater elevation contours, measured from drilled bores during the site investigation programme, are displayed in Figure 13.

The contours indicate a north-westerly groundwater flow direction, with groundwater elevations highest in the southeast and decreasing to the northwest. Contours indicate a relatively steep hydraulic gradient, with a value of 0.005, indicating a low permeability hydrogeological setting. The contours indicate a slight steepening of the hydraulic gradient in the vicinity of the ridge structure running southwest-northeast through the project site (Figure 13), which could be interpreted as a local decrease in permeability or a barrier to groundwater flow associated with the subsurface expression of this ridge. In contrast, the contour spacing is greatest to the southeast of the site where interpreted higher permeability weathered bedrock is situated.

Figure 13: Water Table Elevations



6.1.3 Recharge and Discharge

Groundwater is recharged through direct rainfall infiltration and infiltration from creek lines in upstream settings following significant rainfall events. Discharge likely occurs via evapotranspiration and downstream creek lines during periods of high water table elevations.

6.1.4 Aquifer Properties

Aquifer properties for each of the four hydrostratigraphic units are detailed below:

- Layer 1; Superficial sediments – Generally dry. However the hydraulic conductivity (K) value is interpreted to be 0.06 m/day in places where the unit may become saturated.
- Layer 2; Weathered Bedrock Aquifer – K value of 0.14 m/day across the majority of the site, with a small region to the south east (Figure 12) of 2.9 m/day. The higher K value is interpreted to be associated with the drainage lines/alluvial channels to the east and southeast of the domain, where it appears the weathered bedrock and possibly the alluvial sediments have a greater saturated thickness.
- Layer 3; Fractured Bedrock Aquifer – A K value of 0.007 m/day has been adopted for this area, across the entire thickness (approx. 60m), as the most practical and simplistic way to represent the significantly higher hydraulic conductivity from local fractures across the entire unit.
- Layer 4; Fresh Granite – Negligible K value.

The specific storage has been calculated to be 1x10-6 across all saturated units. Specific yield is estimated to be 0.05 across all saturated units.

6.1.5 Groundwater Quality

Groundwater across both the weathered bedrock and underlying fractured bedrock aquifers is fresh to brackish and slightly alkaline.

6.2 Numerical Groundwater Model

The conceptual hydrogeological model has been used as the basis for creation of a simple, uncalibrated numerical model, which allows predictions of groundwater drawdown associated with abstraction for construction use.

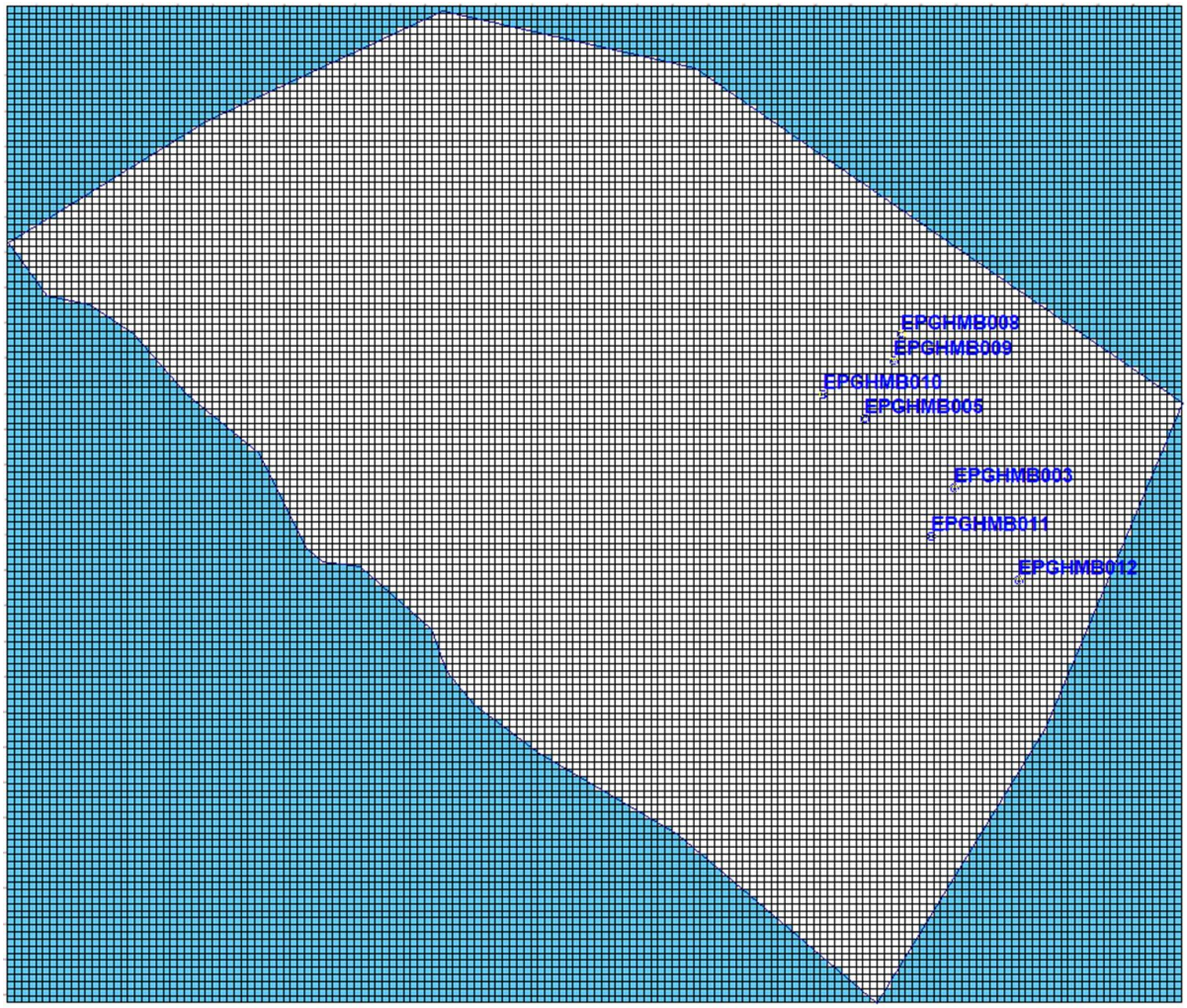
The model was developed using MODFLOW, which is a three-dimensional block-centred finite-difference code developed by the United States Geological Survey to simulate groundwater flow in the saturated subsurface.

The model conforms to the hydrostratigraphy and interpreted hydraulic properties of the conceptual model.

6.2.1 Model Set up and Properties

The model domain covers an area of 903km^2 and is divided into a finite difference grid with a uniform cell size of 200m x 200m. The model domain is shown in Figure 14. White cells represent the active model domain whilst blue cells represent no groundwater flow.

Figure 14: Model Domain

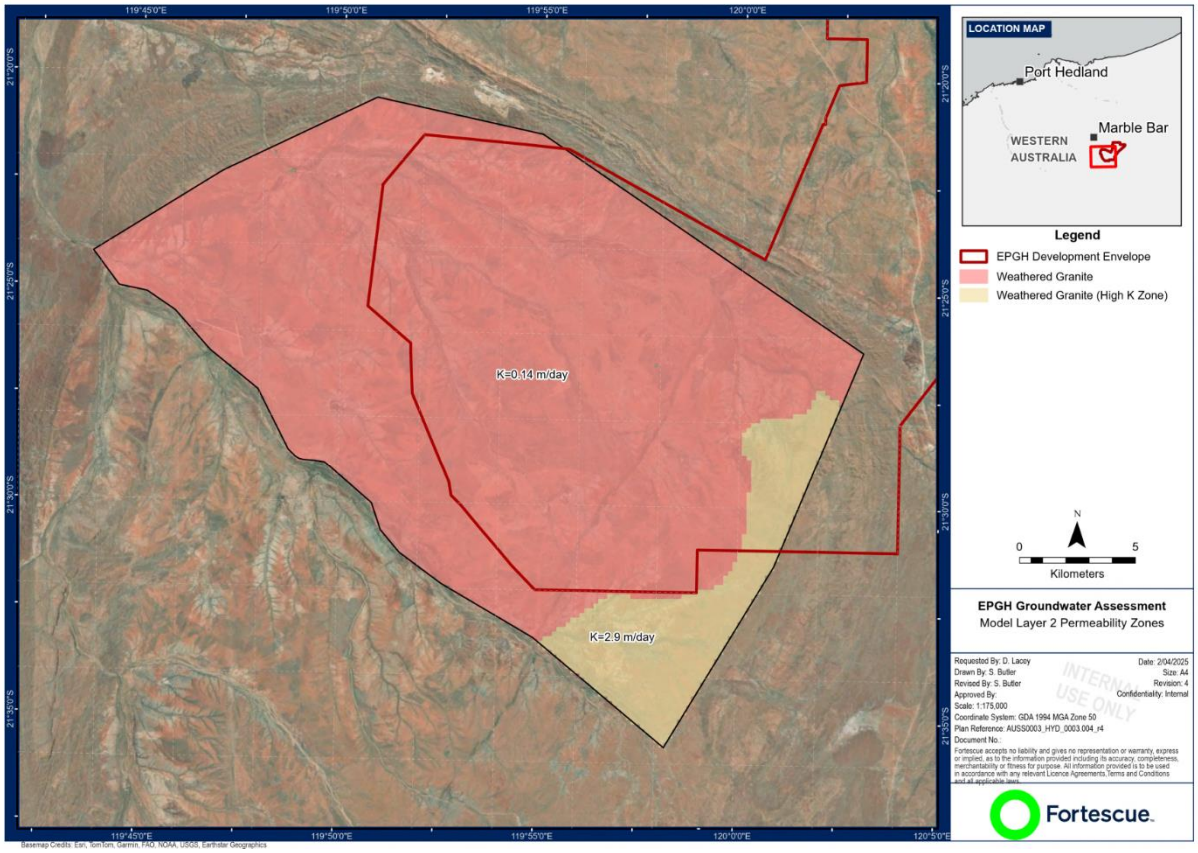


The model layering is based on the conceptual hydrogeological model and interpreted hydrostratigraphy presented in Section 6.1. Layer thickness is governed by the hydrostratigraphic unit thicknesses logged during site investigations. Where no thickness is determined, namely toward the south of the model domain where no drilling was undertaken, average unit thicknesses have been selected.

Initial groundwater heads reflect the groundwater elevations and associated contours provided in Figure 12. Recharge is applied at 0.18mm/yr across the majority of the model domain, with a small area along the southeast, where increased recharge is likely at the base of foothills, set to 4.75mm/yr. Where the water table reaches the ground surface in the model, it is discharged as evaporation.

Two zones have been set in the model to replicate the varied spatial hydraulic conductivity observed in the weathered bedrock unit (Layer 2), as described in Section 6.4. These zone locations and extents are shown in Figure 15.

Figure 15: Model Layer 2 - Hydraulic Conductivity Zones



All sides of the model domain boundary are classified as no flow boundaries.

Aquifer properties for each layer in the model are as shown in Table 8

Table 8: Layer Hydraulic Properties

Layer	K (m/day)	Specific Yield (Sy)	Specific Storage (Ss)
1 - Superficial Formations	0.06	0.05	$1x10^{-6}$
2 – Weathered Bedock	0.14	0.05	$1x10^{-6}$
	2.9	0.05	$1x10^{-6}$
3 – Fractured Bedrock	0.007	0.05	$1x10^{-6}$
4 – Fresh Granite	No flow	No flow	No flow

6.2.2 Modelled Predictions

The numerical model was used to define:

- Estimated groundwater volumes that are sustainable from the project area.

- Impacts to identified receptors due to project construction abstraction, through simulations of groundwater drawdown from abstraction of prescribed groundwater volumes.

It became evident during site investigations that the Group 3 project area is unlikely to provide the full water requirements for construction of the project, due to limited groundwater intersections, low storage and low permeability settings. As such, the model was run iteratively to determine the highest yield available from the site, and what the drawdown impact is associated with this yield.

The model used existing production bore EPGH-PB012, as well as four additional simulated production bores in the high K zone to the southwest of the site for abstraction, in order to achieve the highest sustainable abstraction volume. The model was run iteratively in order to determine the optimum number of bores, bore location and spacing, and maximum abstraction rate from the bores (prior to the bores pumping dry, or extent of drawdown reaching key receptors).

Bore locations are shown on Figure 16.

The simulations were run over a 22 month timeframe to replicate the expected construction period (with abstraction requirements and associated drawdown decreasing significantly during operations). The simulations identified the sustainable flow rate to vary between 1.5 L/s and 2.5 L/s across the five bores. Total abstraction across the construction period amounted to approximately 315,000 kL/yr (0.31 GL/yr), or 46% of the total abstraction requirement.

Simulations of abstraction at this rate included predictions of drawdown, enabling estimation of impacts to identified receptors. The results of this modelled scenario (abstraction of 0.315 GL/yr over 22 months) are shown in Figure 16.

Figure 16: Modelled Scenario 1: Simulated Drawdown at Completion of Construction Phase

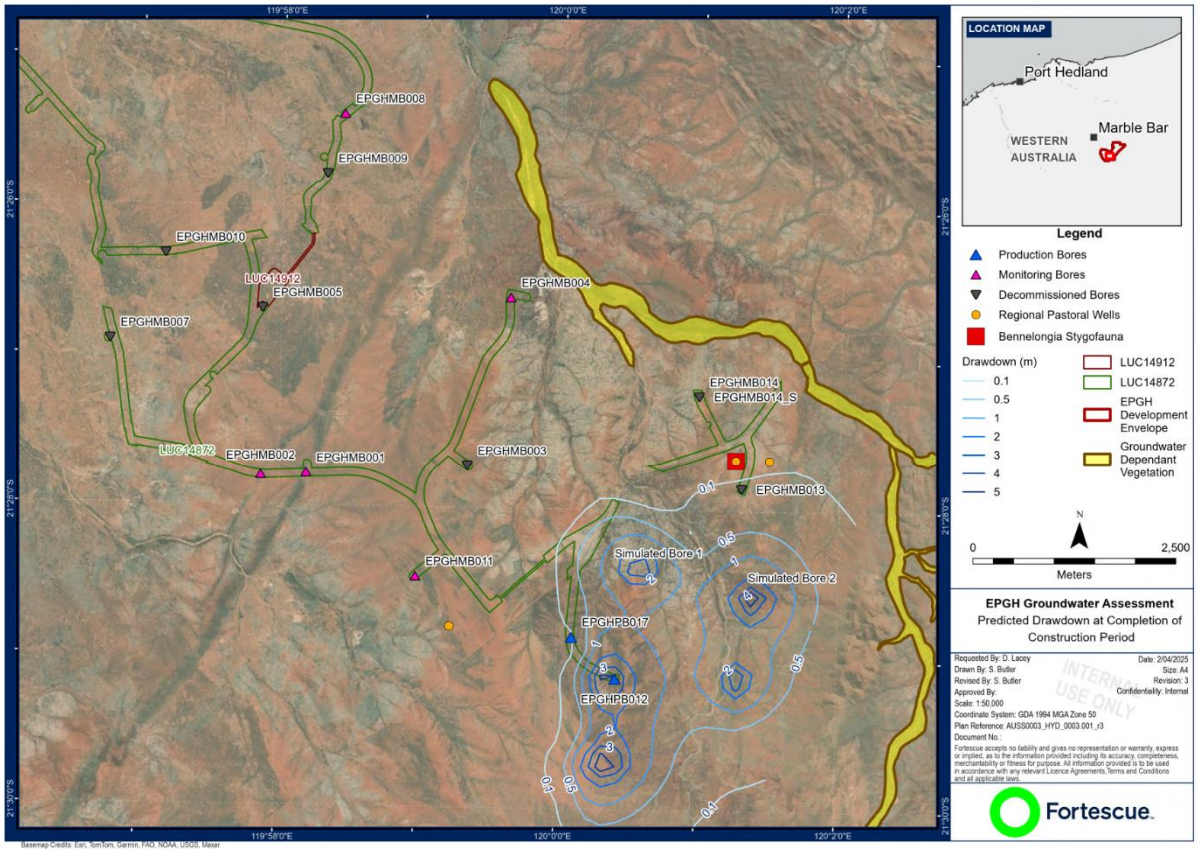


Figure 16 show that drawdown extends locally around the simulated production bores, with the 0.1m drawdown contour extending approximately 800m from each respective bore to the west and approximately 1,100m from Simulated bore 2 to the east. Vertical drawdown reaches a maximum of about 5m at the centre of each bore (excluding potential well losses).

