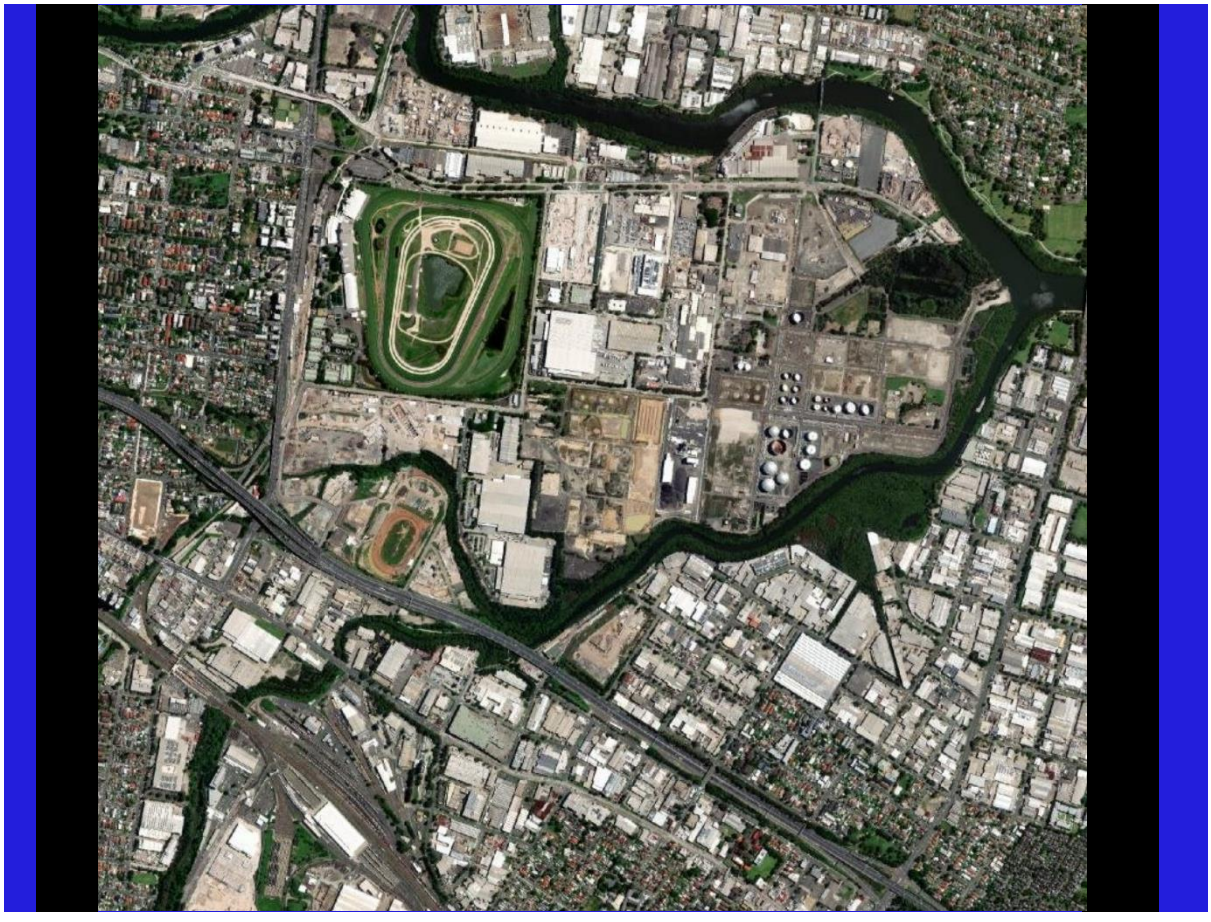
EIS - Groundwater Impact Assessment Report

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16 January 2026



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Executive summary

Project context and objectives

Sydney Water is proposing to build and operate a new water resource recovery facility (WRRF) at Camellia-Rosehill with associated infrastructure to provide wastewater services to the Greater Parramatta and Olympic Peninsula (GPOP) growth area (the project). Three main pipelines are to be constructed using a combination of open trenching and trenchless (Horizontal Directional Drilling (HDD) and micro-tunnelling) methods. The pipelines will connect the WRRF to an existing wastewater tunnel (the Northern Suburbs Ocean Outfall Sewer, NSOOS), an existing pumping station at Camellia and facilitate discharge of advanced treated water into Parramatta River, at Meadowbank.

This report presents the outcomes of a groundwater impact assessment undertaken for the construction and operation of the GPOP Water Cycle Management (WCM) project to support the project Environmental Impact Statement (EIS). The assessment has been informed by preliminary project design information and a review and analysis of the available monitoring data and applicable legislation, policies and guidelines, database searches, and site-specific groundwater investigations.

The main elements of the project include:

- a new WRRF at Camellia-Rosehill
- upgrade of the existing pumping station at Camellia
- a new wastewater transfer pipeline from Camellia pumping station to the WRRF
- a new brine pipeline from the WRRF to Camellia pumping station and repurpose of an existing rising main to transfer brine from Camellia pumping station to the NSOOS
- a new river release pipeline and discharge structure from the WRRF to release advanced treated water into Parramatta River.

This groundwater impact assessment evaluates potential impacts on groundwater during both construction and operation phases.

Groundwater setting

The GPOP WCM impact assessment area is located on both the north and south of the Paramatta River.

The WRRF site, Camellia pumping station, and brine and transfer pipelines lie on a peninsula between the Parramatta River and Duck River in the suburbs of Camellia and Rosehill. The existing rising main that is to be relined to form part of the brine pipeline is located on the northern side of the Parramatta River. This relined section of the brine pipeline extends north to Kissing Point Road, in the suburb of Dundas, where it connects to the existing NSOOS. The river release pipeline extends from the WRRF site roughly parallel to the southern bank of the Parramatta River and spans the suburbs of Camellia, Silverwater, Newington, Sydney Olympic Park, and Wentworth Point, before crossing beneath the Parramatta River to reach Meadowbank.

The basement geology is characterised by two distinct systems:

1. Ashfield shale – underlying project impact assessment areas west of the Newington wetlands
2. Hawkesbury sandstone – underlying project impact assessment areas east of the Newington wetlands

The surficial geology is characterised by low permeability sandy clay/clay fill and alluvium. In impact assessment areas underlain by Ashfield shale, residual soil was also noted, sometimes with the absence of alluvium. The residual soil was interpreted to be weathered shale, mostly recovered as low permeability clay.

Anthropogenic deposits and constructed wetlands are also noted on regional geological mapping in areas across the Sydney Olympic Park Precinct and Wentworth Point.

Groundwater levels are typically 1 m to 4 m below ground level (mbgl) at the WRRF and within the Camellia-Rosehill area. Along the river release pipeline, groundwater levels are typically between 2 mbgl and 3.5 mbgl.

Permeability testing conducted at the WRRF site suggests a hydraulic conductivity range from 1×10^{-4} m/day to 1.2×10^{-3} m/day for the fill/alluvial aquifers at the site. Groundwater flow at the WRRF site is interpreted to be south east, with a low hydraulic gradient of between 0.003 and 0.011 m/m.

Groundwater quality, across the impact assessment area and particularly at the Camellia-Rosehill WRRF has been found to be contaminated. Contaminants include select heavy metals, Total Petroleum Hydrocarbons (TPH), Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAH) and Per- and Poly-fluoroalkyl Substances (PFAS) compounds. Acid Sulphate Soils (ASS) and Potential Acid Sulphate Soils (PASS) have also been observed across project sites. Abstracted groundwater is, therefore, unlikely to be suitable for environmental discharge without treatment.

Seventeen (17) terrestrial GDEs classified with high potential for groundwater dependence were mapped within 500 m of project infrastructure (WRRF, pipelines and the Camellia pumping station). NSW HEVAE considers these mapped GDEs to have low or medium ecological value. There were no aquatic GDEs mapped within the project impact assessment area.

One licenced groundwater bore was listed as functioning within 500 m of the river release pipeline. No other licenced extraction bores were located within the project impact assessment area.

Key waterways surrounding the project include Parramatta River, Duck River, Vineyard Creek and Haslams Creek.

Construction impacts and dewatering requirements

Groundwater interaction during construction is expected to occur where excavation of project elements extends below the water table, and where the construction methodology does not prevent groundwater ingress. The project has been designed with consideration to minimising groundwater interaction.

Project excavations are anticipated to extend between 0.1m and 6.5m below the groundwater table.

Groundwater interaction is expected during construction of:

- Two pumping station (FWPS 1 and FWPS 2) at the Camellia-Rosehill WRRF
- Open trench sections along the river release pipeline between:
  - Carnarvon Street and Silverwater Road
  - Silverwater Road and Pierre de Coubertin (PDC) Park
  - SOPA Pod A carpark and SOPA Pod C carpark
  - Meadowbank Park and the river release pipelines to Parramatta River
  - The river release structure within the Parramatta River
- Open trench section along the brine and transfer pipelines between Rosehill Gardens Racecourse and Camellia pumping station
- Open trench section at Camellia pumping station where the brine and transfer pipelines connect to existing wet well structures
- Excavations comprise three HDD pits approximately 15m by 4m in footprint and 2m in depth.
- Shaft excavations of the river release pipeline HDD pits at the WRRF site

- Shaft excavations along the river release pipeline at:
  - The micro-tunnel launch and retrieval sites on Derby Street, east and west of Silverwater Road

    Micro-tunnel shafts are proposed to be 12 m by 4 m in footprint and 10 m in depth with sheet pile walls to reduce groundwater ingress risks.
  - The HDD pits located at PDC Park
  - The HDD cofferdam pit located at SOPA Pod C carpark.

    The HDD cofferdam pit is proposed to be 50 m long and 4m wide with sheet pile walls to reduce groundwater ingress.
  - The HDD pits located at Meadowbank Park

  Excavations at river release pipeline HDD launch and retrieval sites (including those at the WRRF site) comprise two HDD pits at the launch and retrieval ends, approximately 15 m by 4 m in footprint and 2 m in depth.
- Shaft excavations along the brine and transfer pipeline alignment in the Rosehill Gardens Racecourse overflow carpark area.

  Excavations comprise three HDD pits approximately 15 m by 4 m in footprint and 2 m in depth
- Access points for the relining of the existing rising main (to form the northern part of the brine pipeline) between Camellia pumping station and the NSOOS; access points 1 to 8 and access points 10 to 21 may require excavation depending on the relining methodology (access at point 9 is above ground – refer Table 3-6)

HDD will also be undertaken below the water table along the river release pipeline alignment and brine and transfer pipeline alignment; however, drillholes are filled with drilling muds and not expected to interact significantly with groundwater. The micro-tunnel section of the river release pipeline at Silverwater Road is also not anticipated to interact with groundwater as the concrete encased 'pipe-jack' is impermeable to groundwater ingress.

The estimated total dewatering volume is approximately 5.2 megalitres (ML).

The estimated drawdown due to dewatering of project excavations (shafts or trenches) does not extend to any mapped GDEs or HEVAEs, waterways, or any licenced groundwater users. As such, no drawdown induced groundwater impacts are anticipated to these sensitive groundwater receptors.

Drawdown associated with dewatering of shaft excavations at the WRRF and along the river release pipeline is expected to be of small magnitude and localised. Potential impacts to regional groundwater quality either through changes to existing flow regimes or contaminant migration are, therefore, considered unlikely. The risk of ASS mobilisation beyond the immediate vicinity of each excavation is also considered low.

The limited duration of trench dewatering (one day per trench subsection) is not considered sufficient to impact existing regional groundwater quality, gradients or flow patterns, nor considered likely to mobilise contaminants from beyond drawdown extents. One day of dewatering (per trench subsection) is also not considered long enough to cause significant impact associated with ASS desaturation and mobilisation of additional contaminants from soil to groundwater.

Groundwater management

Groundwater extracted during dewatering is not expected to be suitable for direct discharge to the environment due to the likely presence of contaminated groundwater. Where possible, groundwater would be reused or treated and discharged to stormwater. Where this is not available, disposal options include:

- Trade waste discharge to sewer (subject to Sydney Water acceptance criteria)
- Offsite disposal via licensed waste facilities.

As a minimum, primary treatment via sedimentation and settling tanks, blending and pH balancing is likely to be required.

A Construction Environmental Management Plan (CEMP), Dewatering Management Protocol (DMP) and Acid Sulphate Soils Management Plan (ASSMP) will be developed to guide safe handling, treatment, and disposal of groundwater and excavated materials.

Operational impacts

The risks associated with any potential operational groundwater impacts are considered low. No groundwater takes are anticipated during operation of the project and as such drawdown associated impacts to GDEs, waterways or nearby users are not anticipated. Project operation is unlikely to cause perceptible change to regional groundwater systems.

Limitations

This impact assessment was based on available (as of August 2025) construction design and hydrogeological data. Design details and indicative construction methodology are subject to change in the detailed design stage.

There was some uncertainty surrounding construction methodology and hydrogeological conditions along certain sections of the pipeline alignments. Uncertainty will be addressed during detailed design, where required, or through an observations-based approach during construction.