The model contains high uncertainty with respect to the predicted outputs, most notably due to the simple, uncalibrated nature of the model set up, the variability of the intersected hydrogeological units, the relatively limited nature of site investigations (considering the absence of site-specific data prior to the investigation) and the restrictions imposed on available areas to investigate. Where possible, the model uses conservative inputs, primarily with respect to conceptualisation of alluvial sequences beneath major creek lines (where investigation was prohibited).

In context with the above, the higher K zone in the weathered bedrock to the east and southeast of the site (Figure 15) contains a high degree of uncertainty with respect to its extent and modelled parameters. If conditions encountered in this area differ from that currently conceptualised, sustainable abstraction volumes could differ markedly from the achievable volumes suggested above. This area, along with further structural targets, should be a focus during future investigations, prior to the installation of a production bore network. All new bores should be test pumped, hydraulic parameters updated and the modelled simulations re-run to determine predicted drawdown impacts. Fortescue will adjust its

groundwater usage accordingly to ensure volumes are sustainable and any impacts are minimised and/or effectively managed.

7 ASSESSMENT OF IMPACTS

Modelled drawdown predictions displayed in Figure 16 indicate that at the sustainable abstraction rate (0.31 GL/yr), drawdown will not reach any of the key receptors including pastoral wells, known stygofauna habitats and groundwater dependent vegetation zones.

It is expected that no impacts to groundwater quality will occur during the project, as quality values appear consistent through shallow and deep aquifers (as determined through laboratory analysis of EPGH-PB012 and EPGH-PB017). Furthermore, groundwater quality parameters did not show discernible change during pumping tests.

It is recognised that Fortescue will need to source the remainder of the water requirement from alternative sources, as the modelled abstraction accounts for only 46% of the total required volume. Furthermore, the modelled sustainable volume is highly uncertain. Fortescue will obtain the surplus requirements from alternative sources, and like at the EPGH Group 3 site, limit abstraction to volumes that do not cause unmanageable impacts to the aquifer or key receptors.

Additionally, prior to any site-based abstraction for construction purposes, further drilling and production bore installation will be required. During this drilling and bore construction programme, Fortescue intend to undertake further test pumping and model refinement, to improve the accuracy of drawdown predictions and associated impacts (as discussed in Section 6.2.2).

Although the Group 4 region was not investigated or modelled during the assessment, it is expected that similar available volumes and drawdown attributes to the Group 3 site would exist in this area. Indicatively, higher volumes could potentially be available due to the distribution and frequency of fractures identified in the Group 4 region. Site investigations including drilling and test pumping will be conducted prior to installation of a production bore network to determine sustainable abstraction volumes and quantify potential abstraction impacts.

8 GROUNDWATER MONITORING AND MANAGEMENT

This report will be used to support the application for licence to take water under Section 5C of the RIWI Act. As a condition of this licence, a Groundwater Operating Strategy (GOS) will be developed, which will detail the groundwater monitoring programme to be conducted before, during and after the project construction period. The GOS will also outline management and mitigation procedures should adverse impacts to identified receptors occur.

Indicatively, the monitoring programme will include:

- Monthly measurement of baseline groundwater levels, for period of 6 months in advance of construction commencement, from all site monitoring bores and pastoral bores.
- Monthly measurement of groundwater levels from all monitoring, production and pastoral bores through the construction period and for at least 6 months post-construction.

- Quarterly measurements of field EC, pH and temperature from all monitoring and pastoral bores through the baseline, construction and post construction periods.
- Monthly abstraction volumes (metered) from all active production bores.
- Annual sampling and laboratory analysis for major analytes (in accordance with Fortescue's Water Supply and Treatment Engineering Requirements (FFI-0000-WM-SOR-0002)).

9 CONCLUSIONS

Key conclusions from the preliminary hydrogeological assessment include:

- To enable construction of the EPGH, a secure water source is required. Currently, estimates of construction water use indicate an annual requirement of approximately 0.68 GL/yr (~22 L/s) for an estimated 22-month construction period.
- The annual usage is expected to reduce to less than 0.1 GL/yr for ongoing operations.
- Due to the absence of site-specific hydrogeological information and the subsequent gaps in hydrogeological understanding of the project site, a groundwater exploratory drilling and testing investigation was developed to help characterise the hydrogeological setting, understand the sustainability of the groundwater resource and assist in determining the impact of abstraction from project construction and operations.
- The investigation commenced in September 2024 and was completed in December 2024, with a total of 15 pilot holes drilled, two production bores installed and tested, and six monitoring bores installed and tested.
- Pilot hole drilling indicates relative consistency with respect to the stratigraphic profile, which consists of:
    - A superficial sequence of alluvial and colluvial sediments, consisting of brown, silty and sandy, poorly sorted, sub rounded to sub angular gravels, generally 2m to 6m thick. The alluvial/colluvial sediments appear to be dry, although may be partially saturated in some areas after significant recharge events.
    - An underlying unit of brown, pink and grey weathered granite, generally 2m to 20m thick. The weathered granite appears to host the water table and is saturated through the majority of its thickness.
    - An underlying fractured granite bedrock unit which contains sparse local fractures of low storage value.
    - Underlying basement of fresh granite, with alternating dominance of biotite and/or amphibole minerals and pink orthoclase feldspar, with little to no fracturing. The fresh granite appears to be dry.
- Drilling investigation results indicate a generally low yielding aquifer within the weathered bedrock unit and underlying fractured bedrock. Groundwater is of fresh to brackish and slightly alkaline quality. Groundwater levels are relatively consistent, in the range of 6.96 to 13.61m bgl, and flowing to the northwest under relatively steep hydraulic gradient.
- Aquifer tests provide hydraulic conductivity values of 2.9 m/day in the weathered bedrock to the east of the site across the alluvial channel domain, and 0.14 m/day throughout the

remainder of the weathered bedrock domain. The underlying fractured bedrock is conceptualised to feature an average hydraulic conductivity of 0.007 m/day.

- A simple, uncalibrated numerical model was developed using the three-dimensional block-centred finite-difference code MODFLOW, which simulates groundwater flow in the saturated subsurface and allows predictions of groundwater drawdown associated with abstraction in the project area.
- Modelled predictions indicate a sustainable abstraction volume of 0.31 GL/yr, approximately 46% of the required construction volume, is available at the Group 3 project site. The impacts of abstraction related drawdown at this rate are not predicted to reach any of the key receptors (including pastoral wells, known stygofauna habitats or groundwater dependent vegetation sites).
- The model results however, are highly uncertain, particularly with respect to the higher K zone in the weathered bedrock aquifer to the east and south east of the site. Future investigations would need to be undertaken to confirm water supply volumes for EPGH construction, including but not limited to further drilling in the east and southeast of the Group 3 region, further structural targets in the Group 3 region and similar targets in the Group 4 region.
- This assessment indicates that insufficient water resources are available at the EPGH Group 3 site to support project construction and further work is needed to obtain the required water supply volumes. It is recognised by Fortescue that water requirements beyond that available from the Group 3 area will need to be acquired from alternative sources. These sources, like the EPGH site, will be utilised in a sustainable manner whereby volumes abstracted will not cause unmanageable impacts to key receptors.

10 REFERENCES

This report and all internal supporting documents will be managed as per Fortescue Document Governance Standards. These may be read in conjunction with this report.

[1] AUS0311-0000-HG-MEM-0001, 2022. FFI East Pilbara Generation Hub-Preliminary Hydrogeology Review, Internal Fortescue document, June 2022.

[2] AUSS0003-0000-WM-MEM-0001, 2022. East Pilbara Generation Hub (EPGH) Hydrogeological Assessment, FFI Internal Report.

[3] AUSS0003-0000-CI-MEM-0001, 2022. East Pilbara Green Hub Drawdown Assessment. Internal Fortescue document, December 2022.

[4] AUSS0003-0000-WM-MEM-0009. EPGH Water Sampling. Fortescue Internal Memorandum. 30 April 2024.

[5] Bennelongia, 2022. East Pilbara Generation Hub (EPGH) Subterranean Fauna, desktop Assessment, prepared for Fortescue Future Industries, Draft Report.

[6] BOM 2024a. Water and the Land. http://www.bom.gov.au/watl/?ref=ftr, accessed June 2022.

[7] BOM, 2024b. Groundwater Dependent Ecosystem atlas. http://www.bom.gov.au/water/groundwater/gde/, accessed October 2024.

[8] Calidus 2021. Warrawoona Gold Project. Mining Proposal. Reg ID 90033 - Revision 5a.

[9] DWER, 2024a. Water online register https://maps.water.wa.gov.au/#/webmap/register, accessed June 2024.

[10] DWER, 2024b. Water Information Reporting database https://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx, accessed September 2024.

[11] Ferguson KM, Ruddock, I, 2001. Mineral occurrences and exploration potential of the East Pilbara. Geological Survey of WA, 19 September 2021.

[12] FFI-0000-WM-SOR-0002, 2024. Water Supply and Treatment Engineering Requirements – Rev 5. 28 June 2024.

[13] Groundwater Resource Management, 2019. Warrawoona Gold Project 2 MTPA – Pre-feasibility Hydrogeological Investigations Report. Report J1827R03. July 2019.

[14] GSWA, 2024. 1:100 000 Digital data (DMIRS-048), Department of Mines, Industry Regulation and Safety. https://catalogue.data.wea.gov.au

DOCUMENT CONTROL

EPGH – Construction Water Supply Hydrogeological Assessment		
Status	IFU - Issued for Use	15-Apr-25
Summary of Changes	Update to modelling following request by PM.	
Author	Daniel Lacey	Signature
Checked or Squad Review# (if applicable)	Squad Check	Signature
Approved	Whelan Naidoo	Signature
Next Review Date (if applicable)	Enter a date	

APPENDIX A 26D LICENCE TO CONSTRUCT OR ALTER WELL

Government of **Western Australia**
Department of **Water and Environmental Regulation**

Instrument No. CAW210169(1)

LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

Licensee(s)	Fortescue Ltd
Description of Water Resource	Pilbara Pilbara - Fractured Rock
Location of Well(s)	E45/6278 E45/6280

	Activity	**Location of Activity**
Authorised Activities	Construct as many as required non-artesian well(s) for mining or public supply.	E45/6278 E45/6280
	Construct as many as required monitoring well(s) for mining or public supply.	E45/6278 E45/6280
Duration of Licence	From 10 May 2024 to 9 May 2026	

This Licence is subject to the following terms, conditions and restrictions:

1. The well must be constructed by a driller having a current class 1 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or equivalent certification recognised nationally by the Australian Drilling Industry Association.

2. No well shall be constructed within 400 metres of an existing well without the written permission of the owner of that well.

End of terms, conditions and restrictions

APPENDIX B BORE CONSTRUCTION DIAGRAMS

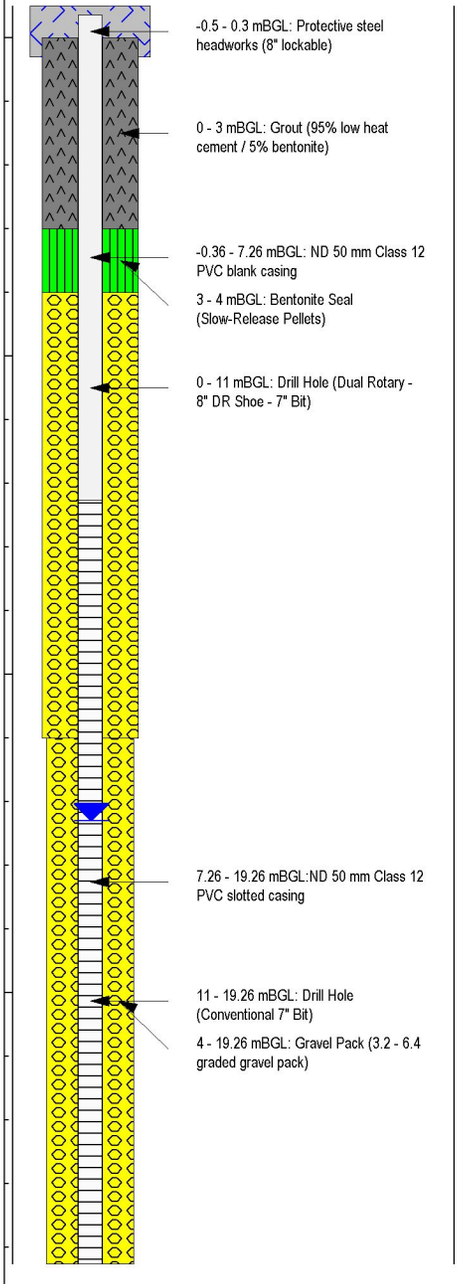
MONITORING BORE LOG

BOREHOLE NUMBER
EPGHMB001

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBO**
SURVEY DETAILS:	**Final**
EASTING:	807,797.55 **MGA94, Zone 50**
NORTHING:	7,623,680.85
GROUND ELEVATION (mAHD):	312.37
DATE BEGUN:	**10/11/2024** DATE COMPLETED: **15/11/2024**

FINAL BORE DETAILS			
Drilled Depth (mBGL):	19.26		
Cased Depth (mBGL):	19.26		
Casing Stick Up (mAGL):	0.36		
Water Level (mBGL):	12.3		16/11/2024
Airlift Yield (L/s):	0.01		15/11/2024
Quality - pH & EC (uS/cm):	8.66	730	15/11/2024



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0	310	TA	SILTY GRAVEL: 0 – 4m BGL Tertiary Alluvium. Weathered granite derived alluvials. Fine to coarse gravels in a matrix of fine sand to silt.			
5	305	AgCm	Granite: 4 - 6m BGL:Weathered granite. Very poorly sorted pink/green/grey chips of plagioclase and orthoclase granite. up to 40 mm in size. hard ground. no water.			
			Granite: 6 - 8m BGL:Weathered granite. Very poorly sorted pink/green/grey chips of plagioclase. Higher concentration of amphobile and mafic mineralogy. Grain zie up tp 40 mm in size. Hard ground cemented silica, fracture zone. Firstv water strike at 8 mBGL.			
10	300		Granite: 8 - 16m BGL: Weathered granite. Very poorly sorted pink/green/grey chips of plagioclase. Higher concentration of amphobile and mafic mineralogy. Grainsize from 2mm to 30mm in size. Hard ground cemented silica, fracture zone.	0.2	699	8.29
15	295		Granite: 16 - 18.5m BGL: Fresh granite, well sorted with angular grains ranging from 1mm to 3mm in size. Hard grains. Predomiantly composed of quartz, plagioclase and amphobile.			

Very hard ground encountered from 11m BGL, end of drilling called at 19m BGL The monitoring bore was installed and developed without issues, however the yield was very low.

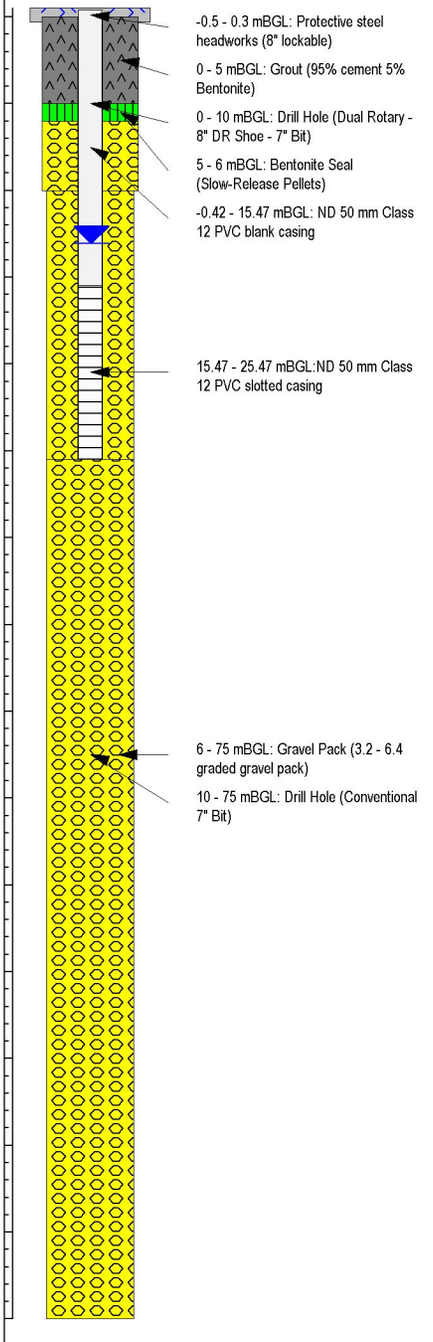
MONITORING BORE LOG

BOREHOLE NUMBER
EPGHMB002

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**SME**
SURVEY DETAILS:	**Final**
EASTING:	807,237.76 **MGA94, Zone 50**
NORTHING:	7,623,660.1
GROUND ELEVATION (mAHD):	308.93
DATE BEGUN:	**04/10/2024** DATE COMPLETED: **14/10/204**

FINAL BORE DETAILS			
Drilled Depth (mBGL):	75		
Cased Depth (mBGL):	25.47		
Casing Stick Up (mAGL):	0.42		
Water Level (mBGL):	13.07		16/10/2024
Airlift Yield (L/s):	0.11		11/10/2024
Quality - pH & EC (uS/cm):	8.71	823	11/10/2024



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	LITHOLOGY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0	308	TA		Silty Gravel: 0 – 8 mBGL Tertiary Alluvium: Weathered granite derived alluvials. Fine to coarse gravels in a matrix of fine sand to silt.			
5	305						
10	300	AgCm		Granite: 8 -18 mBGL: Weathered granite bedrock transitioning into fresher granite. Mostly leaching, no evidence of water bearing structures, staining or chemical reactions			
15	295						
20	290			Granite: 18 - 75 mBGL Fresh granite. Phanertic texture with alternating dominance of biotite and/or amphibole minerals and pink orthoclase feldspar. No evidence of water bearing structures, staining / chemical reactions	0.001	1127	8.71
25	285				0.001	1072	8.12
30	280				0.001	913.9	8.06
35	275				0.001	850.8	8.61
40	270				0.001	920.8	8.44
45	265				0.001	856.7	8.47
50	260				0.1	831	8.68
55	255				0.1	823	8.71
60	250				0.1	824	8.71
65	245						
70	240						
75	235						

Hard ground encountered from 18m BGL, drilling proceeded to 75m BGL with no issues. The monitoring bore was installed at 25m BGL (base of weathered granite) and successfully developed, however the yield was very low.

DECOMMISSIONED BORE LOG

BOREHOLE NUMBER
EPGHMB003

Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**SME**
SURVEY DETAILS:	**Final**
EASTING:	809,787.78 **MGA94 Zone 50**
NORTHING:	7,623,763.29
GROUND ELEVATION (mAHD):	317.93
DATE BEGUN:	**20/10/2024** DATE COMPLETED: **22/10/2024**

FINAL BORE DETAILS		
Drilled Depth (mBGL):	20	
Cased Depth (mBGL):	NA	
Casing Stick Up (mAGL):	NA	
Water Level (mBGL):	NA	
Airlift Yield (L/s):	NA	
Quality - pH & EC (uS/cm):	NA	NA

BORE CONSTRUCTION	DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	LITHOLOGY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0 - 4 mBGL: Drill Hole (Dual Rotary - 8" DR Shoe - 7" Bit) 0 - 4 mBGL: Grout (5% Bentonite / 95% Cement)	0	317	TA		SILTY GRAVEL: 0m - 4m BGL: Silty gravel. Brown, 2 -5mm, moderate quartz content and weathered transported granite chips sub angular to sub rounded showing poorly sorted fine to medium gravel in a matrix of silt.			
	5	315						
4- 20mBGL: Grout (5% Bentonite / 95% Cement) 4 - 20 mBGL: Drill Hole (Conventional 7" Bit)	10	310	AgCm		GRANITE: 4m - 20m BGL: Granite. Fresh granite			
	15	305						
	20	300						

Drilling hard ground from 4m BGL onwards. No water encountered therefore bore was decommissioned by grouting from base to surface

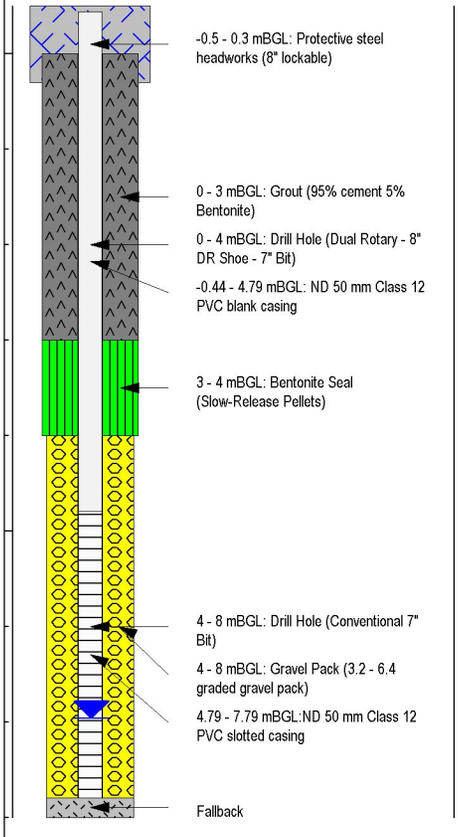
MONITORING BORE LOG

BOREHOLE NUMBER
EPGHMB004

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBI**
SURVEY DETAILS:	**Final**
EASTING:	810,328.3 **MGA94, Zone 50**
NORTHING:	7,625,831.31
GROUND ELEVATION (mAHD):	307.99
DATE BEGUN:	**16/11/2024** DATE COMPLETED: **19/11/2024**

FINAL BORE DETAILS			
Drilled Depth (mBGL):	8		
Cased Depth (mBGL):	7.79		
Casing Stick Up (mAGL):	0.44		
Water Level (mBGL):	6.96		22/11/2024
Airlift Yield (L/s):	NA		NA
Quality - pH & EC (uS/cm):	NA	NA	NA



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	LITHOLOGY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0							
		TA		Gravel: 0 - 4 mBGL: Tertiary Alluvium. Gravel composed of sub angualr to angular weathered granite derived alluvials. Fine to coarse gravels in a matrix of fine sand to silt.			
	305						
				Granite: 4 - 6 mBGL: Weathered zone of granite bedrock. Granite, Monzogranite. Phaneritic texture. transitioning into fresher granite. Angualr to sub angualr moderatly weathered chips ranging from 1mm to 1cm in size.	dry	dry	dry
5		AgCm		Granite: 6 - 8 mBGL: Fresh granite, alternating dominance of biotite and/or amphibole minerals and pink orthoclase feldspar. No evidence of water bearing structures, staining / chemical reactions	dry	dry	dry
	300						

Very hard ground encountered from 4m BGL, end of drilling called at 8m BGL within fresh granite with no water intercepted. The monitoring bore was successfully installed, however not able to develop

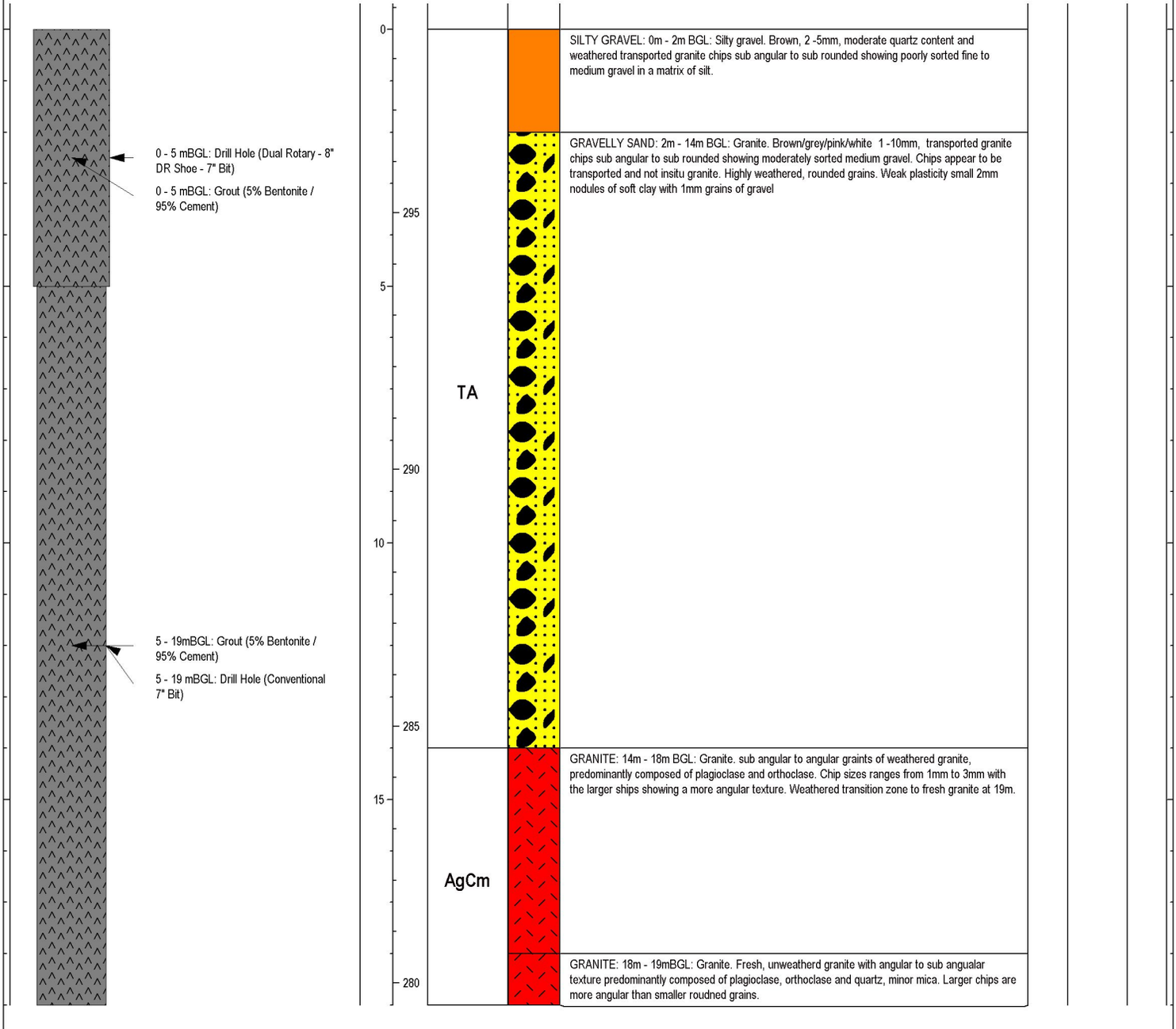
DECOMMISSIONED BORE LOG

BOREHOLE NUMBER
EPGHMB005

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBO**
SURVEY DETAILS:	**Final**
EASTING:	807,267.74 **MGA94 Zone 50**
NORTHING:	7,625,718.07
GROUND ELEVATION (mAHD):	298.57
DATE BEGUN: **16/10/2024**	DATE COMPLETED: **18/10/2024**

FINAL BORE DETAILS		
Drilled Depth (mBGL):	19	
Cased Depth (mBGL):	NA	
Casing Stick Up (mAGL):	NA	
Water Level (mBGL):	NA	
Airlift Yield (L/s):	NA	
Quality - pH & EC (uS/cm):	NA	NA



Drilling hard ground from 5m BGL onwards. No water encountered therefore bore was decommissioned by grouting from base to surface

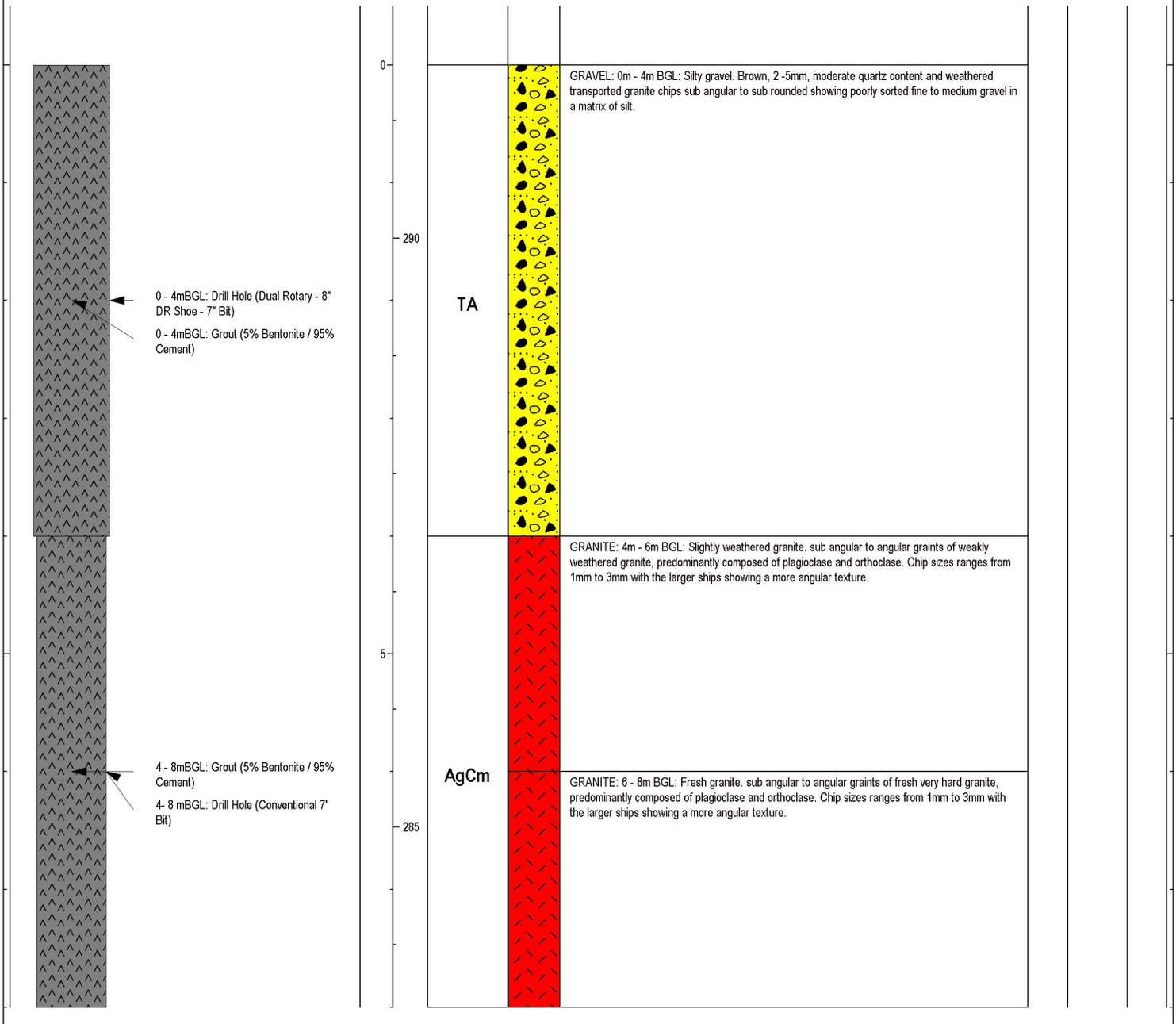
DECOMMISSIONED BORE LOG

BOREHOLE NUMBER
EPGHMB007

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**Water Supply and Groundwater Investigation**	
LOCATION:	**EPGH**	
DRILLING CO:	**Pentium**	
DRILLING METHOD:	**DR & Conventional Air**	
LOGGED BY:	**HBO**	
SURVEY DETAILS:	**Final**	
EASTING:	805,386.21	**MGA94 Zone 50**
NORTHING:	7,625,353.47	
GROUND ELEVATION (mAHD):	291.47	
DATE BEGUN:	**31/10/2024**	DATE COMPLETED: **1/11/2024**