Where conditions were uncertain, conservative assumptions were adopted to complete the assessment. The assumptions provide a 'worst-case' assessment of potential impacts.

Despite the conservative nature of the assessment, significant groundwater impacts are not anticipated.

The project is not expected to cause significant adverse impacts on groundwater levels, quality, or sensitive receptors, and meets with the Level 1 minimal impact considerations of the NSW Aquifer Interference Policy.

If hydrogeological conditions observed during construction differ from those adopted in this groundwater impact assessment, the assessment should be revised. Should further testing be undertaken during detailed design, results should be reviewed, and this report should be updated where required.

Important note about this report

The sole purpose of this report is to present the findings of a groundwater assessment, carried out by Jacobs for Sydney Water ('the Client'), in connection with the GPOP Water Cycle Management Project and associated Groundwater Impact Assessment.

This report was produced in accordance with and is limited to the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

Hydrogeological conditions have been inferred/assumed based on limited site data and desktop data sources. Therefore, hydrogeological conditions are based on numerous assumptions and are therefore uncertain. Actual hydrogeological conditions may differ from those assumed in this assessment.

All reports and conclusions that deal with sub-surface conditions are based on interpretation and judgement and as a result have uncertainty attached to them. This report contains interpretations and conclusions which are uncertain, due to the nature of the investigations. No study can investigate every risk, and even a rigorous assessment and/or sampling programme may not detect all problem areas within a site.

This report is based on assumptions that the site conditions as revealed through sampling (and desktop data sources) are indicative of conditions throughout the site. The findings are the result of standard assessment techniques used in accordance with normal practices and standards, and 0022they represent a reasonable interpretation of the current conditions on the site.

Sampling techniques, by definition, cannot determine the conditions between the sample points and so this report cannot be taken to be a full representation of the sub-surface conditions. This report only provides an indication of the likely sub surface conditions.

Conditions encountered when site work commences may be different from those inferred in this report, for the reasons explained in this limitation statement. If site conditions encountered during site works are different from those indicated by desktop data sources or the limited site data, Jacobs reserves the right to revise any of the findings, observations and conclusions expressed in this report.

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Acronyms and abbreviations

Acronym	Full Term	Definition
AFFF	Aqueous Film-Forming Foam	A fire suppressant used for flammable liquid fires.
AASS	Actual acid sulphate soil(s)	Soils containing sulphuric acid due to oxidation of iron sulphides.
AGS	Australian Geomechanics Society	Professional body for geotechnical engineers and engineering geologists.
AHD	Australian Height Datum	Standard reference for elevation across Australia.
AIP	NSW Aquifer Interference Policy	Regulatory framework developed by the New South Wales Government to manage and assess activities that interfere with aquifers and groundwater system.
ANZECC	Australian and New Zealand Environment and Conservation Council	Former council that developed environmental guidelines.
ANZG	Australian and New Zealand guidelines for fresh and marine water quality	Water quality standards for protecting aquatic ecosystems.
ASS	Acid sulphate soil(s)	Soils with iron sulphides that can produce acid when disturbed.
ASSMAC	Acid Sulphate Soil Management Advisory Committee	Advisory body established in New South Wales to guide best practices for managing acid sulphate soils.
ASSMP	Acid sulphate soils management plan	Plan for identifying and mitigating acid sulphate soil risks.
BH	Borehole	A drilled shaft for the purposes of geotechnical investigations. Potential site for groundwater well installation.
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	Volatile organic compounds found in petroleum products.
BoM	Bureau of Meteorology	Australian national agency for weather and climate data.
CEMP	Construction Environmental Management Plan	Plan outlining environmental controls during construction.
CRS	Chromium reducible sulphur	Form of sulphur used to assess acid sulphate soil potential.
CSWMP	Construction Soils and Water Management Plan	Strategy for managing soil and water impacts during works.
CoPC	Contaminants of potential concern	Substances that may pose environmental or health risks.
DCCEEW	Department of Climate Change, Energy, the Environment and Water	NSW state department overseeing environmental policy.
DMP	Dewatering Management Protocol	Protocol for managing groundwater removal during excavation.
DO	Dissolved oxygen	Oxygen available in water for aquatic life.

Acronym	Full Term	Definition
DPHI	Department of Planning, Housing and Infrastructure	NSW agency overseeing planning and infrastructure regulation.
DPIRD	Department of Primary Industries and Regional Development	NSW department managing agriculture, fisheries.
DSI	Detailed site investigation	In-depth study of site contamination and environmental risks.
EC	Electrical conductivity	Measure of water's ability to conduct electricity, indicating salinity.
EIS	Environmental impact statement	Document assessing environmental effects of a proposed project.
ENM	Excavated natural material	Naturally occurring rock and soil (e.g. sandstone, shale, clay) that has been excavated and contains at least 98% natural material by weight.
EPA	NSW Environment Protection Authority	Regulator of pollution and environmental protection in NSW.
FWPS	Foul water pumping station	Facility for moving wastewater to treatment systems.
GDE	Groundwater dependent ecosystem	Ecosystems partly or wholly reliant on groundwater for survival.
GME	Groundwater monitoring events	Scheduled checks of groundwater levels and quality.
GPOP	Greater Parramatta and Olympic Peninsula	Strategic urban development area in Sydney.
HDD	Horizontal directional drilling	Trenchless method for installing underground pipelines.
HEPA	Heads of EPA Australia and New Zealand	Leaders from environmental protection authorities across Australian states and territories, and New Zealand.
HEVAE	High Ecological Value Aquatic Ecosystems	Aquatic systems with outstanding ecological significance.
Ha	Hectare	Metric unit of area equal to 10,000 square metres.
IL	Invert level	Lowest internal point of a pipe or channel.
LEP	Local Environment Plan	Statutory plan guiding land use and development in NSW.
LGA	Local Government Area	Administrative division governed by a local council.
LOR	Limit of reporting	Lowest concentration of a substance that can be reliably measured.
LTEMP	Long Term Environmental Management Plan	Strategy for ongoing environmental monitoring and mitigation.
ML	Megalitre	Volume unit equal to one million litres.
ML/day	Megalitres per day	Flow rate of water over time.
NEMP	National Environmental Management Plan	Framework or guideline used to manage environmental risks.
NEPC	National Environment Protection Council	Statutory body in Australia that develops National Environment Protection Measures (NEPM)

Acronym	Full Term	Definition
NEPM	National Environment Protection Measures	Standards for environmental quality under Australian national law.
NHMRC	National Health and Medical Research Council	Australian federal body for health research and guidelines.
NSOOS	Northern Suburbs Ocean Outfall Sewer	Major wastewater infrastructure in Sydney.
NSW	New South Wales	Australian state.
PAH	Polycyclic aromatic hydrocarbons	A class of organic compounds made up of multiple fused aromatic rings composed only of carbon and hydrogen atoms.
PASS	Potential acid sulphate soil(s)	Soils that may form acid when exposed to air.
PFAS	Per- and polyfluoroalkyl substances	Persistent synthetic chemicals used in industrial applications, known for their resistance to heat, water, oil, and stains.
PFBA	Perfluorobutanoic acid	Type of PFAS compound.
PFBS	Perfluorobutanesulphonic acid	Type of PFAS compound.
PFHpA	Perfluoroheptanoic acid	Type of PFAS compound.
PFHxA	Perfluorohexanoic acid	Type of PFAS compound.
PFHxS	Perfluorohexanesulphonic acid	Type of PFAS compound.
PFOA	Perfluorooctanoic acid	Type of PFAS compound.
PFOS	Perfluorooctanesulphonic acid	Type of PFAS compound.
PFPeA	Perfluoroheptanoic acid	Type of PFAS compound.
PSI	Preliminary site investigation	An initial environmental assessment conducted to identify potential contamination at a site.
PST	Primary settlement tank	Tank for initial sedimentation in wastewater treatment.
REF	Review of Environmental Factors	A document prepared to assess the potential environmental impacts of a proposed activity or development
RIVM	Rijksinstituut voor Volksgezondheid en Milieu (National Institute for Public Health and the Environment)	Dutch government agency under the Ministry of Health, Welfare and Sport that conducts research and provides policy advice on public health and environmental protection
RO	Reverse Osmosis	Water purification method using a semipermeable membrane.
Redox	Oxidation/reduction potential	Indicator of chemical reactivity in soils or water.
Rev.	Revision (Report)	Version number of a document.
SAC	Site Assessment Criteria	Standards used to evaluate environmental conditions.
SAQP	Sampling Analysis and Quality Plan	Protocol for collecting and analysing environmental samples.

Acronym	Full Term	Definition
SEARs	Secretary's environmental assessment requirements	Key issues to be addressed in an EIS.
SEED	Sharing and Enabling Environmental Data Portal	NSW platform for accessing environmental data.
SOPA	Sydney Olympic Park Authority	Agency managing Sydney Olympic Park lands.
SPOCAS	Suspension Peroxide Oxidation Combined Acidity & Sulphur	Soil test for acid sulphate soil potential.
TDS	Total dissolved solids	Measure of all dissolved substances in water.
TPH	Total Petroleum Hydrocarbons	Group of chemical compounds from petroleum.
TRH	Total Recoverable Hydrocarbons	Hydrocarbons extractable from soil or water samples.
VENM	Virgin excavated natural material	Natural material (such as clay, gravel, sand, soil or rock fines): (a) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities and (b) that does not contain any sulfidic ores or soils or any other waste and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.
WAL	Water access licence	Legal entitlement to extract water under NSW law.
WM	Water Management	The planning, development, distribution, and optimal use of water resources.
WM Act	Water Management Act 2000	Current legislation regulating water resources in NSW.
WQO	Water quality objectives	Targets for maintaining or improving water quality.
WRRF	Water resource recovery facility	Plant for treating and reusing wastewater.
WSP	Water sharing plan	Legal framework for allocating water among users.
WSWA	Water supply works approval	Approval for constructing water supply infrastructure.
Water Act	Water Act 1912	Historic legislation governing water use in NSW.
cm	Centimetre	Metric unit of length equal to 0.01 metres.
e.g.	Exempla gratia (for example)	Used to introduce examples.
etc.	Et cetera (and the rest)	Used at the end of a list to indicate that there are additional items not explicitly mentioned
i.e.	id est (that is)	Used to clarify or restate.
km	Kilometre	Metric unit of length equal to 1,000 metres.
m	Metre	Basic metric unit of length.

Acronym	Full Term	Definition
m/day	Metres per day	Rate of movement, including groundwater or excavation progression etc.
m/s	Metres per second	Velocity measurement.
mV	Millivolts	Unit of electric potential, in the case of groundwater investigation, mV is a measure or oxidation/reduction potential.
mbgl	Metres below ground level	Depth measurement from surface to subsurface features.
mg/L	Milligrams per litre	Concentration unit for substances in water.
mm	Millimetre	Metric unit of length equal to 0.001 metres.
pH	Measure of acidity	Scale indicating acidity or alkalinity of a solution.
pHF	Field acidity in soil	pH measured directly in soil samples.
pHFox	Field acidity in soil after oxidation with hydrogen peroxide	pH after simulating oxidation of potential acid sulphate soils.
µS/cm	Microsiemens per centimetre	Unit of electrical conductivity.

1. Introduction

This report presents the outcomes of a groundwater impact assessment undertaken by Jacobs Group Australia Pty Ltd (Jacobs) for the Greater Parramatta and Olympic Peninsula (GPOP) Water Cycle Management (WCM) project. The groundwater impact assessment is in support of the GPOP WCM project Environmental Impact Statement (EIS).

The impact assessment was prepared in line with the Planning Secretary's Environmental Assessment Requirements (SEARs) and to support environmental approvals for the project. The assessment has been informed by preliminary project design information and review of publicly available databases, available monitoring data and applicable legislation, policies and guidelines. Site-specific groundwater investigations have also been undertaken for the GPOP WCM project, and results were reviewed and included as part of this assessment.

The assessment reviewed existing environment, identified potential groundwater-sensitive receptors and assessed potential groundwater-related impacts during project construction and operation. Groundwater-sensitive receptors considered in this assessment included groundwater dependent ecosystems (GDEs) (sourced from both the Bureau of Meteorology (BoM) national GDE database and cross-checked against the NSW High Ecological Value Aquatic Ecosystem (HEVAE) framework), licenced groundwater users and waterways. The groundwater impact assessment also estimated the total volume of groundwater likely to be extracted during construction dewatering, and reviewed groundwater quality data to advise on dewatering discharge options and potential water treatment requirements. Licencing and regulatory requirements as well as recommendations for further investigation, mitigation strategies and groundwater monitoring are also discussed in this report.

1.1 Project Background

Sydney Water is proposing to build and operate a new water resource recovery facility (WRRF) at Camellia-Rosehill. The new WRRF is needed to provide additional wastewater capacity to support growth across the northern suburbs of Sydney, and in the GPOP growth corridor. The WRRF and associated infrastructure together form the GPOP WCM project (the project).