FINAL BORE DETAILS		
Drilled Depth (mBGL):	8	
Cased Depth (mBGL):	NA	
Casing Stick Up (mAGL):	NA	
Water Level (mBGL):	NA	
Airlift Yield (L/s):	NA	
Quality - pH & EC (uS/cm):	NA	NA



Drilling hard ground from 4m BGL onwards. No water encountered therefore bore was decommissioned by grouting from base to surface

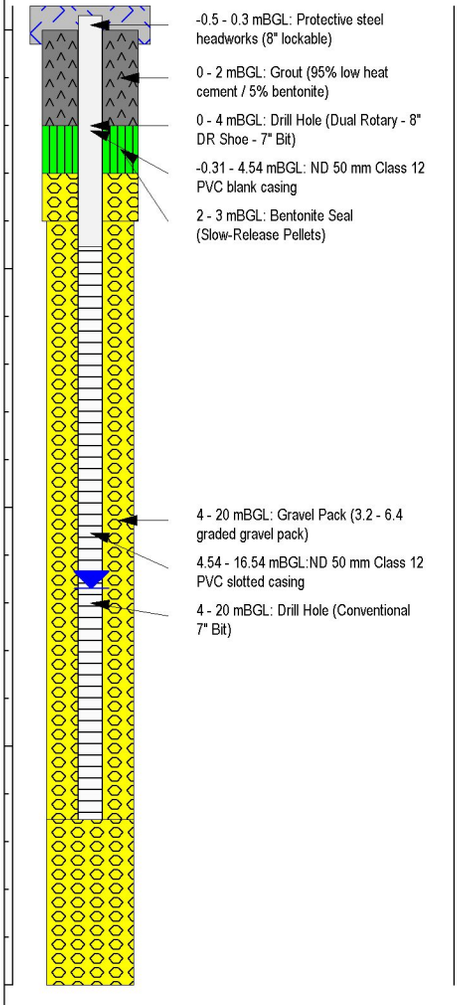
MONITORING BORE LOG

BOREHOLE NUMBER
EPGHMB008

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBO**
SURVEY DETAILS:	**Final**
EASTING:	808,289.87 **MGA94, Zone 50**
NORTHING:	7,628,099.91
GROUND ELEVATION (mAHD):	291.61
DATE BEGUN: **02/11/2024**	DATE COMPLETED: **05/11/2024**

FINAL BORE DETAILS			
Drilled Depth (mBGL):	20		
Cased Depth (mBGL):	16.54		
Casing Stick Up (mAGL):	0.31		
Water Level (mBGL):	11.69		8/11/2024
Airlift Yield (L/s):	NA		NA
Quality - pH & EC (uS/cm):	NA	NA	NA



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0	290	TA	Gravel: 0 - 4 mBGL:Tertiary Alluvium. Silty Gravel: Light brownish grey, sub rounded to sub angular highly weathered moderately hard chips consisting of moderate quartz and highly weathered transported granite chips ranging from 1mm to 3mm. Gravel and granite is poorly sorted with a ratio of 40:30:30 gravel, silt and granite.			
5	285	AgCm	Granite: 4 - 12 mBGL: Weathered granite. Moderately to weakly weathered.. Sub rounded to angular, moderately sorted chips ranging from 1mm to 3mm with high degree of feldspar staining resulting in red colouration. Predominantly composed of feldspar, quartz and mica.	dry	dry	dry
10	280		Granite: 12 - 16 mBGL: Transitional zone from weakly weathered to fresh granite, angular moderately sorted chips ranging from 1mm to 3mm showing significantly less feldspar staining that above.			
15	275		Granite: 16 - 20 mBGL: Fresh granite. Grey, black, white and pinkish colouration on unweathered angular to sub angular grains of granite ranging in size from 2mm to 5mm	dry	dry	dry
20						

Hard ground encountered from 4m BGL, drilling proceeded to 20m BGL with no issues. No water was intercepted. The monitoring bore was successfully installed, however not able to develop

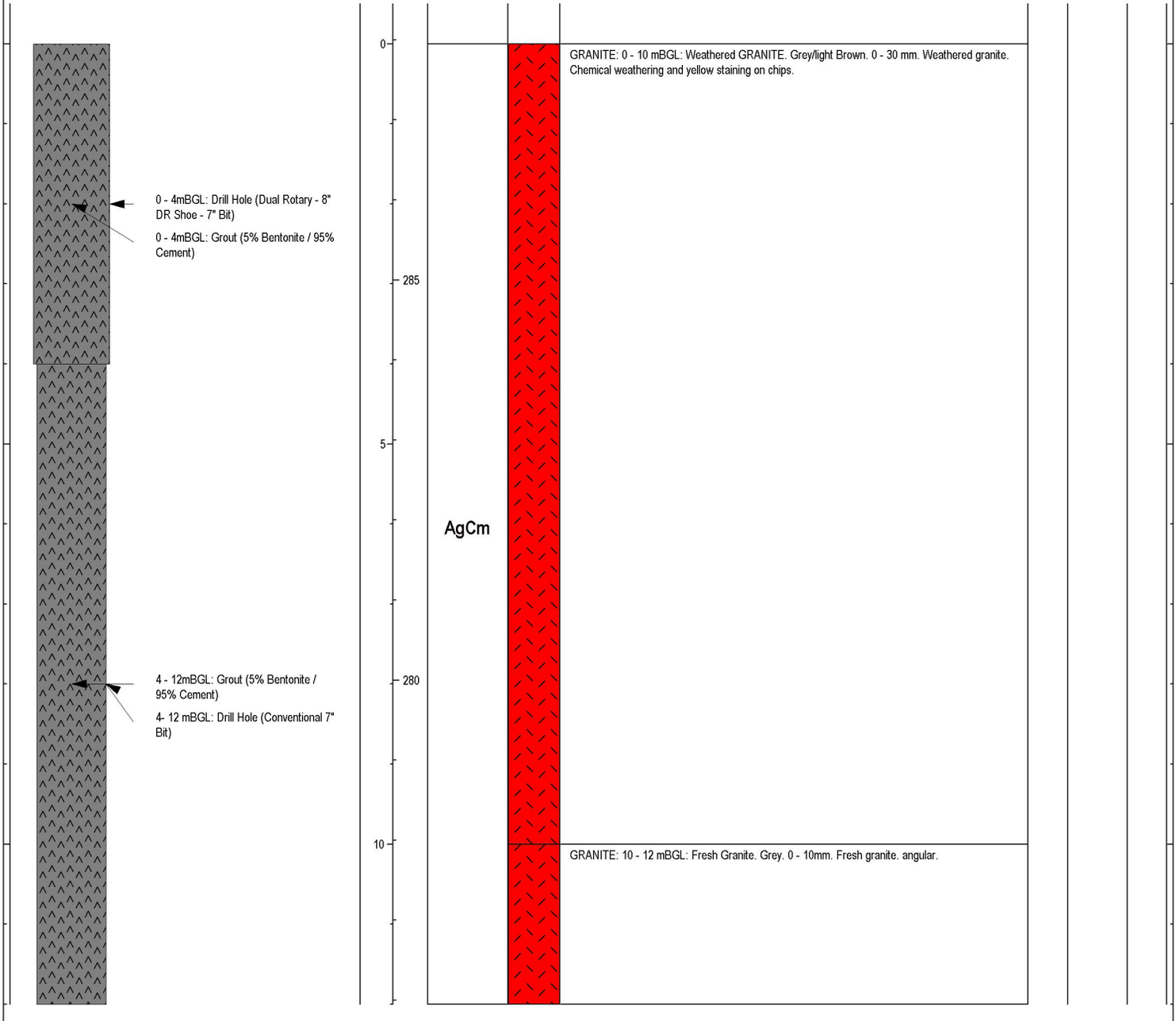
DECOMMISSIONED BORE LOG

BOREHOLE NUMBER
EPGHMB009

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBO**
SURVEY DETAILS:	**Final**
EASTING:	**808,073.74** **MGA94 Zone 50**
NORTHING:	**7,627,365.53**
GROUND ELEVATION (mAHD):	**287.95**
DATE BEGUN: **7/11/2024**	DATE COMPLETED: **9/11/2024**

FINAL BORE DETAILS		
Drilled Depth (mBGL):	12	
Cased Depth (mBGL):	NA	
Casing Stick Up (mAGL):	NA	
Water Level (mBGL):	NA	
Airlift Yield (L/s):	NA	
Quality - pH & EC (uS/cm):	NA	NA



Drilling hard ground from 4m BGL onwards. No water encountered therefore bore was decommissioned by grouting from base to surface

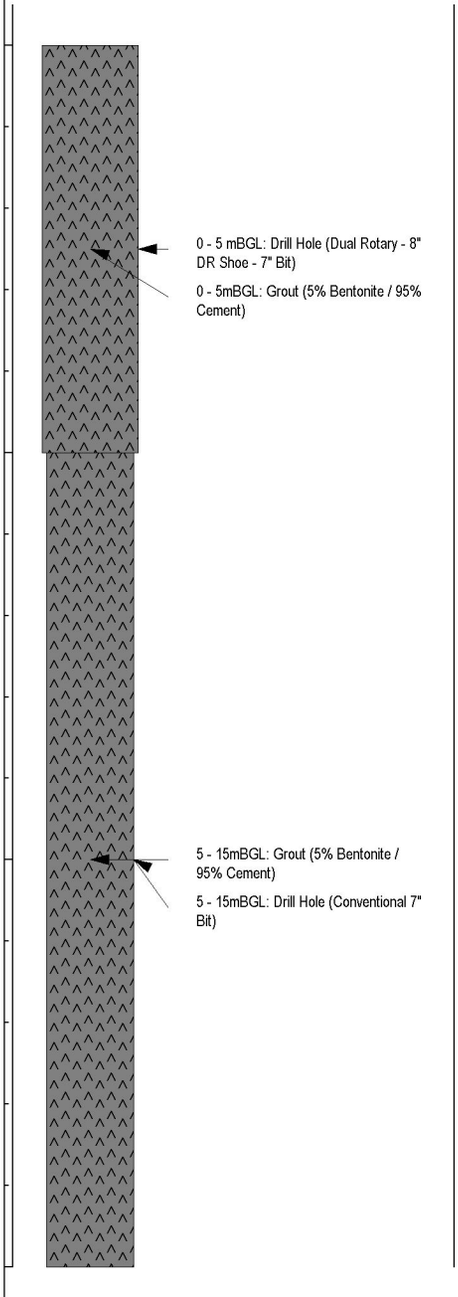
DECOMMISSIONED BORE LOG

BOREHOLE NUMBER
EPGHMB010

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBO**
SURVEY DETAILS:	**Final**
EASTING:	806,074.81 **MGA94 Zone 50**
NORTHING:	7,626,400.94
GROUND ELEVATION (mAHD):	293.98
DATE BEGUN:	**27/10/2024** DATE COMPLETED: **29/10/2024**

FINAL BORE DETAILS		
Drilled Depth (mBGL):	15	
Cased Depth (mBGL):	NA	
Casing Stick Up (mAGL):	NA	
Water Level (mBGL):	NA	
Airlift Yield (L/s):	NA	
Quality - pH & EC (uS/cm):	NA	NA



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0						
	290	TA	GRAVEL: 0 - 6 mBGL: Gravelly CLAY. Brown. Pale. Slightly weathered. Sand Coarse. Hard. Non-plastic. Sub-spherical. Sub-Angular. Poorly sorted. Quartz. 60%. Granite. 40%. GRAVEL. Moderately sorted. slightly weathered grains of granite			
5						
			GRANITE: 6 - 8 mBGL: Moderaely weathered GRANITE. Grey. Gravel Coarse. Coarse grained. Armorphous. Hard. Elongate pink/green/grey chips of plagioclase and orthoclase granite. hard ground. no water.			
	285	AgCm	GRANITE: 8 - 15 mBGL: Fresh GRANITE. Grey. Gravel Coarse. Coarse grained. Blocky very hard ground. no water.			
10						
	280					
15						

Drilling hard ground from 5m BGL onwards. No water encountered therefore bore was decommissioned by grouting from base to surface

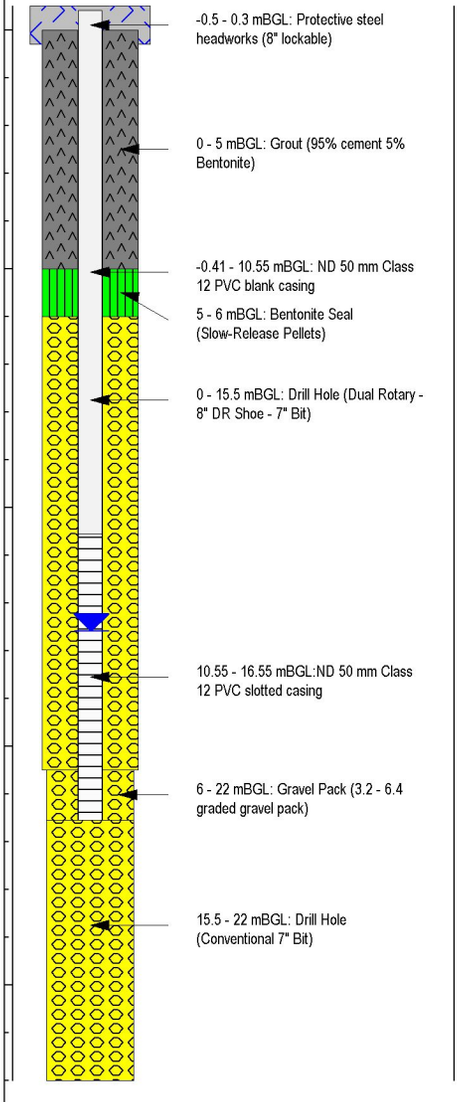
MONITORING BORE LOG

BOREHOLE NUMBER
EPGHMB011

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBI**
SURVEY DETAILS:	**Final**
EASTING:	809,142.02 **MGA94, Zone 50**
NORTHING:	7,622,398.06
GROUND ELEVATION (mAHD):	319.77
DATE BEGUN:	**22/10/2024** DATE COMPLETED: **26/10/2024**

FINAL BORE DETAILS			
Drilled Depth (mBGL):	22		
Cased Depth (mBGL):	16.55		
Casing Stick Up (mAGL):	0.41		
Water Level (mBGL):	12.59		27/10/2024
Airlift Yield (L/s):	0.02		26/10/2024
Quality - pH & EC (uS/cm):	8.88	670	26/10/2024



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	LITHOLOGY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0	320	TA		Silty Gravel: 0 - 4 mBGL: Tertiary Alluvium. Silty Gravel. Brown. 2 -5mm. Major quartz and feldspar grains. moderately weathered. sub angular			
5	315	AgCm		Granite: 4 - 16 mBGL: Weathered, Grey/Brown. 0 - 20 mm. Weathered granite. signs of chemical weathering and yellow staining on few chips indicating slightly fractured zone.			
10	310						
15	305				0.1	734	8.78
				Granite: 16 - 22 mBGL: Fresh Granite. Grey/blue. 0 - 35 mm. Fresh, hard.			
20	300						

Hard ground encountered from 16m BGL, drilling proceeded to 22m BGL with no issues. The monitoring bore was installed at 16m BGL (base of weathered granite) and successfully developed, however the yield was very low.

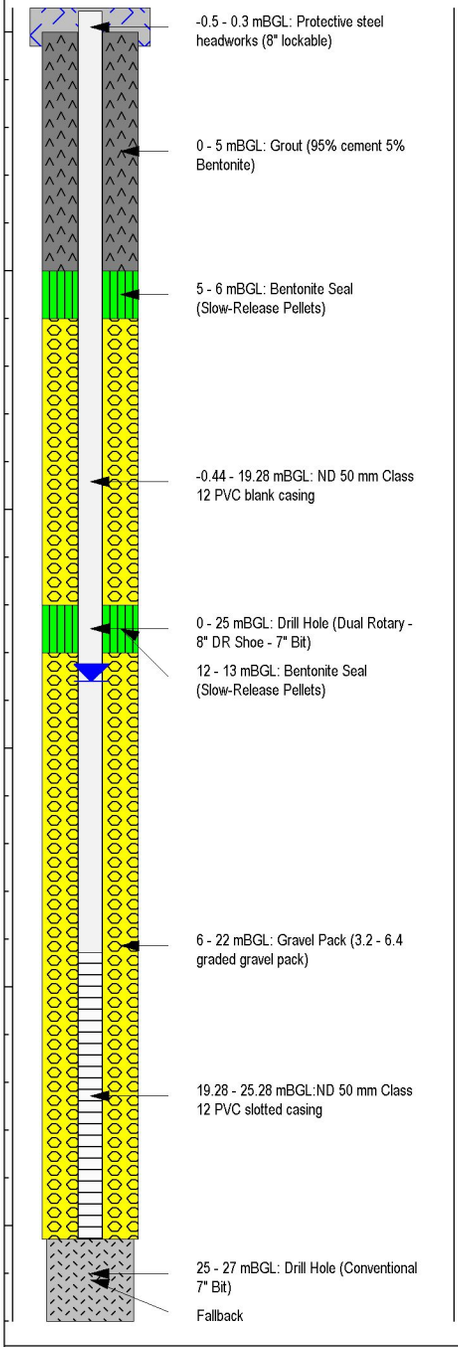
MONITORING BORE LOG

BOREHOLE NUMBER
EPGHMB012

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBO**
SURVEY DETAILS:	**Final**
EASTING:	811,602.51 **MGA94, Zone 50**
NORTHING:	7,621,131.39
GROUND ELEVATION (mAHD):	329.03
DATE BEGUN:	**23/09/2024** DATE COMPLETED: **26/09/2024**

FINAL BORE DETAILS			
Drilled Depth (mBGL):	27		
Cased Depth (mBGL):	25.28		
Casing Stick Up (mAGL):	0.44		
Water Level (mBGL):	13.60		27/09/2024
Airlift Yield (L/s):	0.36		26/09/2024
Quality - pH & EC (uS/cm):	8.42	810	26/09/2024



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	DESCRIPTION	YIELD (L/s)	EC (µS/cm)	pH
0	325		Silty Gravel: 0 - 2 mBGL: Tertiary Alluvium. Silty gravel. Brown, 2 -5mm, moderate quartz content and weathered transported granite chips sub angular to sub rounded showing poorly sorted fine to medium gravel in a matrix of silt.			
5	320		Sandy Gravel: 2 - 10 mBGL: Tertiary Alluvium. Sandy Gravel. Brown, 2 -5mm, moderate quartz content and weathered transported granite chips sub angular to sub rounded showing poorly sorted fine to medium gravel in a matrix of sand.			
10	315	TA	Gravel: 10 - 22 mBGL: Tertiary Alluvium. Gravel. Brown/grey/pink/white 2 -12mm, transported granite chips sub angular to sub rounded showing moderately sorted medium gravel. Decrease in weathering from previous interval with an increase in chip size. Chips appear to be transported and not insitu granite	1.8	815	8.69
15	310					
20	305	AgCm	Granite: 22 - 25 mBGL: Grey. Moderately weathered. Coarse grained. Armorphous. Blocky. Very strong rock. Sub-elongate. Sub-Angular. Transition zone to fresh granite	1.8	816	8.65
25			Granite: 25 - 27 mBGL: Fresh granite. Grey, coarse grained. Blocky. Armorphous. Very strong rock.	1.8	789	8.61

Drilled to target depth without issues The Moniroing Bore installed at 25 mBGL (base of weathered granite) and successfully developed

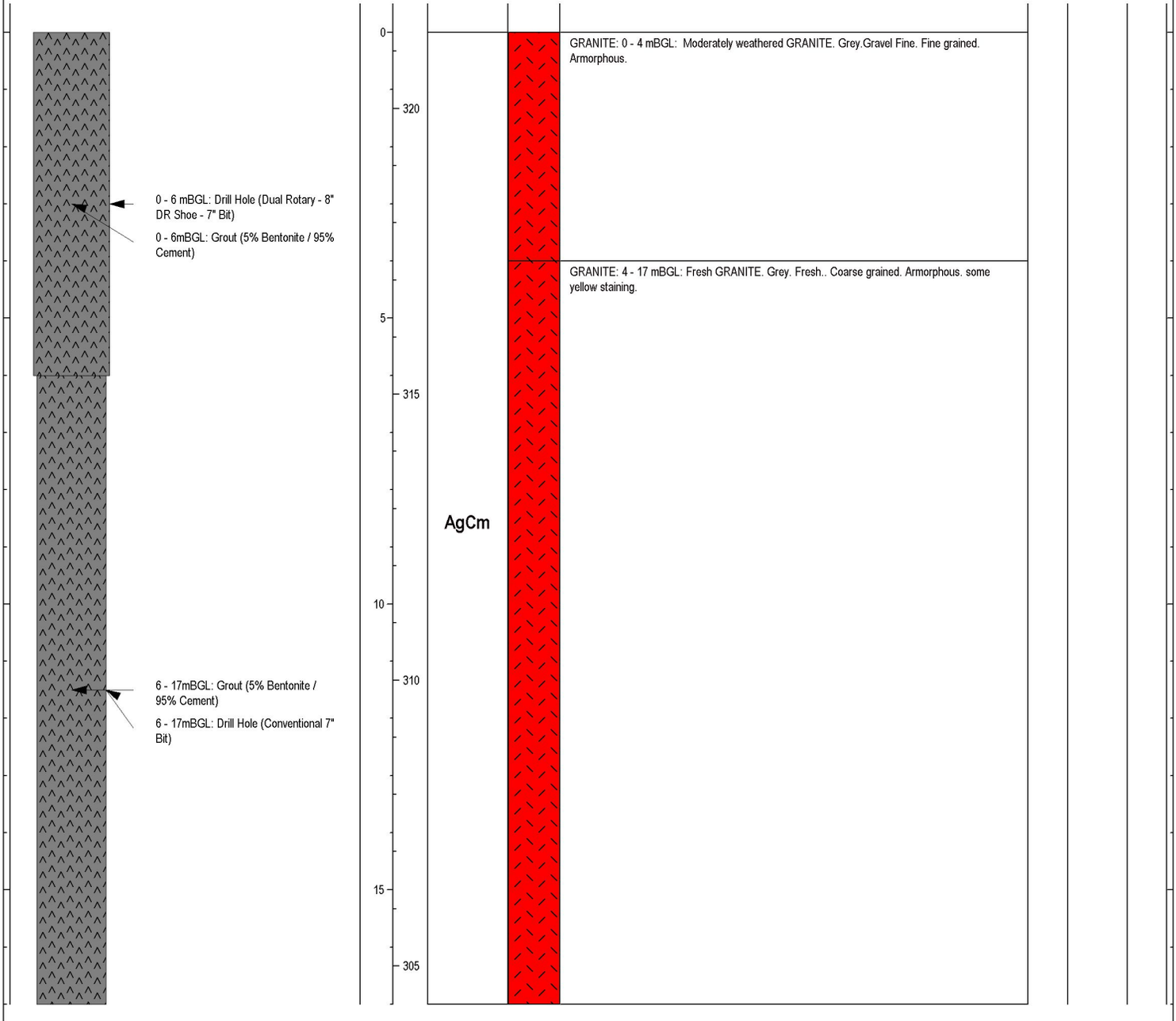
DECOMMISSIONED BORE LOG

BOREHOLE NUMBER
EPGHMB013

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBI**
SURVEY DETAILS:	**Final**
EASTING:	813,168.8 **MGA94 Zone 50**
NORTHING:	7,623,452.95
GROUND ELEVATION (mAHD):	321.33
DATE BEGUN:	**30/09/2024** DATE COMPLETED: **1/10/2024**

FINAL BORE DETAILS		
Drilled Depth (mBGL):	17	
Cased Depth (mBGL):	NA	
Casing Stick Up (mAGL):	NA	
Water Level (mBGL):	NA	
Airlift Yield (L/s):	NA	
Quality - pH & EC (uS/cm):	NA	NA



Drilling hard ground from 6m BGL onwards. No water encountered therefore bore was decommissioned by grouting from base to surface

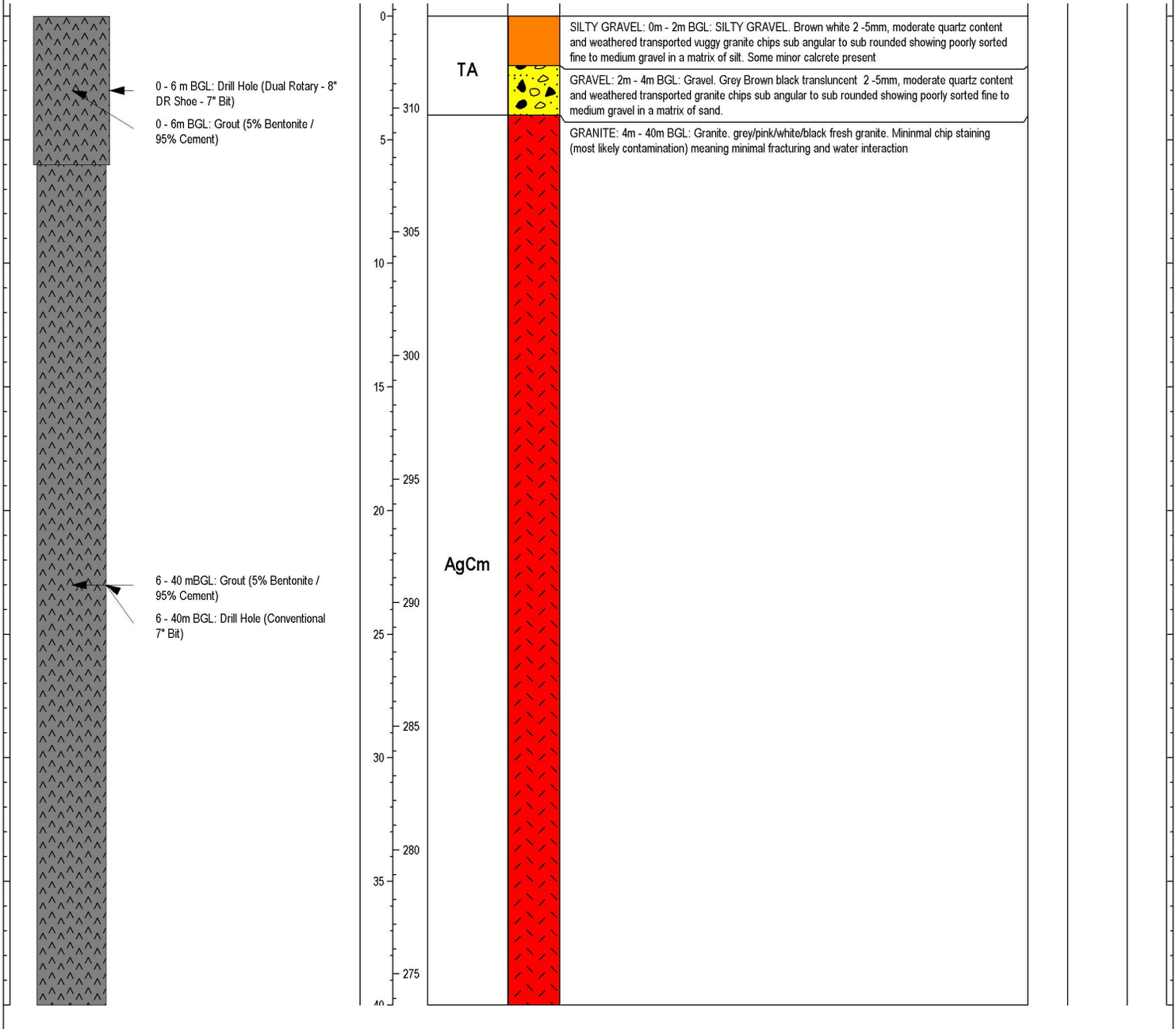
DECOMMISSIONED BORE LOG

BOREHOLE NUMBER
EPGHMB014

Fortescue™
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888 FAX: 08 62188880

PROJECT NAME:	**Water Supply and Groundwater Investigation**	
LOCATION:	**EPGH**	
DRILLING CO:	**Pentium**	
DRILLING METHOD:	**DR & Conventional Air**	
LOGGED BY:	**SME**	
SURVEY DETAILS:	**Final**	
EASTING:	812,648.68	**MGA94 Zone 50**
NORTHING:	7,624,603.69	
GROUND ELEVATION (mAHD):	313.73	
DATE BEGUN:	**27/09/2024**	DATE COMPLETED: **28/09/2024**

FINAL BORE DETAILS		
Drilled Depth (mBGL):	40	
Cased Depth (mBGL):	NA	
Casing Stick Up (mAGL):	NA	
Water Level (mBGL):	NA	
Airlift Yield (L/s):	NA	
Quality - pH & EC (uS/cm):	NA	NA



Drilling hard ground from 6m BGL onwards. First water strike at 6 mBGL with a yield of 0.5 L/s then becoming dry shortly afterwards, therefore bore was decommissioned by grouting from base to surface.