The additional growth would place pressure on the existing northern suburbs wastewater network, which includes the Northern Suburbs Ocean Outfall Sewer (NSOOS) and the North Head WRRF. These critical assets provide wastewater services to around 1.7 million people, and with current growth projections would reach capacity by 2031.

The GPOP WCM project has been designed to be efficient, sustainable, and cost effective for the community, as well as resilient and adaptable for future water uses.

The main elements of the project include:

- a new WRRF at Camellia-Rosehill to treat wastewater to produce advanced treated water
- upgrades to the existing pumping station at Camellia
- a new wastewater transfer pipeline from Camellia pumping station to the WRRF
- a new and repurposed brine pipeline to transfer brine from the WRRF to the NSOOS
- a new river release pipeline to transfer advanced treated water from the WRRF to a release structure in Parramatta River at Meadowbank.

The location of the main elements of the project is provided in Figure 1. Further details of each component of the project are provided in Table 1 and Section 3.

The project is State Significant Infrastructure and Sydney Water is preparing an Environmental Impact Statement (EIS) to support an application to the Minister for Planning and Public Spaces.

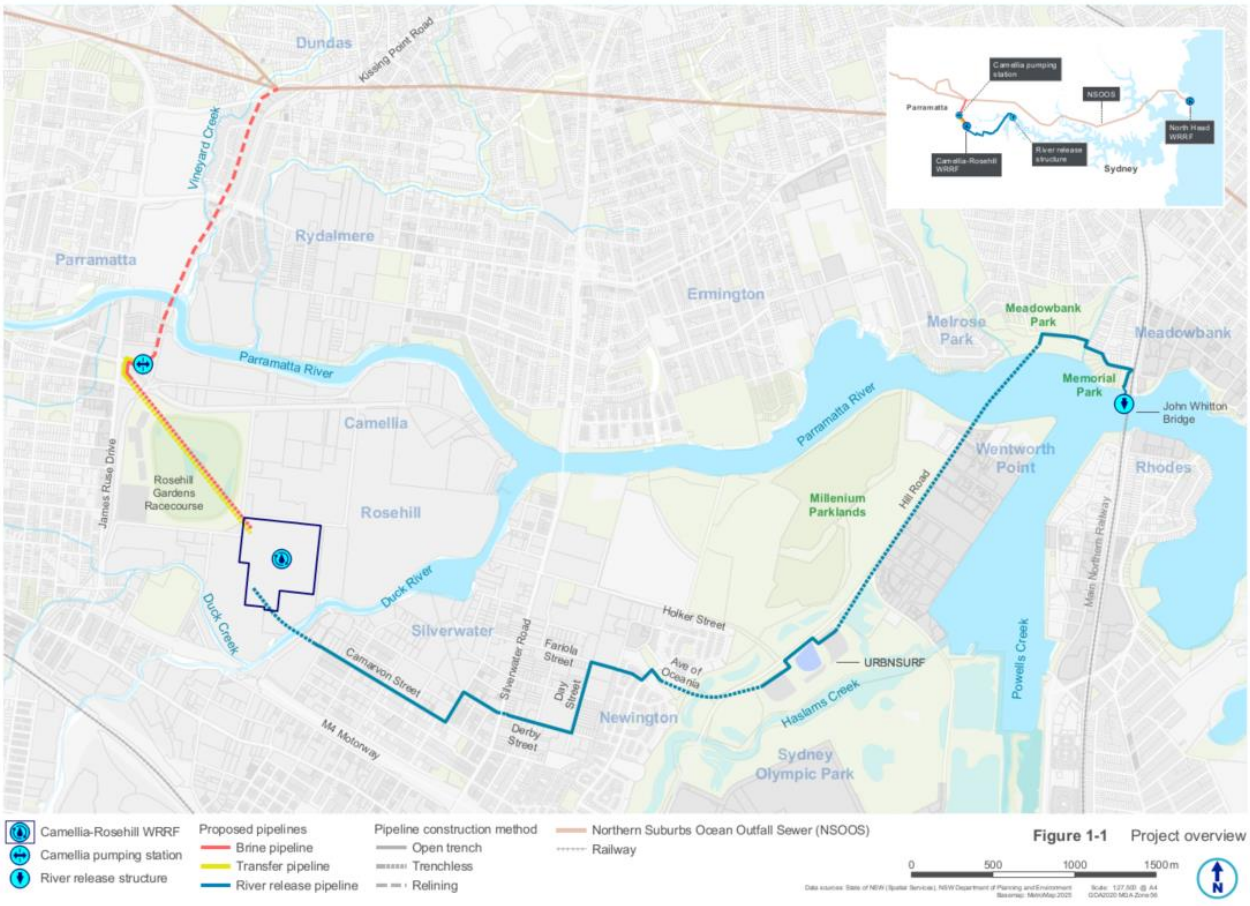


Figure 1-1: Project Overview

1.2 Impact areas and impact assessment areas

In this report, the term 'impact assessment area' refers to the maximum area that would be impacted by the project. Sydney Water has adopted this term to provide flexibility in the planning approval. Actual impacts (if any) will be in an 'impact area' within this impact assessment area. For the WRRF site, the impact assessment area and impact area will be the same. The pipelines will likely have a smaller impact area than the impact assessment area, and will be refined within the impact assessment area as the design progresses.

1.3 Scope of this report

The purpose of this report is to undertake a groundwater impact assessment for the project impact assessment area, consistent with the SEARs, to support environmental approvals and the project EIS.

The groundwater impact assessment involved:

- Review of available geology, hydrogeology, geotechnical, and soils data for the project impact assessment area in the vicinity of the proposed infrastructure listed in Section 3. Refer to Section 2 for a summary of investigations undertaken for the project.
- Development of a hydrogeological conceptual model for the project impact assessment area.
- Identification of key groundwater risks, constraints and opportunities for the construction of proposed infrastructure listed in Section 3.

- Identification of potentially groundwater-sensitive receptors, including groundwater dependent ecosystems (GDEs), surface waters and consumptive groundwater users (based on publicly available information).
- Analytical groundwater modelling to assess the:
  - Quantum of groundwater extracted as required for construction dewatering for the proposed infrastructure listed in Section 3.
  - Potential groundwater level drawdown associated with construction dewatering.
- Estimation of the groundwater take (annual volume) for construction and operation based on the above assessments.
- Use of predictions of estimated groundwater level drawdown during construction (i.e., due to construction excavations) to qualitatively assess potential groundwater-related impacts, including: potential impacts to waterways, GDEs, licenced groundwater users, acid sulphate soils (ASS), and groundwater quality, with consideration of the NSW Aquifer Interference Policy.
- Preparation of a water balance for groundwater components for construction and operation of the project
- Review of groundwater quality data against discharge criteria for construction dewatering (including potential discharge to waterways/stormwater and sewer) and advice on potential water treatment requirements prior to discharge.
- Identification of hydrogeological data gaps.
- Identification of relevant NSW Water Sharing Plans, water availability and Water Access Licensing requirements.
- Recommendations for further monitoring as part of the detailed design phase.
- Identification of potential mitigation measures to reduce any potential groundwater-related impacts, including groundwater monitoring recommended during construction of the project.

2. Data sources

2.1 Site investigations

The groundwater impact assessment for the GPOP Water Cycle Management Project was informed by a comprehensive suite of site investigations conducted by Jacobs between 2024 and 2025. These investigations covered various components of the project including the WRRF site, pipeline alignments, and surrounding areas. The investigations included:

1. Geotechnical Investigations

   Geotechnical Factual and Interpretive Reports were completed for:

   - WRRF site (Jacobs, 2024b, 2024e)
   - River release pipeline (Jacobs, 2025a)
   - Camellia pumping station and brine and transfer pipelines (Jacobs, 2025b)

2. Sampling Analysis and Quality Plan (SAQP)

   A SAQP was developed to guide sampling protocols and analytical methods for contamination assessments to be undertaken across the impact assessment area (Jacobs, 2024c)

3. Contamination Assessments

   Preliminary and Detailed Site Investigations (PSI and DSI) were conducted for:

   - WRRF site (Jacobs, 2024a)
   - River release pipeline (Jacobs, 2025c, 2025f)
   - Brine and transfer pipelines, and Camellia pumping station (Jacobs, 2025d, 2025g)

   These assessments identified contamination in groundwater and soils, including exceedances of adopted Site Assessment Criteria (SAC) for heavy metals, hydrocarbons, BTEX, PAHs, and PFAS compounds.

4. Hydrogeological Monitoring

   A Hydrogeological Monitoring Report was prepared for the WRRF site (Jacobs, 2024d), including:

   - Establishment of a groundwater monitoring network at the WRRF
   - Groundwater level monitoring
   - Rising head permeability tests
   - Interpretation of groundwater flow direction and hydraulic gradients

   These investigations provided data on subsurface conditions, soil profiles, and groundwater observations.

5. Groundwater Contamination Impact Assessment – WRRF Capping

   A targeted assessment was undertaken to evaluate contamination risks associated with WRRF site capping (Jacobs, 2025e).

6. Groundwater Monitoring and Management Plan

   A plan was developed to support WRRF site capping and associated groundwater management (Jacobs, 2025h).

2.2 Concept and reference designs

The groundwater impact assessment for the WRRF was based on the final reference design available as at August 2025.

The groundwater impact assessment for the pipelines were based on the following concept designs:

- River Release Pipeline 100% Concept Design – 27/05/2025
- Influent and Brine Pipelines 100% Concept Design –23/05/2025

3. Proposed works

A summary of the proposed works is provided as part of the Project Description included in Table 3-1.

Table 3-1: Project Description

Project Element	Detailed Description
WRRF	The WRRF would have capacity to treat 70 megalitres per day (ML/d). The WRRF would produce advance treated water to minimise impacts on receiving waterways. The reverse osmosis (RO) treatment process within the WRRF would generate brine as a by-product. The main components of the WRRF include: ▪ inlet works ▪ primary, secondary and tertiary wastewater treatment process units ▪ advanced treatment processes involving RO ▪ disinfection systems ▪ biosolids handling facilities ▪ odour control facilities. The WRRF would require a range of process infrastructure such as tanks, bioreactors and digestors. The operation of the WRRF would also require ancillary facilities such as an administration building and associated car park, chemical storage and stormwater infrastructure.
Camellia pumping station upgrades	The existing Camellia pumping station would be upgraded to divert wastewater to the WRRF. Upgrades would include the installation of new pumps to deliver wastewater flows to the new WRRF while remaining pumps would pump excess existing flows and brine produced by the WRRF to the NSOOS via existing pressure mains. New connections would be installed to divert the wastewater into the transfer pipeline. The existing site sheds would be replaced with a new electrical switch room along the eastern boundary of the site.
Transfer pipeline	The transfer pipeline is about 2.2 kilometres in length and would transfer wastewater from the Camellia pumping station to the WRRF.
Brine pipeline	The brine pipeline is about 5.2 kilometres in length and would transfer brine from the WRRF to the NSOOS for treatment and offshore discharge at North Head WRRF. A new pipeline would be constructed between the WRRF and Camellia pumping station, along the same alignment as the transfer pipeline. Between the Camellia pumping station and the NSOOS the brine pipeline would repurpose an existing pipeline.
River release pipeline and release structure	The river release pipeline is about 7.6 kilometres in length commencing at the WRRF and within the suburbs of Silverwater, Newington, Sydney Olympic Park and Meadowbank. The river release pipeline would discharge advanced treated water into the Parramatta River at Meadowbank. Above ground infrastructure includes two concrete bridge-style aerial crossings over minor waterways in Meadowbank Park, and an approximately 8 metre high barometric loop located near the existing toilet block in Memorial Park. The river release structure involves eight smaller pipelines that extend out underneath the sandstone sea wall and along the riverbed of the Parramatta River. The pipelines would vary in length, with the longest extending about 130m. Diffusers would release water to enable mixing.

Project Element	Detailed Description
Land ownership and location	The WRRF would be located on Sydney Water owned property at the intersection of Colquhoun and Devon Street, Rosehill (Lot 1, Deposited Plan 1308385). The WRRF site comprises an area of 21.41 hectares (ha) (see Figure 1-1) and is located within the City of Parramatta Local Government Area (LGA). Upgrades to the existing sewage pumping station at Camellia are also located on Sydney Water property within the City of Parramatta LGA. Pipeline alignments are generally within the road corridor, Council or Crown land or Sydney Water easements, except for the transfer and brine pipelines beneath Rosehill Gardens Racecourse.
Construction activities	Key activities for construction of the WRRF will include: ▪ site establishment ▪ delivery of materials ▪ earthworks ▪ civil works ▪ structure construction ▪ installation of mechanical and electrical plant and equipment• ▪ landscaping and rehabilitation ▪ commissioning. The new sections of pipelines from the WRRF to Camellia pumping station and the river release location, would be constructed using a combination of trenching and horizontal directional drilling techniques. Between Camellia pumping station and the NSOOS, the existing rising main would be relined and repurposed to form part of the brine pipeline. The upgrade of Camellia pumping station would include augmentation of underground infrastructure, installation of pumps, and upgrade of power supply.
Construction program	Construction of the project would commence in 2028 with a duration of around 36 months. Operation is planned to commence in 2031.