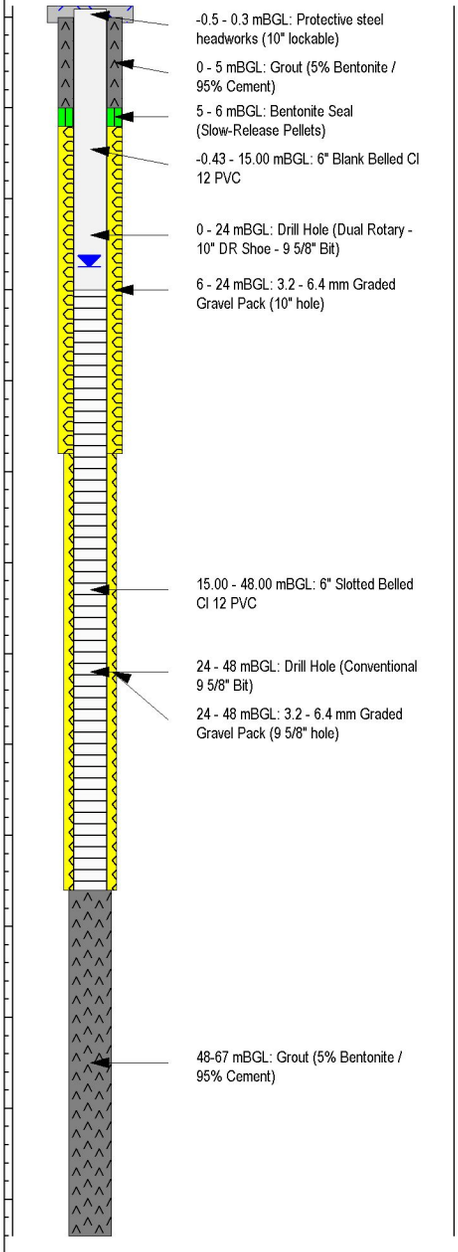
PRODUCTION BORE LOG

BOREHOLE NUMBER
EPGHPB012

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888, FAX: 08 62188880

PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**SME**
SURVEY DETAILS:	**Final**
EASTING:	811,600.31 **MGA94, Zone 50**
NORTHING:	7,621,121.71
GROUND ELEVATION (mAHD):	329.12
DATE BEGUN:	**9/09/2024** COMPLETION DATE **22/09/2024**

FINAL BORE DETAILS			
Drilled Depth (mBGL):	67		
Cased Depth (mBGL):	48		
Casing Stick Up (mAGL):	0.43		
Water Level (mBGL) & Date:	13.73		11/10/2024
Airlift Yield (L/s):	0.5		27/09/2024
Quality - pH & EC (uS/cm):	0.43	830	27/09/2024



DEPTH (mbgl)	ELEVATION (mRL)	STRATIGRAPHY	LITHOLOGY	DESCRIPTION	YIELD (L/s)	EC (uS/cm)	pH
0	325	TA		Silty Gravel: 0m - 2m BGL: Tertiary Alluvium. Silty gravel. Brown, 2 -5mm, moderate quartz content and weathered transported granite chips sub angular to sub rounded showing poorly sorted fine to medium gravel in a matrix of silt.			
5	320			Sandy Gravel: 2m - 4m BGL: Tertiary Alluvium. Sandy Gravel. Brown, 2 -5mm, moderate quartz content and weathered transported granite chips sub angular to sub rounded showing poorly sorted fine to medium gravel in a matrix of sand.			
10	315			Gravel: 4m - 20m BGL: Tertiary Alluvium: Gravel. Brown/grey/pink/white 2 -12mm, transported granite chips sub angular to sub rounded showing moderately sorted medium gravel. Decrease in weathering from previous interval with an increase in chip size. Chips appear to be transported and not insitu granite			
15	310						
20	305			Granite: 20m - 22m BGL: Weathered. Brown/grey/pink/white transition zone from weathered inistu granite to fresh granite	2	925	8.12
25	300	AgCm		Granite: 22m - 67m BGL: Grey/pink/white/black fresh granite. Mininmal chip staining (most likely contamination) meaning minimal fracturing and water interaction	2	1190	8.29
30	295				2	1213	7.96
35	290				2	1296	8.19
40	285				2	1125	8.24
45	280				2	1105	8.5
50	275				2	1030	8.2
55	270				2	1250	8.39
60	265						
65							

Bore initially drilled as a 8" pilot bore to 67m BGL, then reamed out with a 10" bit. The reaming stopped at 48m BGL due to the hard ground conditions and rods getting stuck. Decision was made to construct the hole at the current depth. The production bore was installed and developed without issues. The remainder of the pilot hole from 48m to 67m BGL was grouted.

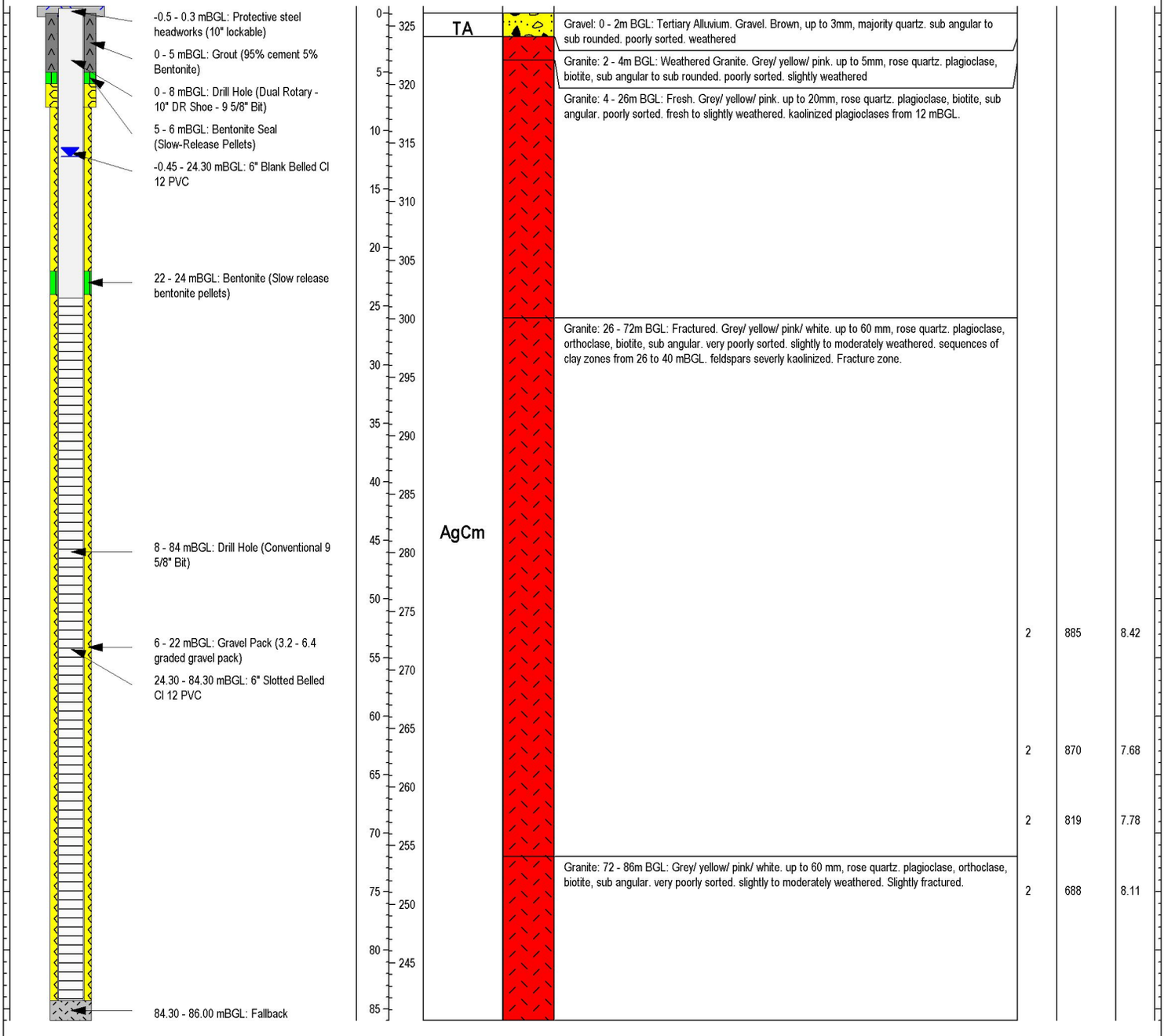
PRODUCTION BORE LOG

BOREHOLE NUMBER
EPGHPB017

Fortescue
Level 2, 87 Adelaide Terrace, East Perth, WA 6004
PH: 08 62188888, FAX: 08 62188880

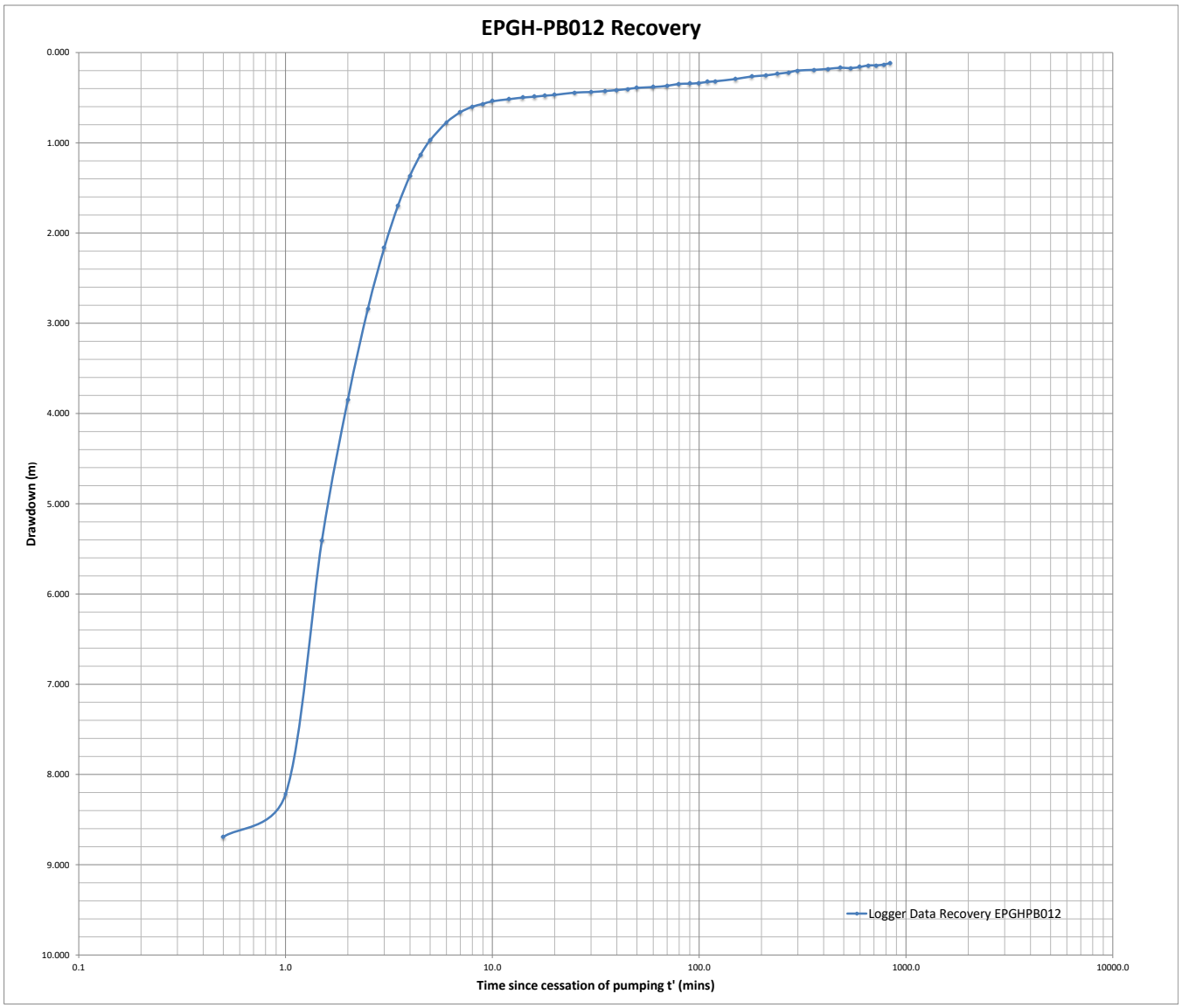
PROJECT NAME:	**EPGH Water Supply and Groundwater Investigation**
LOCATION:	**EPGH**
DRILLING CO:	**Pentium Hydro**
DRILLING METHOD:	**DR & Conventional Air**
LOGGED BY:	**HBI**
SURVEY DETAILS:	**Final**
EASTING:	811,064.17 **MGA94, Zone 50**
NORTHING:	7,621,636.66
GROUND ELEVATION (mAHD):	326.08
DATE BEGUN:	**21/11/2024** COMPLETION DATE **01/12/2024**

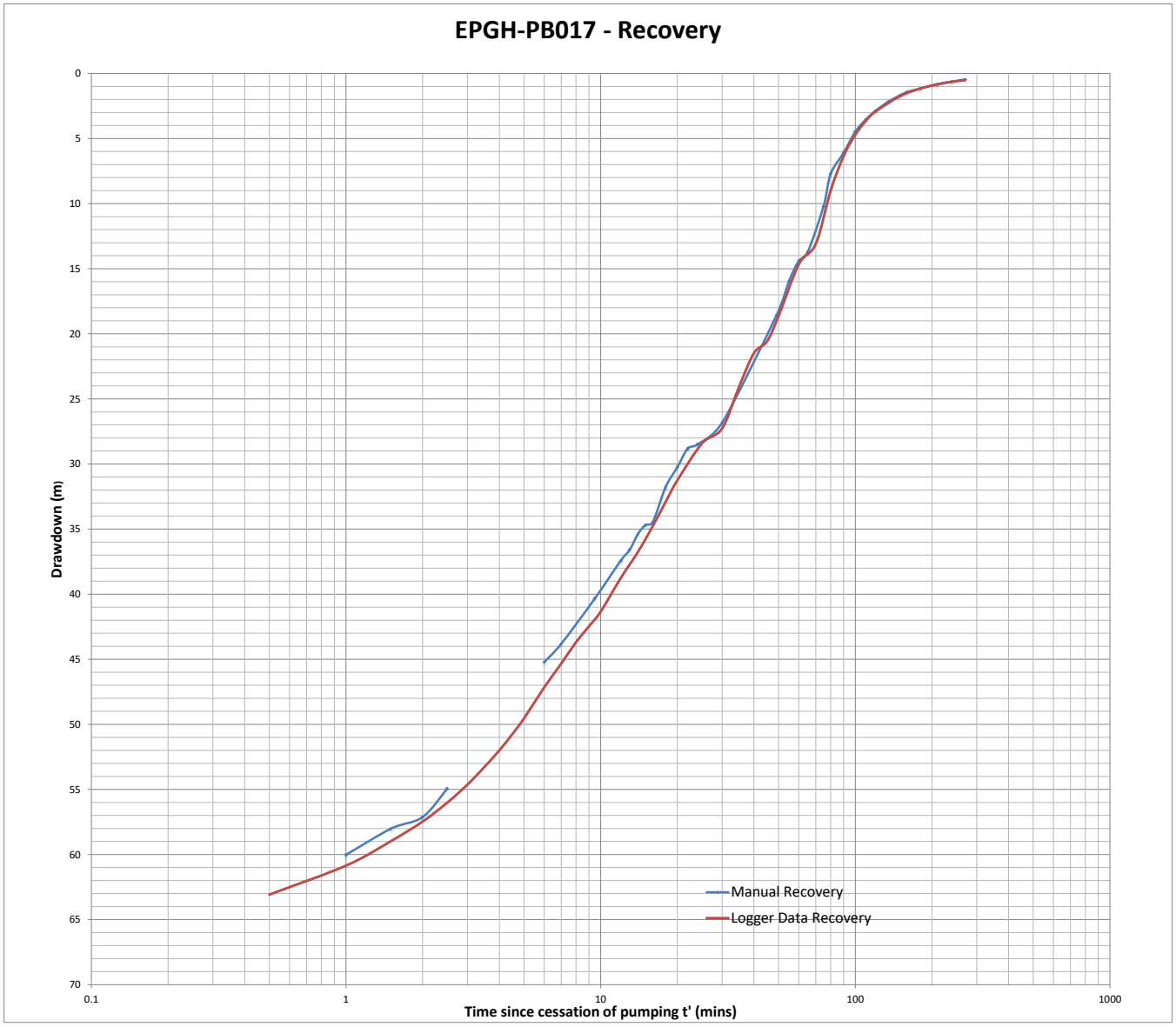
FINAL BORE DETAILS			
Drilled Depth (mBGL):	86		
Cased Depth (mBGL):	84.30		(not final tag/dip)
Casing Stick Up (mAGL):	0.45		(date not recorded)
Water Level (mBGL) & Date:	12.22		30/11/2024
Airlift Yield (L/s):	2		2/12/2024
Quality - pH & EC (uS/cm):	8.58	764	30/11/2024



Very hard ground encountered from 6m BG, end of drilling called at around 19m BGL The monitoring bore was installed and developed without issues, however the yield was marginal

APPENDIX C RECOVERY TEST GRAPHS


EPGH-PB012 Recovery
Drawdown (m)
0.000
1.000
2.000
3.000
4.000
5.000
6.000
7.000
8.000
9.000
10.000
0.1
1.0
10.0
100.0
1000.0
10000.0
Time since cessation of pumping t' (mins)
Logger Data Recovery EPGHPB012


EPGH-PB017 - Recovery
Drawdown (m)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
0.1
1
10
100
1000
Time since cessation of pumping t' (mins)
Manual Recovery
Logger Data Recovery

APPENDIX D LABORATORY CERTIFICATES

CERTIFICATE OF ANALYSIS

Work Order	: **EP2418558**	Page	: 1 of 6
Client	: **FORTESCUE METALS GROUP**	Laboratory	: Environmental Division Perth
Contact	: Daniel Lacey	Contact	: Georgina Nearygrant
Address	: LEVEL 2, 87 ADELAIDE TERRACE EAST PERTH WA, AUSTRALIA 6004	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 401 006 981	Telephone	: +61-8-9406 1301
Project	: EPGH Water Supply and Groundwater Investigation	Date Samples Received	: 11-Dec-2024 08:00
Order number	: 14103222	Date Analysis Commenced	: 11-Dec-2024
C-O-C number	: ----	Issue Date	: 20-Dec-2024 23:21
Sampler	: Harry Bodgener / Hamidreza Behbahani		
Site	: EPGH project (Marble Bar)		
Quote number	: EP24FORMET0013		
No. of samples received	: 3		
No. of samples analysed	: 3		

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*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Niamh Carthew	Inorganic Chemist	Perth Inorganics, Wangara, WA

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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Absorption 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	EPGHPB012 CRT AM	EPGHPB012 End of CRT	EPGHPB017 Start of CRT	----	----
			Sampling date / time	03-Dec-2024 19:10	03-Dec-2024 16:50	03-Dec-2024 18:50	----	----
Compound	CAS Number	LOR	Unit	EP2418558-001	EP2418558-002	EP2418558-003	--------	--------
				Result	Result	Result	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.09**	**8.07**	**8.18**	**----**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**819**	**827**	**754**	**----**	**----**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**502**	**494**	**468**	**----**	**----**
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**532**	**538**	**490**	**----**	**----**
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	<5	**7**	**----**	**----**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**0.5**	**0.4**	**1.5**	**----**	**----**
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	**321**	**319**	**291**	**----**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	**321**	**319**	**291**	**----**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**17**	**17**	**18**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**68**	**70**	**56**	**----**	**----**
ED093F-DW: Dissolved Major Cations - Drinking Water								
Calcium	7440-70-2	0.1	mg/L	**64.6**	**64.6**	**52.8**	**----**	**----**
Magnesium	7439-95-4	0.1	mg/L	**26.8**	**26.8**	**16.7**	**----**	**----**
Potassium	7440-09-7	0.1	mg/L	**0.4**	**0.4**	**2.6**	**----**	**----**
Sodium	7440-23-5	0.1	mg/L	**81.7**	**81.9**	**92.6**	**----**	**----**
EG020F: Dissolved Metals by ICP-MS								
Lanthanum	7439-91-0	0.001	mg/L	<0.001	<0.001	<0.001	**----**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EPGHPB012 CRT AM	EPGHPB012 End of CRT	EPGHPB017 Start of CRT	----	----
				Sampling date / time	03-Dec-2024 19:10	03-Dec-2024 16:50	03-Dec-2024 18:50	----	----
Compound	CAS Number	LOR	Unit		EP2418558-001	EP2418558-002	EP2418558-003	--------	--------
					Result	Result	Result	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Yttrium	7440-65-5	0.001	mg/L		<0.001	<0.001	<0.001	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L		<0.00004	<0.00004	<0.00004	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**63.2**	**62.0**	**42.4**	----	----
Reactive Silica as Silicon	----	0.05	mg/L		**29.5**	**29.0**	**19.8**	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Aluminium	7429-90-5	0.005	mg/L		<0.005	<0.005	<0.005	----	----
Antimony	7440-36-0	0.0002	mg/L		<0.0002	<0.0002	<0.0002	----	----
Arsenic	7440-38-2	0.0002	mg/L		**0.0012**	**0.0011**	**0.0014**	----	----
Barium	7440-39-3	0.0005	mg/L		**0.0620**	**0.0094**	**0.0514**	----	----
Beryllium	7440-41-7	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Boron	7440-42-8	0.005	mg/L		**0.141**	**0.121**	**0.127**	----	----
Bismuth	7440-69-9	0.00005	mg/L		<0.00005	<0.00005	<0.00005	----	----
Cadmium	7440-43-9	0.00005	mg/L		**0.00009**	<0.00005	<0.00005	----	----
Chromium	7440-47-3	0.0002	mg/L		<0.0002	<0.0002	<0.0002	----	----
Cobalt	7440-48-4	0.0001	mg/L		**0.0002**	<0.0001	**0.0002**	----	----
Copper	7440-50-8	0.0005	mg/L		<0.0005	<0.0005	<0.0005	----	----
Iron	7439-89-6	0.002	mg/L		**0.044**	**0.002**	<0.002	----	----
Lead	7439-92-1	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Manganese	7439-96-5	0.0005	mg/L		**0.0425**	**0.0114**	**0.0186**	----	----
Molybdenum	7439-98-7	0.0001	mg/L		**0.0013**	**0.0014**	**0.0066**	----	----
Nickel	7440-02-0	0.0005	mg/L		<0.0005	<0.0005	<0.0005	----	----
Selenium	7782-49-2	0.0002	mg/L		**0.0014**	**0.0015**	**0.0014**	----	----
Silver	7440-22-4	0.00001	mg/L		<0.00001	<0.00001	<0.00001	----	----
Strontium	7440-24-6	0.001	mg/L		**0.383**	**0.375**	**0.309**	----	----
Thallium	7440-28-0	0.00002	mg/L		<0.00002	**0.00002**	<0.00002	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EPGHPB012 CRT AM	EPGHPB012 End of CRT	EPGHPB017 Start of CRT	----	----
				Sampling date / time	03-Dec-2024 19:10	03-Dec-2024 16:50	03-Dec-2024 18:50	----	----
Compound	CAS Number	LOR	Unit		EP2418558-001	EP2418558-002	EP2418558-003	--------	--------
					Result	Result	Result	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued									
Tin	7440-31-5	0.0002	mg/L		<0.0002	<0.0002	<0.0002	----	----
Uranium	7440-61-1	0.00005	mg/L		**0.0117**	**0.0122**	**0.0241**	----	----
Vanadium	7440-62-2	0.0002	mg/L		**0.0030**	**0.0027**	**0.0036**	----	----
Zinc	7440-66-6	0.001	mg/L		**0.027**	<0.001	**0.016**	----	----
EG094T: Total metals in Fresh water by ORC-ICPMS									
Iron	7439-89-6	0.002	mg/L		**0.079**	**0.038**	**0.129**	----	----
Manganese	7439-96-5	0.0005	mg/L		**0.0464**	**0.0181**	**0.0246**	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**2.4**	**2.4**	**3.0**	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.01**	<0.01	**0.01**	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	**0.07**	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**5.62**	**5.73**	**6.61**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**5.62**	**5.73**	**6.68**	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.6**	**0.5**	**0.4**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**6.2**	**6.2**	**7.1**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.16**	**0.18**	**0.15**	----	----
Total Phosphate	----	0.10	mg/L		**0.48**	**0.54**	**0.47**	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**8.68**	**8.70**	**7.78**	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	EPGHPB012 CRT AM	EPGHPB012 End of CRT	EPGHPB017 Start of CRT	----	----
			Sampling date / time	03-Dec-2024 19:10	03-Dec-2024 16:50	03-Dec-2024 18:50	----	----
Compound	CAS Number	LOR	Unit	EP2418558-001	EP2418558-002	EP2418558-003	--------	--------
				Result	Result	Result	----	----
EN055: Ionic Balance - Continued								
ø Total Cations	----	0.01	meq/L	**8.99**	**9.00**	**8.10**	**----**	**----**
ø Ionic Balance	----	0.01	%	**1.76**	**1.73**	**2.00**	**----**	**----**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**3**	**4**	**3**	**----**	**----**
EP025: Oxygen - Dissolved (DO)								
Dissolved Oxygen	----	0.1	mg/L	**8.9**	**8.6**	**7.9**	**----**	**----**

Inter-Laboratory Testing

Analysis conducted by ALS Melbourne, NATA accreditation no. 825, site no. 13778 (Chemistry).

(WATER) EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser

(WATER) EK061G: Total Kjeldahl Nitrogen By Discrete Analyser

(WATER) EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser

(WATER) EK055G: Ammonia as N by Discrete Analyser

(WATER) EK067G: Total Phosphorus as P by Discrete Analyser

QUALITY CONTROL REPORT

Work Order	: **EP2418558**	Page	: 1 of 10
Client	: **FORTESCUE METALS GROUP**	Laboratory	: Environmental Division Perth
Contact	: Daniel Lacey	Contact	: Georgina Nearygrant
Address	: LEVEL 2, 87 ADELAIDE TERRACE EAST PERTH WA, AUSTRALIA 6004	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 401 006 981	Telephone	: +61-8-9406 1301
Project	: EPGH Water Supply and Groundwater Investigation	Date Samples Received	: 11-Dec-2024
Order number	: 14103222	Date Analysis Commenced	: 11-Dec-2024
C-O-C number	: ----	Issue Date	: 20-Dec-2024
Sampler	: Harry Bodgener / Hamidreza Behbahani		
Site	: EPGH project (Marble Bar)		
Quote number	: EP24FORMET0013		
No. of samples received	: 3		
No. of samples analysed	: 3		

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*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Niamh Carthew	Inorganic Chemist	Perth Inorganics, Wangara, WA

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
* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

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: 6265647)									
EP2418452-003	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	8.14	8.18	0.5	0% - 20%
EP2418452-009	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	8.03	7.98	0.6	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 6265650)									
EP2418452-003	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	2100	2060	1.5	0% - 20%
EP2418452-009	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1590	1580	0.6	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 6271958)									
EP2418040-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	765	768	0.5	0% - 20%
EP2418948-004	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	530	551	4.0	0% - 20%
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 6271959)									
EP2418558-001	EPGHPB012 CRT AM	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
EA045: Turbidity (QC Lot: 6254940)									
EP2418233-007	Anonymous	EA045: Turbidity	----	0.1	NTU	173	170	1.7	0% - 20%
EP2418612-001	Anonymous	EA045: Turbidity	----	0.1	NTU	1.8	1.6	8.3	0% - 50%
ED037P: Alkalinity by PC Titrator (QC Lot: 6265649)									
EP2418452-003	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	378	379	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	378	379	0.0	0% - 20%
EP2418452-009	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

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: 6265649) - continued									
EP2418452-009	Anonymous	ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	198	197	0.8	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	198	197	0.8	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6252766)									
EP2418558-002	EPGHPB012 End of CRT	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	17	17	0.0	0% - 50%
EP2418591-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	308	313	1.5	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 6252769)									
EP2418558-002	EPGHPB012 End of CRT	ED045G: Chloride	16887-00-6	1	mg/L	70	68	1.9	0% - 20%
EP2418591-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	326	328	0.5	0% - 20%
ED093F-DW: Dissolved Major Cations - Drinking Water (QC Lot: 6251547)									
EP2418556-001	Anonymous	ED093F-DW: Calcium	7440-70-2	0.1	mg/L	53.2	53.1	0.2	0% - 20%
		ED093F-DW: Magnesium	7439-95-4	0.1	mg/L	78.5	78.9	0.5	0% - 20%
		ED093F-DW: Potassium	7440-09-7	0.1	mg/L	52.2	52.1	0.2	0% - 20%
		ED093F-DW: Sodium	7440-23-5	0.1	mg/L	344	346	0.5	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 6251542)									
EP2418297-001	Anonymous	EG020D-F: Lanthanum	7439-91-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020D-F: Yttrium	7440-65-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EP2418281-010	Anonymous	EG020D-F: Lanthanum	7439-91-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020D-F: Yttrium	7440-65-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 6263591)									
EP2418451-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.0	No Limit
EP2418488-002	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.0	No Limit
EG052G: Silica by Discrete Analyser (QC Lot: 6252767)									
EP2418558-001	EPGHPB012 CRT AM	EG052G: Reactive Silica	----	0.05	mg/L	63.2	61.8	2.3	0% - 20%
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 6256088)									
EP2418556-001	Anonymous	EG094-AgF: Silver	7440-22-4	0.01	µg/L	<0.00001 mg/L	<0.01	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 6256089)									
EP2418664-004	Anonymous	EG094A-F: Thallium	7440-28-0	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EG094A-F: Bismuth	7440-69-9	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.00044 mg/L	0.45	0.0	No Limit
		EG094A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	0.0005 mg/L	0.5	0.0	No Limit
		EG094A-F: Antimony	7440-36-0	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	0.0002 mg/L	0.2	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 (%)*
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 6256089) - continued									
EP2418664-004	Anonymous	EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Tin	7440-31-5	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	0.0025 mg/L	2.6	5.3	0% - 50%
		EG094A-F: Barium	7440-39-3	0.5	µg/L	0.116 mg/L	118	1.9	0% - 20%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.0154 mg/L	15.7	2.2	0% - 20%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Strontium	7440-24-6	1	µg/L	101	102	1.2	0% - 20%
		EG094A-F: Zinc	7440-66-6	1	µg/L	0.023 mg/L	23	0.0	0% - 20%
		EG094A-F: Aluminium	7429-90-5	5	µg/L	0.021 mg/L	21	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	0.180 mg/L	184	2.1	0% - 20%
EP2418556-001	Anonymous	EG094A-F: Thallium	7440-28-0	0.02	µg/L	<0.00002 mg/L	<0.02	0.0	No Limit
		EG094A-F: Bismuth	7440-69-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.00005 mg/L	<0.05	0.0	No Limit
		EG094A-F: Uranium	7440-61-1	0.05	µg/L	0.00064 mg/L	0.63	1.8	0% - 50%
		EG094A-F: Beryllium	7440-41-7	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	0.0001 mg/L	0.1	0.0	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.0001 mg/L	<0.1	0.0	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	0.0018 mg/L	1.9	7.9	0% - 50%
		EG094A-F: Antimony	7440-36-0	0.2	µg/L	0.0003 mg/L	0.3	0.0	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Tin	7440-31-5	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094A-F: Vanadium	7440-62-2	0.2	µg/L	0.0002 mg/L	0.2	0.0	No Limit
		EG094A-F: Barium	7440-39-3	0.5	µg/L	0.0411 mg/L	41.6	1.4	0% - 20%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.0005 mg/L	<0.5	0.0	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.142 mg/L	142	0.3	0% - 20%
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.0008 mg/L	0.8	0.0	No Limit
		EG094A-F: Strontium	7440-24-6	1	µg/L	0.230 mg/L	230	0.0	0% - 20%
		EG094A-F: Zinc	7440-66-6	1	µg/L	0.066 mg/L	67	0.0	0% - 20%
		EG094A-F: Aluminium	7429-90-5	5	µg/L	<0.005 mg/L	<5	0.0	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	0.262 mg/L	276	5.5	0% - 20%
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 6256090)									
EP2418664-004	Anonymous	EG094B-F: Selenium	7782-49-2	0.2	µg/L	<0.0002 mg/L	<0.2	0.0	No Limit
		EG094B-F: Iron	7439-89-6	2	µg/L	0.045 mg/L	43	4.0	0% - 20%
EP2418556-001	Anonymous	EG094B-F: Selenium	7782-49-2	0.2	µg/L	0.0004 mg/L	0.4	0.0	No Limit
		EG094B-F: Iron	7439-89-6	2	µg/L	<0.002 mg/L	<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 (%)*
EG094T: Total metals in Fresh water by ORC-ICPMS (QC Lot: 6256101)									
EP2418528-001	Anonymous	EG094B-T: Iron	7439-89-6	2	µg/L	1620	1610	0.8	0% - 20%
EP2418664-004	Anonymous	EG094B-T: Iron	7439-89-6	2	µg/L	283	262	7.5	0% - 20%
EG094T: Total metals in Fresh water by ORC-ICPMS (QC Lot: 6256102)									
EP2418528-001	Anonymous	EG094A-T: Manganese	7439-96-5	0.5	µg/L	121	120	0.2	0% - 20%
EP2418664-004	Anonymous	EG094A-T: Manganese	7439-96-5	0.5	µg/L	68.8	69.5	1.0	0% - 20%
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 6257389)									
EP2418663-006	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EP2418698-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004 (4.00)*	mg/L	204	205	0.6	0% - 20%
EK040P: Fluoride by PC Titrator (QC Lot: 6265648)									
EP2418452-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	2.0	2.0	0.0	0% - 20%
EP2418452-009	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	2.5	2.5	0.0	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 6263582)									
EP2418556-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.08	0.0	No Limit
EP2418571-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.01	0.02	65.2	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6252765)									
EP2418558-002	EPGHPB012 End of CRT	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2418591-002	Anonymous	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: 6263583)									
EP2418556-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.58	0.60	3.3	0% - 20%
EP2418571-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	8.71	8.75	0.5	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 6271628)									
EP2418555-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1 (0.5)*	mg/L	3.0	4.6	41.3	No Limit
EP2418590-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1 (0.5)*	mg/L	3.0	2.4	22.4	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 6271627)									
EM2422096-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01 (0.05)*	mg/L	0.25	0.25	0.0	No Limit
EP005: Total Organic Carbon (TOC) (QC Lot: 6255514)									
EP2418417-003	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	7	8	0.0	No Limit
EP2418558-002	EPGHPB012 End of CRT	EP005: Total Organic Carbon	----	1	mg/L	4	4	0.0	No Limit
EP025: Oxygen - Dissolved (DO) (QC Lot: 6252364)									
EP2418549-001	Anonymous	EP025: Dissolved Oxygen	----	0.1	mg/L	6.6	6.7	0.0	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
EA005P: pH by PC Titrator (QCLot: 6265647)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.5	102
				----	7 pH Unit	100	98.5	102
EA010P: Conductivity by PC Titrator (QCLot: 6265650)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	24800 µS/cm	100	92.1	105
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 6271958)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	97.6	80.0	120
				<10	293 mg/L	100	80.0	120
				<10	2470 mg/L	98.1	80.0	120
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 6271959)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	92.7	80.0	120
				<5	1000 mg/L	100	80.0	120
				<5	841 mg/L	93.7	80.0	120
EA045: Turbidity (QCLot: 6254940)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	96.8	90.6	109
ED037P: Alkalinity by PC Titrator (QCLot: 6265649)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	112	85.1	126
				<1	200 mg/L	106	90.5	111
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6252766)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	101	89.9	112
				<1	500 mg/L	98.8	89.9	112
ED045G: Chloride by Discrete Analyser (QCLot: 6252769)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	95.1	88.6	113
				<1	1000 mg/L	97.5	88.6	113
ED093F-DW: Dissolved Major Cations - Drinking Water (QCLot: 6251547)								
ED093F-DW: Calcium	7440-70-2	0.1	mg/L	<0.1	50 mg/L	98.8	88.4	108
ED093F-DW: Magnesium	7439-95-4	0.1	mg/L	<0.1	50 mg/L	102	86.8	109
ED093F-DW: Potassium	7440-09-7	0.1	mg/L	<0.1	50 mg/L	92.7	83.8	103