Sections 3.1, 3.2, 3.3 and 3.4 provide more detail on project components requiring excavation at:

- the Camellia-Rosehill WRRF
- along the river release pipeline
- along the brine and transfer pipelines between the WRRF and Camellia pumping station
- Camellia pumping station
- along the existing rising main that is to be relined to form part of the brine pipeline, between Camellia pumping station and the NSOOS.

Construction details were based on available design information, as presented in Section 2. Design specifications included below are subject to change.

This report only assesses potential groundwater-related environmental impacts to project elements included in Table 3-1 where excavation is anticipated to extend below the groundwater table. Where excavation of project elements is not expected to intercept groundwater, elements have not been assessed. The project elements included in this assessment where potential interception of groundwater during construction was identified are presented in Tables 3.2-3.5 and Section 7.

3.1 WRRF

A summary of proposed works at the WRRF (based on the Camellia WRRF Final Reference Design Report, dated 1 August, 2025), including those that have been assessed for potential groundwater-related impacts, is provided in Table 3-2.

Prior to excavation works, it is understood that a section of the ground surface at the WRRF will have approximately 1.7m of VENM/ENM (and/or other material under suitable resource recovery orders) placed on part of the site, to a final engineered level of 6.8mAHD. Excavation of the project elements included in Table 3-2 will be completed after the site receives this material. Therefore, where construction elements are located within this material extent, the excavation depth included in Table 3-2 is relative to the top of the raised surface.

Refer to the Camellia WRRF Reference Design Report (WRRF 05) for more detail regarding the design, construction and operation of the WRRF.

Table 3-2: Summary of proposed works at the Camellia-Rosehill WRRF

Project Element	Design Summary	Included in assessment?
Two Foul Water Pumping Stations (FWPS)	Excavation depth of approximately 6.8 m below the top of the raised site. Approximate footprint 5 m by 5 m	Yes
Water retaining structures, including: ▪ Primary Settlement Tank (PST) Stage 1 ▪ PST Stage 2 ▪ Bioreactor Stage 1 ▪ Bioreactor Stage 2 ▪ Membrane Bioreactor (MBR)	Excavation depth of 1.7 m below the top of the raised site.	No. Excavation not anticipated to intercept groundwater.
First Flush Tank	Excavation depth of 1.7 m below the top of the raised site.	No. Excavation not anticipated to intercept groundwater.
Electrical pits	14 larger pits with a design footprint of 2.4 m by 2.4 m and 8 smaller pits with a design footprint of 1.2 m by 1.2 m. Proposed excavation depth of 1.5 m below the top of the raised site.	No. Excavation not anticipated to intercept groundwater.
Electrical conduits	1.5 m wide trenched excavation to a depth of 1.5 m below the top of the raised site.	No. Excavation not anticipated to intercept groundwater.
Two river release pipeline HDD pits Located toward the south-west corner of WRRF site	HDD pits are currently situated outside of the proposed raised area, and as such the base of the excavation is anticipated to sit at 2 mbgl Approximate footprint of 15 m by 4 m	Yes

Project Element	Design Summary	Included in assessment?
Brine and transfer pipelines HDD pits (three launch) Located toward the north-west corner of WRRF site	Three pits for the launch of: 1. Brine pipeline 2. Transfer pipeline 1 3. Transfer pipeline 2 Proposed location is within the raised site extent and as such the maximum excavation depth of all pits is 2 m below the top of the raised area. Approximate footprint of 15 m by 4 m	No. Excavation not anticipated to intercept groundwater.
Additional connecting pipelines	Pipelines including, but not limited to, connection to the FWPS, water retaining structures and the first flush tank. The current construction design indicates all excavation activities shall be contained within the raised layer.	No. Excavation not anticipated to intercept groundwater.

3.2 New pipelines

Construction of the new river release pipeline and brine and transfer pipelines involves both open trenching and trenchless methods. Trenchless methods will primarily be HDD, with one micro-tunnelled section along the river release pipeline beneath Silverwater Road.

During HDD, drilling muds are used maintain pressure at the face of the drill head and within the tunnel as it is advanced. The outward pressure from the drilling muds prevents groundwater ingress from the surrounding formation. HDD sections are to remain open and ungrouted at the surface, meaning that pressure buildup will not occur and the risk of fracturing the surrounding formation during HDD is low. Additives in the drilling mud also prevent losses to the formation due to increasing the viscosity and density. As such, the HDD sections have not been included in this assessment as potential risks arising from interaction with the surrounding groundwater environment were considered low. Groundwater taken from HDD sections was considered insignificant and the risk of contaminated the existing groundwater environment from the use of drilling fluids was also considered low.

The microtunnel section at Silverwater Road is also not anticipated to interact with groundwater as the concrete encased 'pipe-jack' is impermeable to groundwater ingress.

Figure 3-1 and Figure 3-2 illustrate typical HDD and micro-tunnelling construction methodologies. The figures are not to scale, and depths and surrounding environments are indicative only.

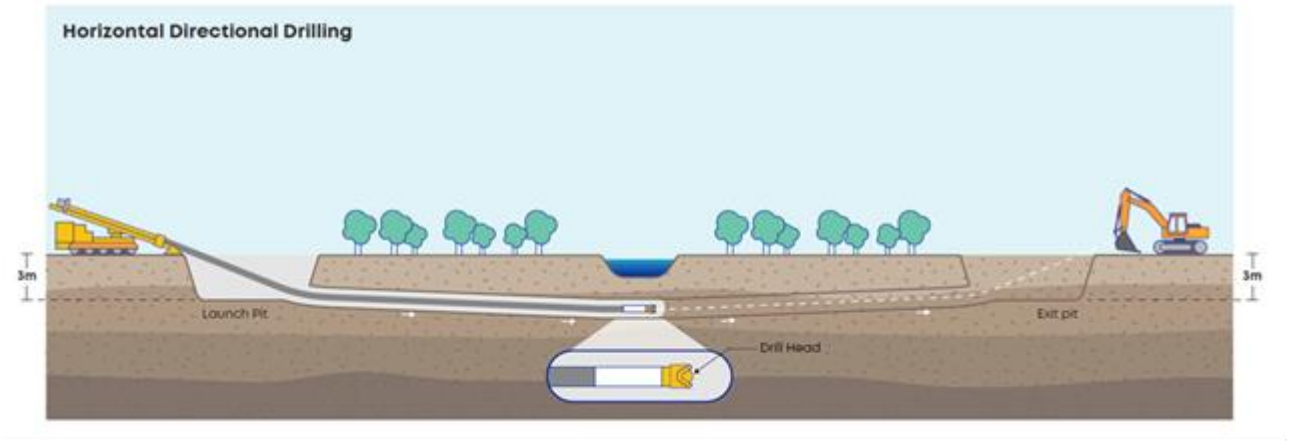


Figure 3-1: Illustration of HDD tunnelling construction

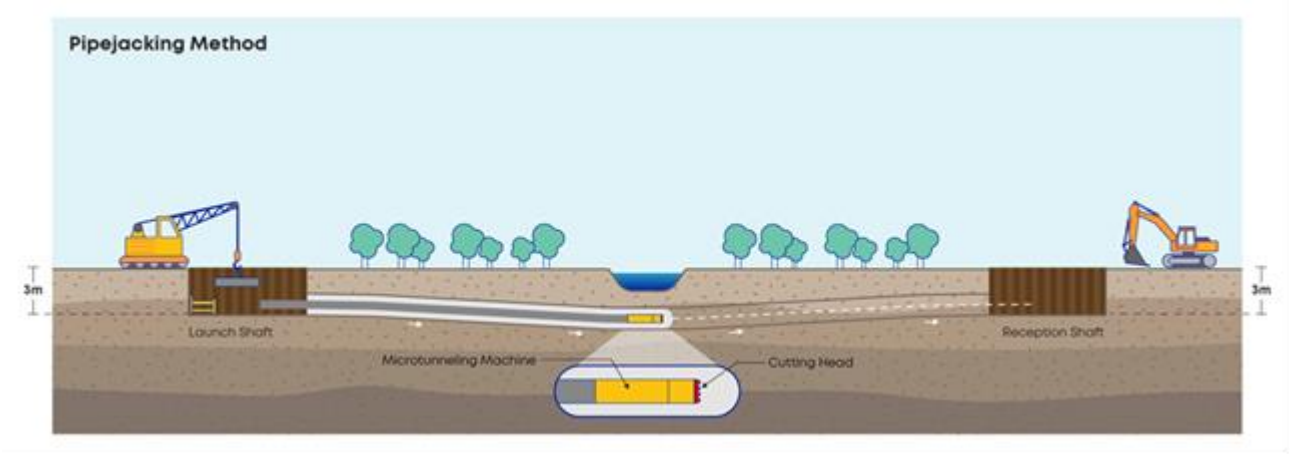


Figure 3-2: Illustration of micro-tunnelling (pipe-jacking) tunnelling construction

3.2.1 River release pipeline

A summary of proposed works along the river release pipeline is provided in Table 3-3. Project elements that have been included in the groundwater impact assessment due to the potential for groundwater interception are also highlighted in Table 3-3.

Design details are based on the 100% Concept Design, dated 27 May 2025 and are subject to change in the Detailed Design phase.

Table 3-3: Summary of proposed works along the river release pipeline

Project Element	Location	Design Summary	Included in assessment?
Open trench	Carnarvon Street to Silverwater Road	Approximately 1,375 m of open trench, to a maximum depth of 5 m Maximum trench width 2.2 m	Yes
Open trench	Silverwater Road to Pierre De Coubertin (PDC) Park	Approximately 1,374 m of open trench, to a maximum depth of 5 m Maximum trench width 2.2 m	Yes
Open trench	SOPA POD A Carpark to SOPA POD C Carpark	Approximately 662 m of open trench, to a maximum depth of 6 m Maximum trench width 2.2 m	Yes

Project Element	Location	Design Summary	Included in assessment?
Open trench	Meadowbank Park to John Whitton Bridge	Approximately 829 m of open trench, to a maximum depth of 7 m Maximum trench width 2.2 m	Yes
Two HDD pits	South-west corner of WRRF site	Refer Section 3.1	Yes
Two HDD pits	Carnarvon Street	Proposed excavation depth of 2 m Approximate footprint of 15 m by 4 m	No. Excavation not anticipated to intercept groundwater.
Two HDD pits	SOPA Pod A Carpark	Proposed excavation depth of 2 m Approximate footprint of 15 m by 4 m	No. Excavation not anticipated to intercept groundwater.
Two HDD pits	PDC Park	Proposed excavation depth of 2 m Approximate footprint of 15 m by 4 m	Yes
One HDD cofferdam pit	SOPA Pod C Carpark	Proposed excavation depth of 6.5 m Approximate footprint of 50 m by 4 m	Yes
Two HDD pits	Meadowbank Park	Proposed excavation depth of 2 m Approximate footprint of 15 m by 4 m	Yes
Micro-tunnelling shafts (launch and receival)	East and west sides of Silverwater Road	Proposed excavation depth of 10 m Approximate footprint of 12 m by 4 m	Yes
HDD sections (i.e. tunnels)	1. WRRF to Carnarvon Street 2. PDC Park to SOPA Pod A Carpark 3. SOPA Pod C Carpark to Meadowbank Park	Twin 800OD HDPE PN25 pipes. Maximum design depths are approximately: 1. WRRF to Carnarvon Street – 16 m (below Duck River) 2. PDC Park to SOPA Pod A Carpark – 53 m 3. SOPA Pod C Carpark to Meadowbank Park – 52 m	No. HDD methodology to use sufficient pressure to prevent groundwater ingress during drilling.
Micro-tunnelled sections (i.e. actual tunnels)	Silverwater Road	1350 ID concrete jacking pipe	No. Micro-tunnel construction methodology considered impermeable to groundwater inflow.
River release structure	From the outfall header at Memorial Park, Meadowbank to the Parramatta River, Meadowbank	About 8 x 300 mm pipes and duck bill valves with grout mattress to be laid on top of riverbank	Yes, section of open trenching between the outfall header and the headwall on the bank of the river has been assessed.

3.2.2 Brine and transfer pipelines

Construction of the brine and transfer pipelines between the WRRF and Camellia pumping station involves both open trenching and trenchless methods. Along the trenchless (HDD) section between the WRRF and Rosehill Gardens Racecourse overflow carpark the transfer pipelines consists of twin OD800 PN25 pipes and the brine pipeline comprises one OD630 PN25 pipe. In the section of open trenching from the carpark to Camellia pumping station the transfer pipeline consists of one OD914 pipe and the brine pipeline comprises a OD560 PN16 pipe. Both the transfer and brine pipelines are proposed to be laid in the same trench.

A summary of proposed works along the brine and transfer pipelines between the WRRF site and Camellia pumping station is provided in Table 3-4. Project components that have been included in the groundwater impact assessment due to the potential for groundwater interception are also highlighted in Table 3-4.

Design details are based on the 100% Concept Design, dated 23 May, 2025 and are subject to change in the Detailed Design phase.

Table 3-4: Summary of proposed works along the brine and transfer pipeline alignment

Project Element	Location	Design Summary	Included in assessment?
Open trench	North-west of Rosehill Gardens Racecourse to Camellia pumping station	Approximately 220 m of open trenching, to a maximum depth of 3.5 m. The trench is proposed to contain both the brine and transfer pipelines and is designed to be 2.8 m wide	Yes
HDD pits (three launch)	North-west corner of WRRF site	Refer Section 3.1	No. Located within the raised extent of the site and to be excavated following site raising. Excavation not anticipated to intercept groundwater.
HDD pits (three retrieval)	North-west of Rosehill Gardens Racecourse, in the overflow carpark area	Three pits for the launch or receival of: 1. Brine pipeline 2. Transfer pipeline 1 3. Transfer pipeline 2 Proposed maximum excavation depth of all pits is 2 m below ground surface	Yes
HDD sections (i.e. tunnels)	North-west corner of WRRF site to north-west of Rosehill Gardens Racecourse	Tunnelled sections for: 1. Brine pipeline – OD630 PN25 pipe 2. Transfer pipeline 1 – OD800 PN25 pipe 3. Transfer pipeline 2 – OD800 PN25 pipe	No. HDD methodology to use sufficient pressure to prevent groundwater ingress during drilling.

3.3 Camellia pumping station

Connection of the brine and transfer pipelines at the existing Camellia pumping station involves open trenching. Table 3-5 summarises the proposed open trenching that allows connection between the new brine and transfer pipelines and the existing wet well structures at the pumping station.

Design details are based on the 100% Concept Design, dated 23 May, 2025, and are subject to change in the Detailed Design phase.

Table 3-5: Summary of proposed excavation works at Camellia pumping station

Open trench	Connection of transfer pipeline to existing pumping station wet well	Approximately 41 m of open trenching, to a maximum depth of 6.5 m. Trenching proposed to be approximately 3 m wide	Yes
Open trench	Connection of brine pipeline to existing pumping station wet well	Approximately 38 m of open trenching, to a maximum depth of 6 m. Trenching proposed to be approximately 2.6 m wide	Yes

3.4 Brine pipeline (relined section)

Proposed works along the relined section of brine pipeline involve relining the existing DN750 rising main between Camellia pumping station and the existing NSOOS. As of August 2025, design information was limited. Depending on the type of relining works needed, some excavation may be required. A worst case assessment has been undertaken, which includes excavation of up to 21 access points along the existing rising main to allow for access of relining equipment. Preliminary investigations indicate that the existing rising main is structurally sound. The relining methodology is therefore subject to change.

For the purposes of this groundwater assessment, the excavation depth of access points were assumed to be 1m below the existing pipe invert level. Pipe invert levels at the location of access points were estimated from historical drawings provided by Sydney Water. The footprint of excavations was assumed to be 15 m by 4 m, in line with the assumed footprint of shaft excavations at the other GPOP WCM project sites. The ground surface level was sourced from 1 m resolution Digital Elevation Model accessed through NSW Government Spatial Services. Table 3-6 summarises the details of the proposed access points.

Table 3-6: Summary of proposed access points for relining of the existing rising main (to form the brine pipeline between Camellia pumping station and the NSOOS)

Project Element	Approx. chainage (m)	Ground surface level (mAHD)	Existing pipe invert level (mAHD)	Adopted excavation depth (mbgl)[1]	Assumed footprint	Included in assessment?
Access point 1	0	4.4	0.0	5.4	15 m by 4 m	Yes
Access point 2	3	4.4	0.0	5.4	15 m by 4 m	Yes
Access point 3	11	4.2	0.1	5.1	15 m by 4 m	Yes
Access point 4	34	4.0	0.2	4.8	15 m by 4 m	Yes
Access point 5	53	3.7	0.2	4.6	15 m by 4 m	Yes
Access point 6	61	3.4	0.0	4.4	15 m by 4 m	Yes

Project Element	Approx. chainage (m)	Ground surface level (mAHD)	Existing pipe invert level (mAHD)	Adopted excavation depth (mbgl)[1]	Assumed footprint	Included in assessment?
Access point 7	70	3.2	0.0	4.2	15 m by 4 m	Yes
Access point 8	100	2.9	0.0	3.9	15 m by 4 m	Yes
Access point 9	443	2.0	2.4	N/A - pipe aboveground	15 m by 4 m	No. Access is above ground.
Access point 10	485	7.8	4.5	4.3	15 m by 4 m	Yes
Access point 11	596	9.7	3.0	7.7	15 m by 4 m	Yes
Access point 12	629	8.1	2.1	7.0	15 m by 4 m	Yes
Access point 13	654	7.0	2.1	5.8	15 m by 4 m	Yes
Access point 14	777	8.5	5.2	4.3	15 m by 4 m	Yes
Access point 15	930	8.5	5.9	3.6	15 m by 4 m	Yes
Access point 16	1002	11.8	10.5	2.3	15 m by 4 m	Yes
Access point 17	1028	15.1	13.0	3.2	15 m by 4 m	Yes
Access point 18	1182	16.9	14.0	3.9	15 m by 4 m	Yes
Access point 19	1307	16.6	14.1	3.5	15 m by 4 m	Yes
Access point 20	1673	15.5	12.9	3.6	15 m by 4 m	Yes
Access point 21	1760	17.1	13.4	4.7	15 m by 4 m	Yes

Note 1: Adopted excavation floor depth was assumed to 1 m below the existing pipe invert level

4. Legislation and policy framework

This groundwater impact assessment has been prepared in accordance with the following groundwater legislation and policy documents:

- Water Act 1912 and Water Management Act 2000
- Rules of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (NSW DPI, 2023)
- Minimal harm criteria presented in the NSW Aquifer Interference Policy (NSW DPI, 2012)
- NSW Water Strategy (DPE Water)
- Groundwater Assessment Toolbox for Major projects in NSW (DPE, 2022)
- Guidelines for Groundwater Documentation for SSD/SSI Projects, Technical guideline (DPE, 2022)
- Minimum Groundwater Modelling Requirements for SSD/SSI Projects (DPE, 2022)
- Cumulative Groundwater Impact Assessment Approaches (DPE, 2022)
- Guidelines for the Assessment and Management of Groundwater Contamination (DEC)
- Parramatta River Catchment Group Master Plan 2018
- Framework for Biodiversity Assessment (OEH, 2018).

4.1.1 *Water Management Act 2000* and *Water Act 1912*

The interaction with and use of water in NSW are regulated by the *Water Management Act 2000* (WM Act) or the *Water Act 1912* (Water Act). The WM Act governs water approvals and licensing for water sources in areas where water sharing plans (WSPs) have been enacted for those sources. The Water Act applies to water sources where a WSP has not been enacted or does not extend to the specific types of licences or approvals. As a WSP is in place for the impact assessment area (the Greater Metropolitan Region Groundwater Sources 2023), the interaction with and use of water for the project is regulated by the WM Act.

The aims of the WM Act are to provide for the sustainable and integrated management of the State's water sources for the benefit of both present and future generations. The WM Act implicitly recognises the need to allocate and provide water for the environmental health of our rivers and groundwater systems, while also providing licence holders with more secure access to water and greater opportunities to trade water through the separation of water licences from land. The WM Act enables the State's water resources to be managed under WSPs, which establish rules for sharing water between the environmental needs of rivers or aquifers and water users, and between different types of water use such as domestic supply, stock watering, industry, and irrigation.

The WM Act (2000) was modified on 06 June 2025, and the Water Management (General) Amendment (Exemptions for Infrastructure) Regulation 2025 was published and commenced on 30 June 2025 (NSW Govt., 2025). The modification exempts essential infrastructure projects by a public authority from requiring a water access licence (WAL) for groundwater inflows; this includes the installation, maintenance, repair, alteration or extension of a work. Under the modification, a public authority is defined to include, amongst other entities, water supply authorities; of which Sydney Water is one. The modification also provides a definition of essential infrastructure as infrastructure that includes sewerage systems, water supply systems, stormwater management systems or flood water management, among other infrastructure. That said, the reporting requirements still stand and include "that the public authority must:

1. record in the approved form and manner the amount of water taken within 24 hours of the water being taken, and

2. keep the record for 5 years after the record is made, and

3. give a copy of the record to the Minister in an approved manner
    a. not later than 28 days after the end of the water year in which the water was taken, or
    b. by an earlier date if notified in writing by the Minister."

In addition, as the project is considered state significant infrastructure, certain approvals are not required as per s.5.22-5.24 of the *Environmental Planning and Assessment Act 1979.* These include a water use approval under section 89, a water management work approval under section 90, or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000* (s.5.23(1)(g) of the EP&A Act). Therefore, Sydney Water do not need to obtain a Water Supply Works Approval (WSWA) for the project as a water management works approval is not required.

4.1.2 Water Sharing Plan – Greater Metropolitan Region Groundwater Sources 2023

The project impact assessment area lies within the Sydney Basin Central Groundwater Source of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023. The Sydney Basin Central Groundwater Source is categorised as a 'less productive' porous rock groundwater source. Any minor groundwater within alluvium or residual soils overlying the porous rock is considered to be part of the porous rock groundwater source. Therefore, the alluvium (NSW DPI, 2012) does not have an assigned extraction limit, and any 'take' would come from the underlying porous rock source.

The Sydney Basin Central Groundwater Source is classified as a 'less productive groundwater source'. As a result, project impacts have been assessed against *Less Productive Minimal Impact Considerations* of the NSW Aquifer Interference Policy (AIP) (see Section 9.5).

As of June 30, 2025, amendments to the WM Act allow public authorities constructing essential infrastructure to undertake the work without obtaining a WAL.

4.1.3 NSW Aquifer Interference Policy (AIP)

The NSW AIP (NSW DPI, 2012) clarifies the water licensing and approval requirements for aquifer interference activities in NSW. Many aspects of this policy will be given legal effect in the future through an Aquifer Interference Regulation. Stage 1 of the Aquifer Interference Regulation commenced on 30 June 2011.

Applying the definitions in the WM Act, the AIP details the types of projects and activities that constitute aquifer interference. WSPs are the main tool for water sharing management at the source scale; the AIP is the water management tool for impacts on the water users, including the environment.

The AIP is applied by proponents of aquifer interference activities in preparing applications and used by the Department of Climate Change, Energy, the Environment and Water to assess those applications. The AIP requires proponents of high-risk activities to plan their projects based on an 'account for, mitigate, avoid/prevent, and remediate' approach. Importantly, the AIP defines minimal impact considerations for proposed projects, which include assessment of cumulative impacts. In addition, the AIP provides specific requirements for dealing with perpetual inflow volumes for projects that continue to take groundwater after the activity has ceased.

Section 3.2 of the AIP outlines the framework for assessing the impacts of aquifer interference activities on water resources, in particular how a project will demonstrate:

- The ability to obtain licences for water take; or
- That water take can be prevented if a licence cannot be granted
- How minimal impact considerations from AIP Section 3.2.2 can be met

- Where impacts are greater than predicted, the proponent has adequate remedial mitigation plans in place to address these impacts.

Potential impacts of a proposal on groundwater are considered acceptable if they are less than the minimal impact considerations. As the Sydney Basin Central Groundwater Source is categorised as a 'less productive' porous rock groundwater source, the project has been assessed against the *Less Productive Minimal Impact Considerations* of the NSW Aquifer Interference Policy in Section 9.4.

4.1.4 Secretary Environmental Assessment Requirements (SEARs)

The assessment is required to address both General and Key Issue SEARs. Key Issue SEARs as they relate to groundwater, and where in the assessment these have been addressed, are detailed in Table 4-1. General SEARs have been included in Appendix B of the EIS.