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
ED093F-DW: Dissolved Major Cations - Drinking Water (QCLot: 6251547) - continued								
ED093F-DW: Sodium	7440-23-5	0.1	mg/L	<0.1	50 mg/L	95.8	94.0	114
EG020F: Dissolved Metals by ICP-MS (QCLot: 6251542)								
EG020D-F: Lanthanum	7439-91-0	0.001	mg/L	<0.001	0.01 mg/L	102	82.1	118
EG020D-F: Yttrium	7440-65-5	0.001	mg/L	<0.001	0.01 mg/L	98.7	86.6	120
EG035F: Dissolved Mercury by FIMS (QCLot: 6263591)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.005 mg/L	101	85.7	118
EG052G: Silica by Discrete Analyser (QCLot: 6252767)								
EG052G: Reactive Silica	----	0.05	mg/L	<0.05	5 mg/L	104	94.6	110
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 6256088)								
EG094-AgF: Silver	7440-22-4	0.01	µg/L	<0.01	2 µg/L	94.6	83.6	110
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 6256089)								
EG094A-F: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	101	94.0	116
EG094A-F: Antimony	7440-36-0	0.2	µg/L	<0.2	2 µg/L	103	74.0	106
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	100	92.1	119
EG094A-F: Barium	7440-39-3	0.5	µg/L	<0.5	10 µg/L	99.6	91.2	114
EG094A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	93.4	78.9	123
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	85.8	69.0	137
EG094A-F: Bismuth	7440-69-9	0.05	µg/L	<0.05	10 µg/L	87.2	68.2	121
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	99.8	92.7	111
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	108	90.0	112
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	101	92.1	114
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	10 µg/L	96.0	88.5	111
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	95.7	89.2	109
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	100	91.1	109
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	101	91.8	114
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	102	91.5	113
EG094A-F: Strontium	7440-24-6	1	µg/L	<1	10 µg/L	96.2	88.9	122
EG094A-F: Thallium	7440-28-0	0.02	µg/L	<0.02	10 µg/L	95.6	89.1	107
EG094A-F: Tin	7440-31-5	0.2	µg/L	<0.2	10 µg/L	101	92.1	113
EG094A-F: Uranium	7440-61-1	0.05	µg/L	<0.05	10 µg/L	101	90.8	111
EG094A-F: Vanadium	7440-62-2	0.2	µg/L	<0.2	10 µg/L	106	91.5	111
EG094A-F: Zinc	7440-66-6	1	µg/L	<1	10 µg/L	105	90.5	123
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 6256090)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	116	87.8	121

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	LCS: Spike Recovery (%)	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 6256090) - continued								
EG094B-F: Selenium	7782-49-2	0.2	µg/L	<0.2	10 µg/L	83.6	77.8	103
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 6256101)								
EG094B-T: Iron	7439-89-6	2	µg/L	<2	50 µg/L	112	93.0	123
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 6256102)								
EG094A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	105	90.9	108
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 6257389)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	100	76.7	110
EK040P: Fluoride by PC Titrator (QCLot: 6265648)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	104	86.0	116
EK055G: Ammonia as N by Discrete Analyser (QCLot: 6263582)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	101	90.0	110
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6252765)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	102	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6263583)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	103	90.0	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6271628)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	86.8	70.0	117
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6271627)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	106	71.9	114
EP005: Total Organic Carbon (TOC) (QCLot: 6255514)								
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	97.1	87.2	116
				<1	100 mg/L	98.2	87.2	116

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: 6252766)							
EP2418558-001	EPGHPB012 CRT AM	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	102	70.4	130
ED045G: Chloride by Discrete Analyser (QCLot: 6252769)							
EP2418558-001	EPGHPB012 CRT AM	ED045G: Chloride	16887-00-6	200 mg/L	112	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 6251542)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG020F: Dissolved Metals by ICP-MS (QCLot: 6251542) - continued							
EP2418281-002	Anonymous	EG020D-F: Lanthanum	7439-91-0	0.05 mg/L	87.1	70.0	130
		EG020D-F: Yttrium	7440-65-5	0.05 mg/L	85.4	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 6263591)							
EP2418451-002	Anonymous	EG035F-LL: Mercury	7439-97-6	0.005 mg/L	80.6	70.0	130
EG052G: Silica by Discrete Analyser (QCLot: 6252767)							
EP2418558-002	EPGHPB012 End of CRT	EG052G: Reactive Silica	----	5 mg/L	# Not Determined	70.0	116
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 6256089)							
EP2418528-002	Anonymous	EG094A-F: Arsenic	7440-38-2	50 µg/L	105	81.0	141
		EG094A-F: Barium	7440-39-3	50 µg/L	93.9	70.0	130
		EG094A-F: Beryllium	7440-41-7	50 µg/L	106	66.2	135
		EG094A-F: Cadmium	7440-43-9	12.5 µg/L	87.6	79.1	129
		EG094A-F: Chromium	7440-47-3	50 µg/L	92.4	71.8	127
		EG094A-F: Cobalt	7440-48-4	50 µg/L	98.1	78.3	132
		EG094A-F: Copper	7440-50-8	50 µg/L	93.4	75.8	126
		EG094A-F: Lead	7439-92-1	50 µg/L	80.6	73.9	112
		EG094A-F: Manganese	7439-96-5	50 µg/L	88.6	69.6	127
		EG094A-F: Nickel	7440-02-0	50 µg/L	93.9	76.6	131
		EG094A-F: Vanadium	7440-62-2	50 µg/L	95.4	74.1	129
		EG094A-F: Zinc	7440-66-6	50 µg/L	94.8	76.8	133
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 6256102)							
EP2418528-002	Anonymous	EG094A-T: Manganese	7439-96-5	50 µg/L	74.3	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 6257389)							
EP2418698-001	Anonymous	EK026SF: Total Cyanide	57-12-5	200 mg/L	100.0	67.0	118
EK040P: Fluoride by PC Titrator (QCLot: 6265648)							
EP2418452-004	Anonymous	EK040P: Fluoride	16984-48-8	4.9 mg/L	104	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 6263582)							
EP2418558-001	EPGHPB012 CRT AM	EK055G: Ammonia as N	7664-41-7	1 mg/L	87.7	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6252765)							
EP2418591-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	112	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6263583)							
EP2418558-001	EPGHPB012 CRT AM	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6271628)							
EP2418590-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	94.3	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*
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6271627)							
EM2422096-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	93.3	70.0	130
EP005: Total Organic Carbon (TOC) (QCLot: 6255514)							
EP2418417-002	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	96.7	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2418558**	Page	: 1 of 12
Client	: **FORTESCUE METALS GROUP**	Laboratory	: Environmental Division Perth
Contact	: Daniel Lacey	Telephone	: +61-8-9406 1301
Project	: EPGH Water Supply and Groundwater Investigation	Date Samples Received	: 11-Dec-2024
Site	: EPGH project (Marble Bar)	Issue Date	: 20-Dec-2024
Sampler	: Harry Bodgener / Hamidreza Behbahani	No. of samples received	: 3
Order number	: 14103222	No. of samples analysed	: 3

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.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, where applicable to the methodology, 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: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG052G: Silica by Discrete Analyser	EP2418558--002	EPGHPB012 End of CRT	**Reactive Silica**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	EP2418558--001	EPGHPB012 CRT AM	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

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							
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	----	----	----	18-Dec-2024	04-Dec-2024	**14**
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural							
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	----	----	----	19-Dec-2024	10-Dec-2024	**9**
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural							
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	----	----	----	19-Dec-2024	10-Dec-2024	**9**
EA045: Turbidity							
Clear Plastic Bottle - Natural							
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	----	----	----	12-Dec-2024	05-Dec-2024	**7**
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural							
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	----	----	----	18-Dec-2024	17-Dec-2024	**1**
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	----	----	----	11-Dec-2024	05-Dec-2024	**6**
EP025: Oxygen - Dissolved (DO)							
Clear Plastic Bottle - Natural							
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	----	----	----	11-Dec-2024	04-Dec-2024	**7**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)						
Total Phosphorus as P By Discrete Analyser	EK067G	1	14	7.14	10.00	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: **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)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	----	**18-Dec-2024**	04-Dec-2024	×
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	----	**18-Dec-2024**	31-Dec-2024	✓
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Clear Plastic Bottle - Natural (EA015H)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	----	**19-Dec-2024**	10-Dec-2024	×
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025H)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	----	**19-Dec-2024**	10-Dec-2024	×
EA045: Turbidity								
Clear Plastic Bottle - Natural (EA045)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	----	**12-Dec-2024**	05-Dec-2024	×
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	----	**18-Dec-2024**	17-Dec-2024	×

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)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**11-Dec-2024**	31-Dec-2024	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**11-Dec-2024**	31-Dec-2024	✓
ED093F-DW: Dissolved Major Cations - Drinking Water							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F-DW)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**14-Dec-2024**	31-Dec-2024	✓
EG020F: Dissolved Metals by ICP-MS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG020D-F)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**13-Dec-2024**	01-Jun-2025	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-LL)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**16-Dec-2024**	31-Dec-2024	✓
EG052G: Silica by Discrete Analyser							
Clear Plastic Bottle - Natural (EG052G)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**19-Dec-2024**	31-Dec-2024	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**13-Dec-2024**	01-Jun-2025	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094-AgF)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**16-Dec-2024**	01-Jun-2025	✓
EG094T: Total metals in Fresh water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG094B-T)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**13-Dec-2024**	01-Jun-2025	✓	**13-Dec-2024**	01-Jun-2025	✓
EK026SF: Total CN by Segmented Flow Analyser							
Black Opaque Plastic Bottle - NaOH (EK026SF)							
EPGHPB012 CRT AM, EPGHPB012 End of CRT, EPGHPB017 Start of CRT	**03-Dec-2024**	**----**	----	**----**	**13-Dec-2024**	17-Dec-2024	✓

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
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	**----**	**18-Dec-2024**	31-Dec-2024	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	**----**	**19-Dec-2024**	31-Dec-2024	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	**----**	**11-Dec-2024**	05-Dec-2024	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	**----**	**18-Dec-2024**	31-Dec-2024	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**20-Dec-2024**	31-Dec-2024	✓	**20-Dec-2024**	31-Dec-2024	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**20-Dec-2024**	31-Dec-2024	✓	**20-Dec-2024**	31-Dec-2024	✓
EP005: Total Organic Carbon (TOC)								
Amber TOC Vial - Sulfuric Acid (EP005)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	**----**	**13-Dec-2024**	31-Dec-2024	✓
EP025: Oxygen - Dissolved (DO)								
Clear Plastic Bottle - Natural (EP025)								
EPGHPB012 CRT AM, EPGHPB017 Start of CRT	EPGHPB012 End of CRT,	**03-Dec-2024**	**----**	----	**----**	**11-Dec-2024**	04-Dec-2024	×

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)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite D	EG020D-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low-Level Dissolved Silver in Fresh Water by ORC-ICPMS	EG094-AgF	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved - Drinking Water	ED093F-DW	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oxygen - Dissolved	EP025	1	3	**33.33**	**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
Silica (Reactive) by Discrete Analyser	EG052G	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	14	**7.14**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	**10.00**	**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
Ammonia as N by Discrete analyser	EK055G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite D	EG020D-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	17	**5.88**	**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 Control Samples (LCS) - Continued							
Fluoride by Auto Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low-Level Dissolved Silver in Fresh Water by ORC-ICPMS	EG094-AgF	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved - Drinking Water	ED093F-DW	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.14**	**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
Silica (Reactive) by Discrete Analyser	EG052G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	4	**75.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	3	17	**17.65**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by Auto Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite D	EG020D-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Low-Level Dissolved Silver in Fresh Water by ORC-ICPMS	EG094-AgF	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved - Drinking Water	ED093F-DW	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Silica (Reactive) by Discrete Analyser	EG052G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	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							
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite D	EG020D-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Silica (Reactive) by Discrete Analyser	EG052G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	14	**7.14**	**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 by Auto Titrator	EA005-P	WATER	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	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	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	WATER	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)
Chloride by Discrete Analyser	ED045G	WATER	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.
Major Cations - Dissolved - Drinking Water	ED093F-DW	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite D	EG020D-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. 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.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. 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).
Silica (Reactive) by Discrete Analyser	EG052G	WATER	In house: Referenced to APHA 4500-SiO2 D: Under Acdic conditions reactive silicon combines with ammonium molybdate to form a yellow molybdosilicic acid complex. This is reduced by 1-amino-2-naphthol-4-sulfonic acid to a silicomolybdenum blue complex which is measured by discrete analyser at 670 nm. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Low-Level Dissolved Silver in Fresh Water by ORC-ICPMS	EG094-AqF	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Digestion for Total Recoverable Metals - ORC	* EN25-ORC	WATER	In house: Referenced to USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM Schedule B(3)