Table 4-1: Secretary's Environmental Assessment Requirements (SEARs) - Groundwater

Desired Performance Outcome	Requirement	Where addressed in the EIS[1]
Water – Hydrology Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources	1. Describe the existing hydrological regime for surface and groundwater resources (including reliance by users and for ecological purposes) likely to be impacted by the project, including stream orders, as per the Framework for Biodiversity Assessment. This must include a description of groundwater levels across the site under a range of wet and dry conditions.	Section 5 and 9
	2. Map the following features: a. rivers, streams, estuaries, and wetlands (as described in section 3.1.3 of the BAM) b. groundwater c. groundwater dependent ecosystems d. proposed discharge locations.	Section 5
	3. A description of works / activities that may intercept, interfere, extract, use divert or receive surface water and groundwater on a temporary or permanent basis during construction and operation.	Section 7
	4. Identify any relevant Water Sharing Plans that may potentially be impacted by the project	Section 9.4
	5. Surface and groundwater hydrology impacts (both quality and source) of the construction and operation of the project and any ancillary facilities (both built elements and discharges) in accordance with the current guidelines, including: a. natural processes within rivers, wetlands, estuaries, marine waters and floodplains that affect the health of the fluvial, riparian, estuarine or marine system and landscape health (such as modified discharge volumes, durations and velocities), aquatic connectivity and access to habitat for spawning and refuge b. effects to upstream and downstream rivers, wetlands, estuaries, marine waters, floodplain areas and water-dependant fauna and flora (including groundwater dependant ecosystems) c. impacts from permanent and temporary interruption or interference of groundwater flow, including the extent of drawdown, barriers to flows, implications for groundwater dependent surface flows, ecosystems and species, groundwater users and the potential for geotechnical settlement associated with surface water bodies	a), b), c), d), e), g) Section 9 and Section11 f) Section 10 h) Section 14

Desired Performance Outcome	Requirement	Where addressed in the EIS[1]
	d. changes to environmental water availability and flows, both regulated/licensed and unregulated/rules-based sources e. direct or indirect increases in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses f. methods for minimising the effects of proposed stormwater and wastewater management during construction and operation on natural hydrological attributes (such as volumes, flow rates, management methods and re-use options) and on the conveyance capacity of existing stormwater systems where discharges are proposed through such systems g. water take (direct or indirect) from all surface and groundwater sources with estimates of annual volumes during construction and operation h. details of the proposed surface and groundwater monitoring to identify construction and operational hydrological impacts, including changes to groundwater levels	
Water - Quality The project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).	6. Water Quality (surface and groundwater) impacts on waterways potentially impacted by the project, including but not limited to the Parramatta River, Homebush Bay and Haslams Creek, including: a. existing background levels b. details on the ambient NSW Water Quality Objectives (NSW WQO) and environmental values for the receiving waters relevant to the project, including the indicators and associated trigger values or criteria for the identified environmental values c. identification and estimation of the quality and quantity of pollutants that may be introduced into the water cycle by source and discharge point and describe the nature and degree of impact that any discharge(s) may have on the receiving environment, including consideration of all pollutants that pose a risk of non-trivial harm to human health and the environment d. results of water quality modelling and analysis including descriptions under the full range of operating scenarios, including average or typical through to worst case for any proposed discharge point, including but not limited to the full range of weather conditions, bypasses, and 'off-spec' effluent scenarios.	a) to k) Section 9 l) Section 14

Desired Performance Outcome	Requirement	Where addressed in the EIS[1]
	e. outline impacts from the proposal on existing sewage infrastructure including any potential impacts on dry weather and wet weather overflows from the existing reticulation network and any impacts on North Head Water Resource Recovery Facility concentrations and loads discharged and hydraulic and treatment capacity f. details on the rainfall event that the water quality protection measures will be designed to cope with g. the significance of any identified impacts including consideration of the relevant ambient water quality outcomes h. details on how construction and operation of the project will, to the extent that the project can influence, ensure that: where the NSW WQOs for receiving waters are currently being met they will continue to be protected where the NSW WQOs are not currently being met activities will work toward their achievement over time the objectives of making the Paramatta River swimmable can be met migration of contamination is considered and how it will be managed and minimised i. justification for, if required, why the WQOs cannot be maintained or achieved over time j. demonstration that all practical measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented. This also includes consideration and management of frac out from the temporary loss of drilling fluids and inappropriate storage of chemicals and fuels k. Identification of sensitive receiving environments (which may include estuarine and marine waters downstream) and develop a strategy to avoid or minimise impacts on these environments l. proposed water quality monitoring programs, including monitoring locations, monitoring frequency and the parameters that will be monitored pre-construction, during construction and during operation, including justification for these.	

Notes: 1. This table and assessment relates only to the groundwater requirements in the SEARs. Separate assessments for Biodiversity and Surface Water and Geomorphology have been undertaken which address the remainder of these SEARs.

5. Existing environment

The existing environment section presents an understanding of the expected site conditions across the GPOP WCM Project impact assessment area. Publicly available information was reviewed, supplemented by current site investigation data (where available – refer to Section 2), to conceptualise existing geological and hydrogeological conditions.

5.1 Location and topography

The impact assessment area is located on both the north and south sides of the Parramatta River. The location of the project impact assessment area and surrounding locale is shown in Figure 1-1. The impact assessment area spans the City of Parramatta and Ryde LGAs. Land use across the impact assessment area is mixed, comprising largely urbanised areas with residential, industrial, and recreational land uses.

The relined section of the brine pipeline is mostly located on the northern side of the Parramatta River, and extends north to Kissing Point Road, in the suburb of Dundas, where it connects to the existing NSOOS. The topography along the relined section of brine pipeline slopes upward from the Parramatta River at an approximate 1% grade (elevation increase of about 17 m).

The brine and transfer pipelines and WRRF site lie on a peninsula between the Parramatta River and the Duck River within the Camellia-Rosehill Precinct. The topography of the peninsula is relatively flat and generally falls gently to the south.

The river release pipeline connects at the WRRF (on the southern side of the Parramatta River) and extends east toward Meadowbank, located on the northern side of the Parramatta River, crossing beneath the River off Wentworth Point. The river release pipeline extends roughly parallel to the southern bank of the Parramatta River and spans the suburbs of Rosehill, Silverwater, Newington, Sydney Olympic Park, Wentworth Point, and Meadowbank. The river release pipeline is proposed to cross beneath the Duck River just south of the WRRF, and the Parramatta River between Sydney Olympic Park ferry wharf and Meadowbank. The topography along the river release pipeline is generally flat and low-lying (between 0 m and 4 m above sea level), with two peaks of about 19 mAHD at Newington and Meadowbank.

5.2 Climate

Review of data available through the Bureau of Meteorology (BoM) – Monthly Statistics: Climate Data Online (BoM, 2025) indicates that the nearest BoM weather station with comprehensive climate records also at a suitable elevation consistent with that of the impact assessment area is the Sydney Olympic Park AWS (Archery Centre) weather station (#066212). The station is located adjacent to the river release pipeline, near the SOPA Pod C carpark. Data have been analysed over the approximate 14-year period of record. This length of record is considered sufficient to account for year-to-year variations in climate (BoM, 2025).

Utilising the BoM climate database the average total rainfall for each calendar month from September 2011 (the earliest recorded rainfall) to June 2025 (approximately 14 years) was calculated and is summarised in Table 5-1 and shown graphically in Figure 5-1.

Table 5-1: Average total monthly rainfall (mm) recorded at Sydney Olympic Park Archery Centre (#066212)

Jan	Feb	Mar	Apr	May	Ju	Jul	Aug	Sep	Oct	Nov	Dec
117	133	177	89	58	105	62	60	47	62	79	73

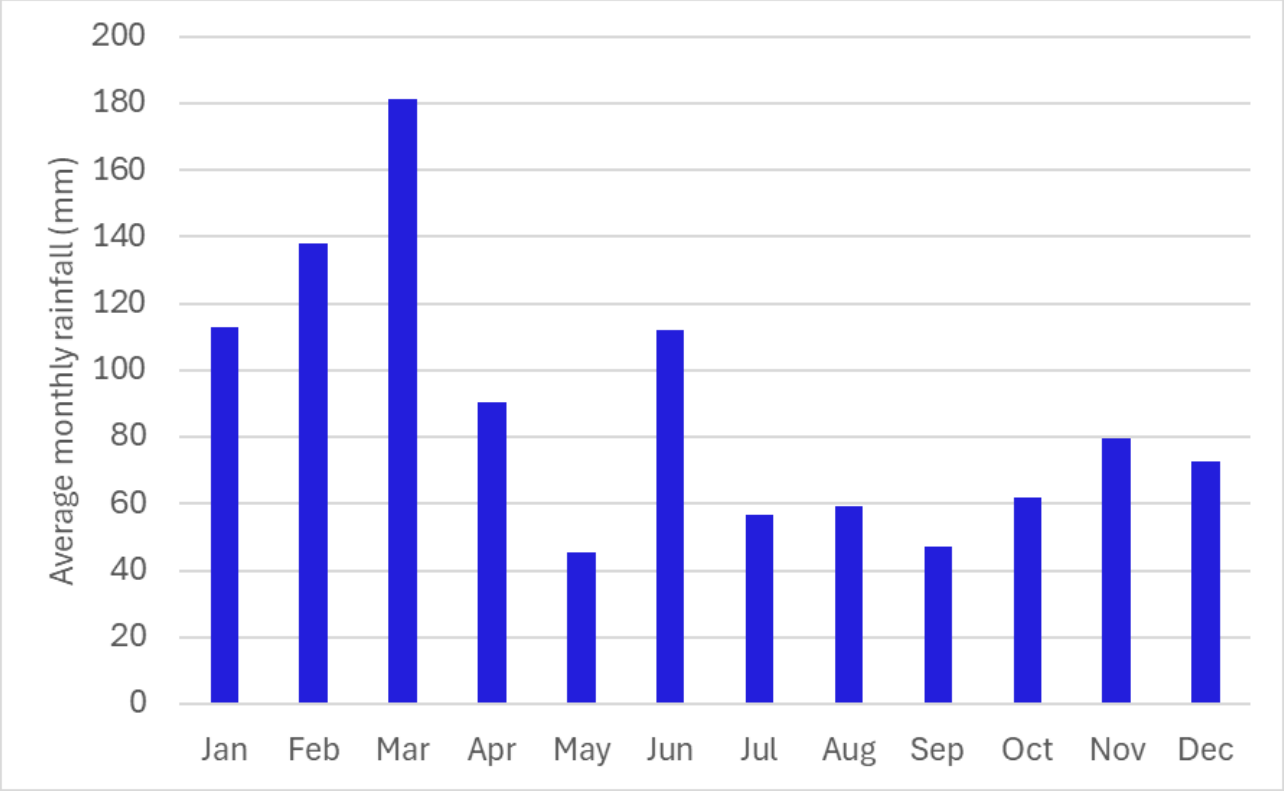


Figure 5-1: Average total monthly rainfall between September 2011 and June 2025 recorded at Sydney Olympic Park Archery Centre (#066212)

Analysis of the available rainfall data presented in Figure 5-1 shows that the project area experiences a moderate level of rainfall throughout the year. The wettest months are typically between January and March, with average rainfall ranging between 117 mm and 177 mm. The driest months are generally between July and September, where average monthly rainfall ranges between 47 mm and 62 mm. Data indicates that May is also a typically dry month, with average rainfall of 58 mm.

The cumulative monthly rainfall deviation (CRD) for all data since September 2011 is shown in Figure 5-2. The CRD is the cumulative deficit, or surplus, of monthly rainfall totals compared to long term average monthly rainfall and is an indicator of long-term climatic trends.

From Figure 5-2, dominant rainfall trends over the past 14 years include:

- September 2016 to January 2020, persistent below average rainfall (strong downwards trend)
- October 2021 to February 2023, persistent above average rainfall (strong upwards trend)
- February 2023 to April 2025, below average rainfall (strong downwards trend)
- Recent data indicates the possibility of a trend in above average rainfall from April 2025 to present, noting data trends cannot be confirmed until more data is available.

Temperature data was reviewed from Sydney Olympic Park Archery Centre weather station between September 2011 and June 2025 (BoM, 2025). The mean monthly minimum and maximum temperatures are shown in Figure 5-3 and demonstrates that the project is positioned within a temperate climate zone with distinct seasons throughout the year with warm summers and cooler winters. Average monthly maximum and minimum temperature generally differ by about 10 to 12 degrees Celsius (°C). The mean maximum monthly temperature ranges from 18.4°C in May to 28.8°C in January. The mean minimum monthly temperature ranges from 6.6°C in June to 19.4°C in January.



Figure 5-2: Cumulative rainfall deviation from 2011 to 2025 recorded at Sydney Olympic Park Archery Centre (#066212)

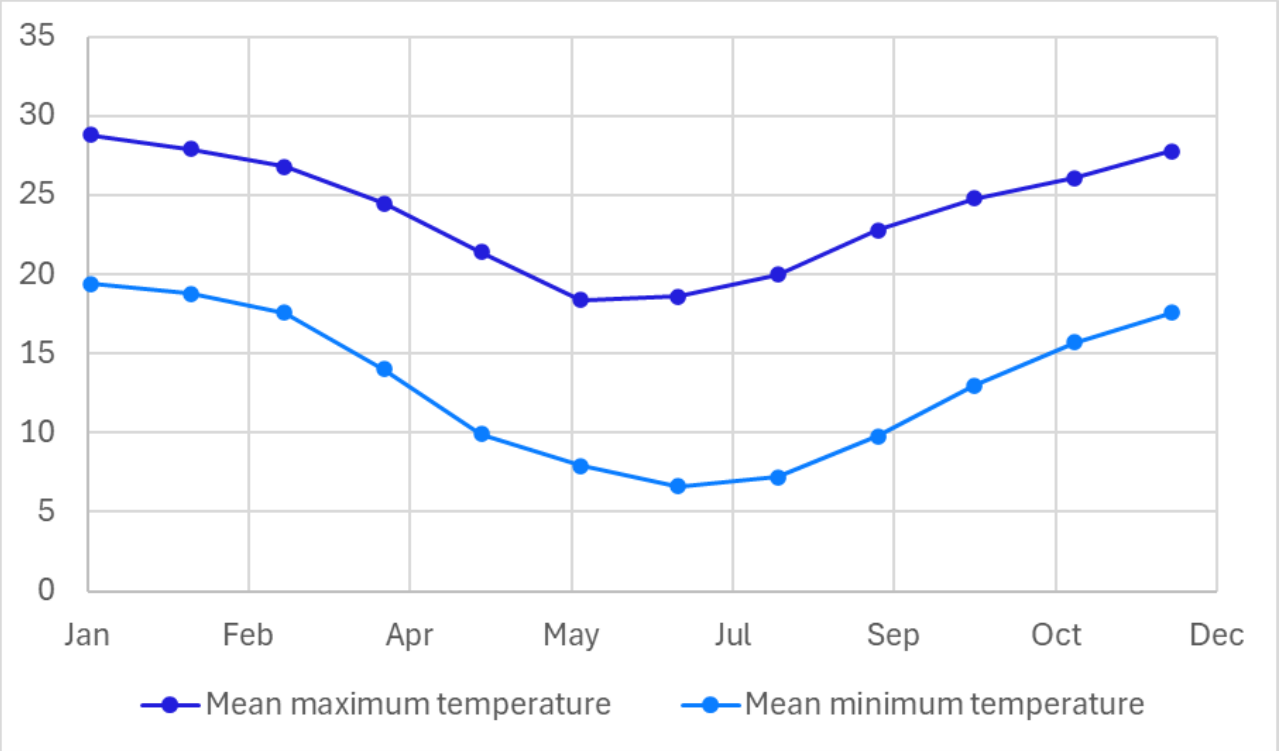


Figure 5-3: Mean monthly minimum and maximum temperature measured between September 2011 and June 2025 at Sydney Olympic Park Archery Centre (#066212) (BoM, 2025)

5.3 WRRF site raising

Sydney Water are currently raising a portion of the WRRF site (see Figure 5-4). Approximately 1.7 m of VENM/ENM (and/or other material under suitable resource recovery orders) will be placed on the site, raising the surface to a final engineered level of 6.8 mAHD (approved under separate approvals determined by Sydney Water). The material will be tested and be clean and free of contaminants. Construction of the WRRF and pipelines will commence approximately 12 to 24 months after completion of the site raising.

The raising of the WRRF site is not expected to cause a perceptible change in the existing groundwater environment. The existing groundwater level, groundwater quality and rate of groundwater flow / contaminant migration through groundwater is not expected to change significantly from conditions prior to site raising.

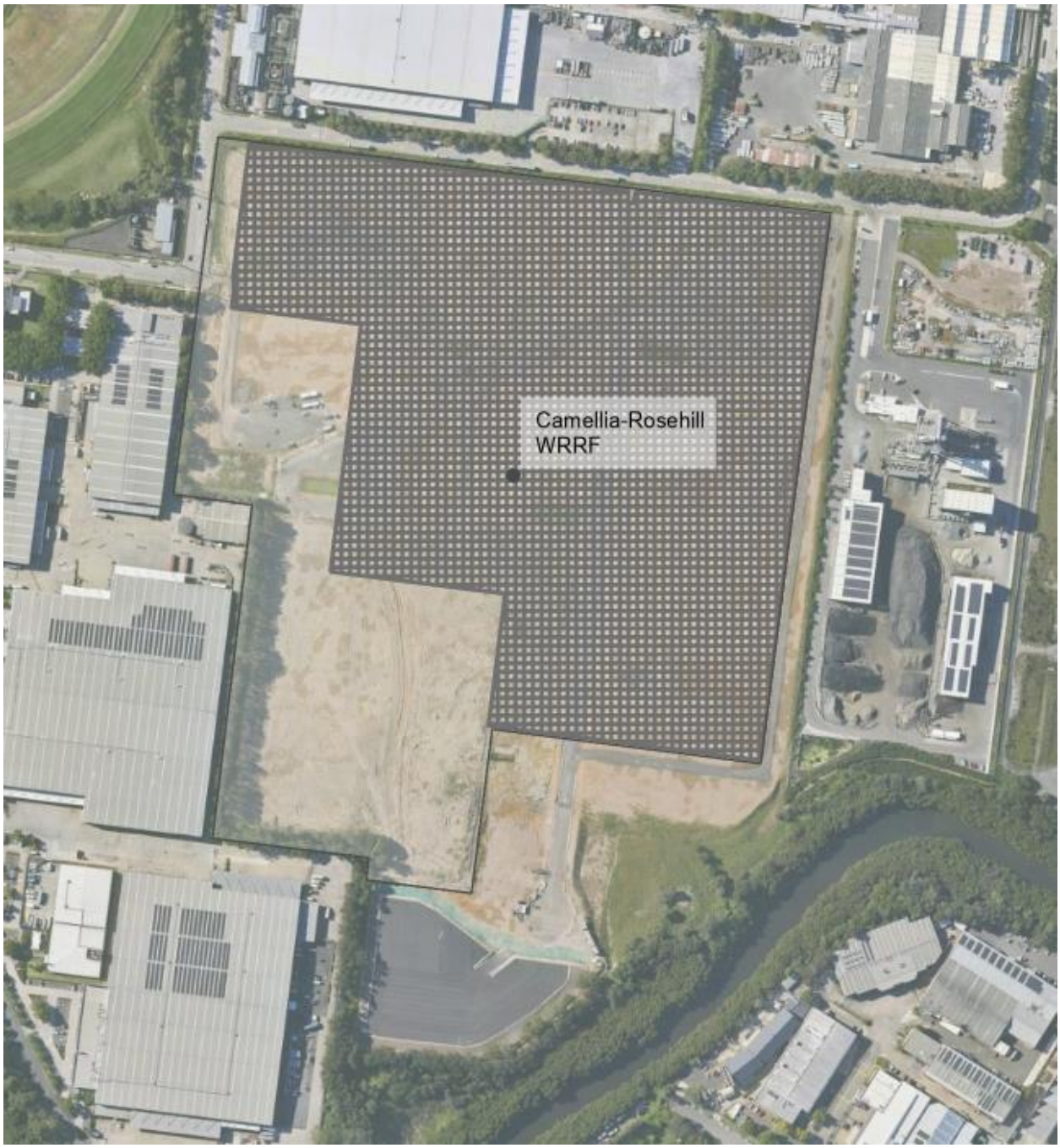


Figure 5-4: WRRF Site Raising Extent (Indicative)

5.4 Geology and soils

The Sydney 1:100,000 Geological Map (Herbert, 1983) published by Geological Survey of NSW (NSW Government, 2017) indicates two geological profiles across the project impact assessment area. These profiles are generally separated by the Parramatta River and are defined by either Hawkesbury Sandstone or Ashfield Shale, as bedrock. The geological mapping across the impact assessment area and broader region is shown in Figure 5-5.

The bedrock underlying the relined section of the brine pipeline and eastern section of river release pipeline, from the Sydney Olympic Park Authority (SOPA) Pod C carpark to pipeline termination at the river, at Meadowbank near John Whitton Bridge, is Hawkesbury Sandstone. The brine and transfer pipelines, WRRF site and western portion of the river release pipeline between the WRRF and SOPA Pod C carpark, are underlain by Ashfield Shale bedrock. Ashfield Shale is mapped at the surface along the majority of the western section of river release pipeline, between the WRRF and PDC Park in the suburb of Newington. Hawkesbury Sandstone is mapped at the surface along the eastern section of river release pipeline and along the majority of the relined brine pipeline, north of Parramatta.

Geological mapping also indicates surficial alluvial terrace deposits present along the brine and transfer pipelines and at the WRRF. Alluvial valley deposits are mapped along the relined section of brine pipeline where the alignment crosses Vineyard Creek. Anthropogenic deposits are also mapped along the river release pipeline in Silverwater and Meadowbank and in reclaimed wetland areas along Wentworth Point.

Site investigations, including geotechnical borehole drilling, were undertaken by Jacobs along the brine and transfer pipelines and river release pipeline, and at the WRRF (Jacobs, 2025a, Jacobs, 2024b). Section 5.4.1 summarises the ground conditions at the WRRF, along the western section of the river release pipeline and along the brine and transfer pipelines, based on current site investigations. Section 5.4.2 and Section 5.4.3 outline the ground conditions, based on current site investigations, along the eastern portion of the river release pipeline and along the brine pipeline (relined existing rising main), respectively. Ground conditions are outlined in order of increasing depth.

Geotechnical logs of boreholes and pavement holes drilled at the WRRF and along the river release pipeline and brine and transfer pipelines are included in Appendix A.

Geological cross sections at the WRRF, which are based on results from the current site investigation undertaken by Jacobs, are also provided in Appendix A.

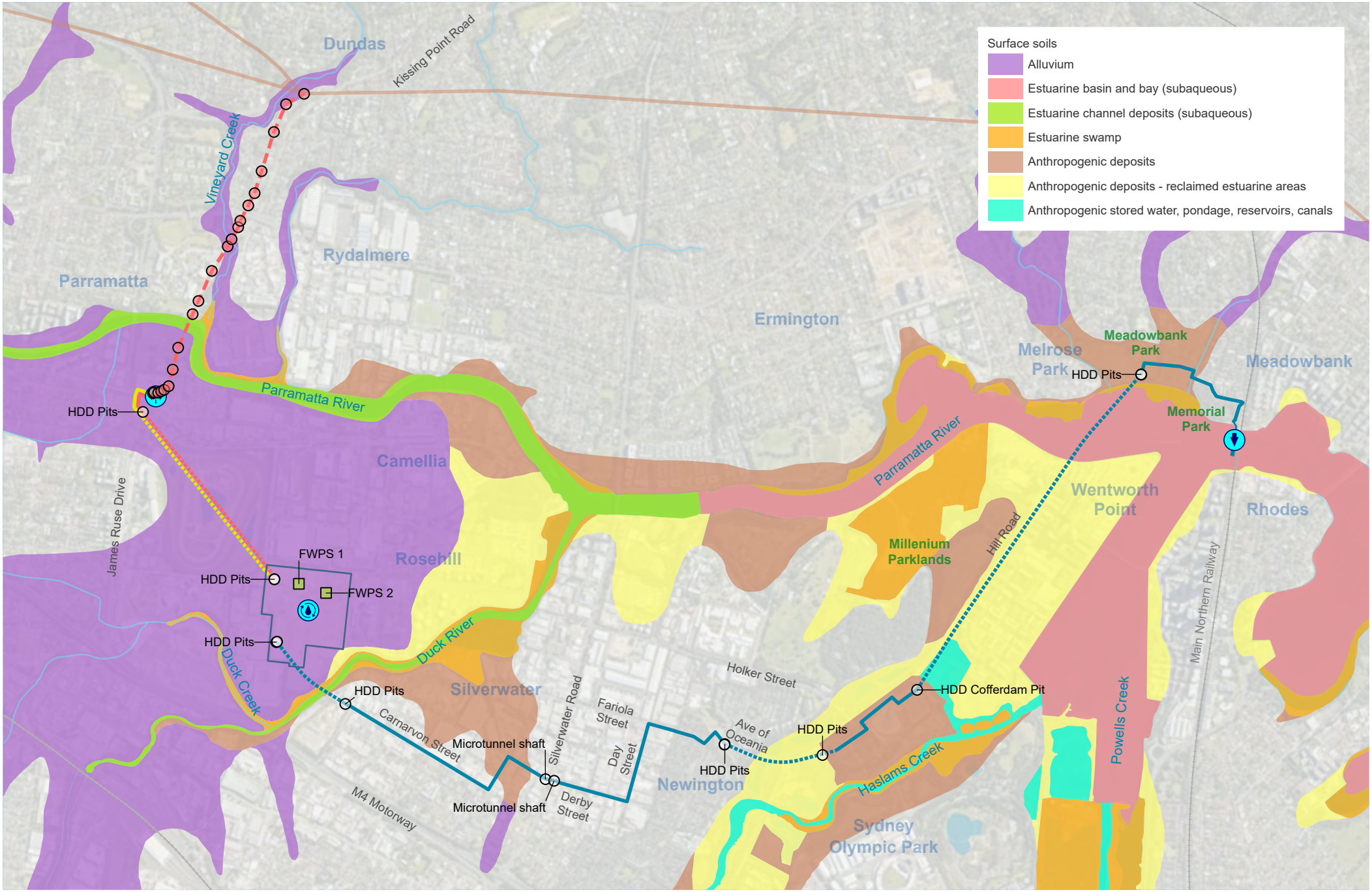


Figure 5-5a Regional geology across project area – surface soils

Data sources: State of NSW (Spatial Services), NSW Department of Planning and Environment
Basemap: MetroMap 2025
Scale: 1:27,500 @ A4
GDA2020 MGA Zone 56



Figure 5-5b Regional geology across project area – bedrock units

Data sources: State of NSW (Spatial Services), NSW Department of Planning and Environment
Basemap: MetroMap 2025
Scale: 1:27,500 @ A4
GDA2020 MGA Zone 56

5.4.1 WRRF, brine and transfer pipelines, Camellia pumping station and the western section of river release pipeline (between the WRRF and SOPA Pod C carpark)

The ground conditions at the WRRF, along the western section of the river release pipeline and along the brine and transfer pipelines can be summarised as:

- **Fill**, typically comprising clay or sandy clay, and with shallow sandy gravel in some locations. The fill is typically around 1 m to 2 m thick but can be up to 6.5 m thick in areas of reclaimed wetlands adjacent to RRP-BH-119. The fill is typically underlain by alluvium along the brine and transfer pipelines and at the WRRF, or by residual soil along the western section of river release pipeline (between the WRRF and SOPA Pod C carpark).
- **Alluvium**, between approximately 3 m to 13 m thick. The alluvium comprises clay and silty clay. The alluvium is generally present beneath the fill along the brine and transfer pipelines, at the WRRF and in areas of reclaimed wetlands toward SOPA Pod A carpark (RRP-BH-118 and RPP-BH-119).
- **Residual soil**, approximately 1 m to 3 m thick, comprising clay or sandy clay likely derived from Ashfield Shale. Residual soil is present along most of the western river release pipeline where it directly underlies fill. At the WRRF, along the brine and transfer pipelines and in reclaimed wetland areas, the residual soil underlies alluvium. The residual soil is underlain by a weathered profile of siltstone/interlaminated siltstone and sandstone, interpreted to represent Ashfield Shale.
- **Siltstone/interlaminated siltstone and sandstone**. The siltstone/interlaminated siltstone and sandstone is interpreted to represent Ashfield Shale and can extend from a top depth of around 3 mbgl to 5 mbgl (1.5 mAHD to – 2 mAHD) along the western section of the river release pipeline. At the WRRF, brine and transfer pipelines or in areas where fill is thicker the top depth of the siltstone is noted around 10 mbgl to 12 mbgl. At the residual soil interface, the Ashfield Shale is typically extremely to highly weathered and is described as clay. The unit becomes less weathered with depth and is typically noted as fresh rock at a depth of around 10 mbgl to 15 mbgl (-12 mAHD). The fresh Ashfield Shale extends beyond the termination depth of all boreholes (maximum depth of 35 mbgl or 28 mAHD).

5.4.2 Eastern section of river release pipeline between SOPA Pod C carpark and river release structure at Parramatta River, Meadowbank

The ground conditions along the eastern portion of the river release pipeline can be summarised as:

- **Fill**, typically between 3 m to 5 m thick comprising clay, sandy clay or gravelly clay, underlain by either alluvium or marine deposits.
- **Alluvium**, between 12 m and 15 m thick comprising predominately of clay with clayey sand lenses noted in some locations, underlain by Hawkesbury Sandstone.
- **Marine deposits** occur beneath the fill in locations on the banks of the Parramatta River (river release pipeline-BH-127 and river release pipeline-BH-128). The marine deposits typically occur from about 2 mbgl (-0.2 mAHD) and are 10 m to13 m thick, comprising sandy clay and clay. Hawkesbury Sandstone underlies the marine deposits.
- **Hawkesbury Sandstone** occurs from a top depth of about 18 mbgl (-14 mAHD) on the southern side of the Parramatta River, and about 13 mbgl (-10 mAHD) on the northern side of the river. At the outlet site at Meadowbank, near John Whitton Bridge, Hawkesbury Sandstone is noted to occur directly beneath the fill, from a top depth of around 1.5 to 2 mbgl (17.4 mAHD/5.1 mAHD). The sandstone extends beyond the termination depth of all boreholes (maximum depth of 51.3 mbgl or -45.9 mAHD).

5.4.3 Brine pipeline (relined section)

Understanding of the geology and soils along the brine pipeline (relined existing rising main) between Camellia pumping station and the NSOOS were based on geological mapping. The subsurface conditions are considered to comprise alluvial sediments, overlying Hawkesbury Sandstone. Alluvial sediments are likely thicker where the brine pipeline (relined section) crosses Vineyard Creek.

5.5 Acid Sulphate Soils (ASS)

ASS are soils and sediments containing iron sulphides that, when exposed to oxygen, generate sulphuric acid, as well as aluminium and other heavy metals. The majority of ASS are formed by natural processes under thermal-specific environmental conditions. Their occurrence is generally limited to low-lying areas of coastal floodplains, rivers and creeks (NSW Environment Protection Authority, 2014).

The potential for ASS to be encountered across the impact assessment area has been assessed using:

- ASS Risk Mapping – used to supplement information from site investigations and identify the potential for ASS across the project impact assessment area. ASS Risk mapping was prepared by the NSW Department of Climate Change, Energy, the Environment (DCCEEW) and was accessed via the Sharing and Enabling Environmental Data (SEED) Portal (State Government of NSW, 1998).
- ASS Classification – used to classify environmental risk associated with ASS or Potential ASS (PASS). ASS Classifications were based on the Environmental Planning Instrument (EPI) – Acid Sulphate Soils dataset (NSW Department of Planning, Housing and Infrastructure, 2025)
- ASS testing results from the WRRF DSI (Jacobs, 2024a)
- ASS screening from geotechnical investigations along the river release pipeline, the brine and transfer pipelines and at Camellia pumping station (Jacobs, 2025a; Jacobs,2025b)

ASS Risk Mapping indicated high probability of ASS:

- in the sediment of the Paramatta River bed at the confluence of Vineyard Creek and the Parramatta River
- at/near ground surface in areas of Silverwater, to the east of the WRRF and Duck River

Areas mapped as 'Disturbed Terrain' on the ASS Risk Mapping indicates that soil disturbance prevented the identification of the landform and the identification of any ASS or PASS. It is, therefore, uncertain whether ASSs may occur at these locations. 'Disturbed Terrain' is mapped along majority of the river release pipeline, along all of the brine and transfer pipelines, as well as at the WRRF and Camellia pumping station.

Figure 5-6 shows the ASS Risk Mapping across the project impact assessment area and broader region. ASS Classification also indicates Class 2 and Class 4 ASS at locations across the impact assessment area. That is, ASSs are likely found below the natural the ground surface (Class 2) or more than 2 metres below the natural ground surface (Class 4). A summary of ASS classes that may be encountered across the project impact assessment area is provided in Table 5-2.

Potential ASS impacts to groundwater during construction are discussed in Section 9.1. Where excavations encounter ASS, management will be required as outlined in Section 14.

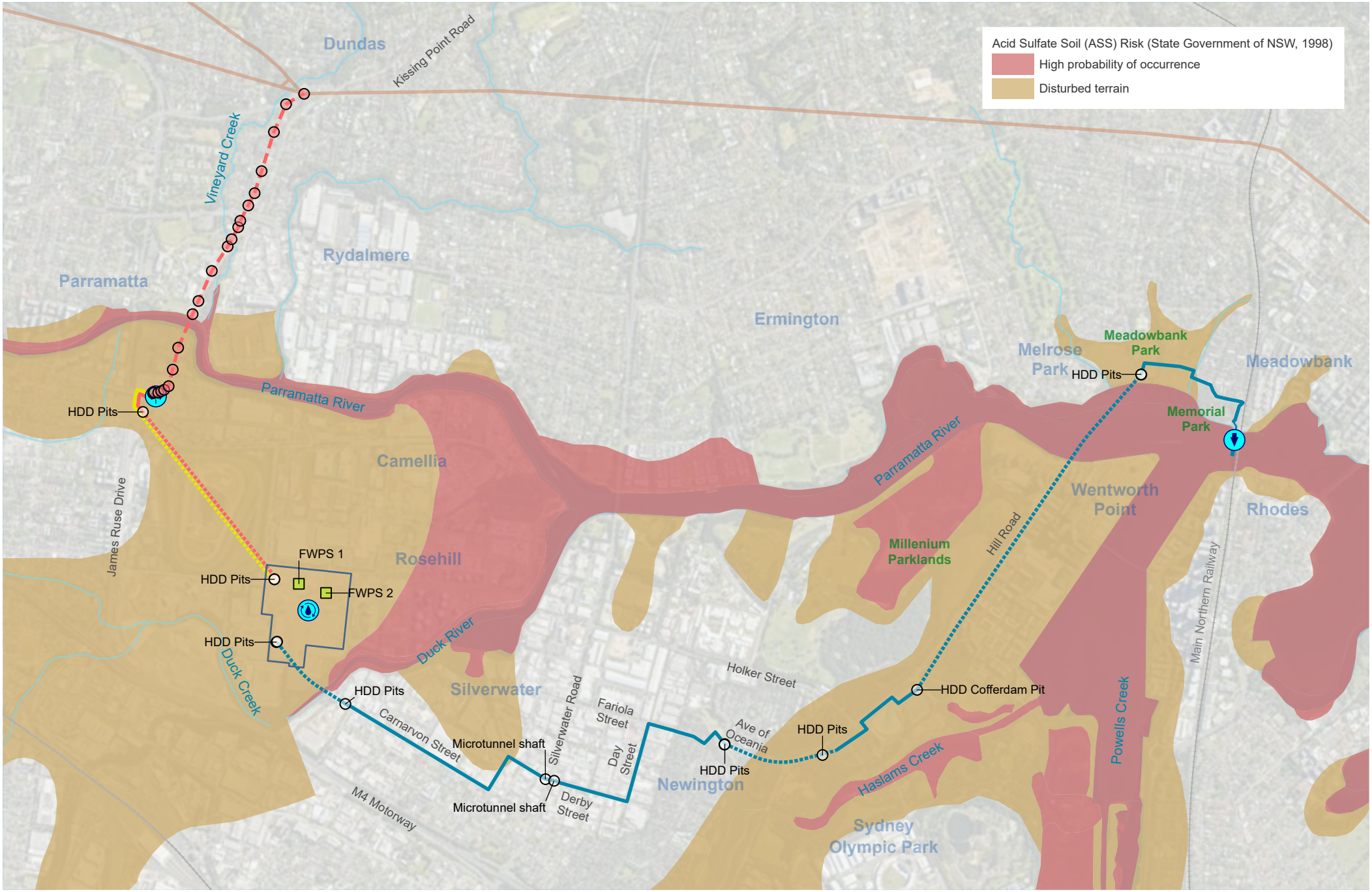


Figure 5-6 ASS risk mapping across project area

Table 5-2: ASS Classification for the WRRF, river release, and brine and transfer pipelines

Alignment	ASS Class	General Location	Description	Associated Plan / Policy
River release pipeline and brine and transfer pipelines	Class 2	Southeast of Duck River, Silverwater Intersection of Vore Street and Derby Street, Silverwater Sydney Olympic Precinct Wentworth Point Meadowbank	Works by which the water table is likely to be lowered present an environmental risk	Parramatta LEP (2023) Ryde LEP (2014)
River release pipeline and brine and transfer pipelines	Class 4	WRRF. Camellia-Rosehill, surrounding the WRRF site	Works by which the water table is likely to be lowered more than 2 m below the natural ground surface present an environmental risk	Parramatta LEP (2023)
River release pipeline Brine pipeline (relined section)	Class 5	Silverwater Meadowbank Relined section of brine pipeline north of the Parramatta River	Class 5 is considered low risk	Parramatta LEP (2023) Ryde LEP (2014)
River release pipeline	X	Sydney Olympic Precinct Wentworth Point	Disturbed terrain prevented classification of PASS/ASS	State Environmental Planning Policy (State Significant Precincts) 2005

5.5.1 WRRF

Sampling undertaken at the WRRF indicates that soils below a depth of 1.5 mbgl may be considered ASS (Jacobs, 2024a). ASS testing was carried out in accordance with the Acid Sulphate Soils Management Advisory Committee (ASSMAC) guidelines and the Acid Sulphate Soils Laboratory Methods Guidelines (ASSMAC,1998). Results of ASS sampling are included in the WRRF DSI (Jacobs, 2024a).

Excavation of project elements at the WRRF that extend below 1.5 from the existing natural ground surface may encounter ASS and may cause ASS related impacts to groundwater. Given majority of excavations are to occur within the raised portion of the site (refer to Section 5.3), the likelihood of encountering ASS is limited. There is potential for ASS to be encountered during excavation of the river release pipeline HDD pits located outside of the raised site extent.

5.5.2 River release pipeline

ASS screening was undertaken during geotechnical investigations along the river release pipeline (Jacobs, 2025a). Results from field pH screening and Suspension Peroxide Oxidation Combined Acidity & Sulphur (SPOCAS) testing indicated the potential presence of ASS at:

- Day Street North, north of Derby Street, Silverwater
- PDC Park, Newington
- Corner of Avenue of Oceania and Hill Road
- Meadowbank Park, Meadowbank

During DSI fieldwork, ASS visual indicators (shells, odour, change in colour for example) were observed in soils at additional locations including:

- Corner of Vore Street and Derby Street, Silverwater
- SOPA Pod A carpark, Olympic Park
- SOPA Pod C carpark, Olympic Park

These soils were not tested for ASS.

Given that the above locations generally correspond to areas of Class 2 ASS, and as per DSI recommendations, it is recommended that ASS laboratory sampling and analysis is undertaken prior to construction at all locations listed above where screening or visual observations indicated the potential presence of ASS (Jacobs, 2025f).

5.5.3 Brine and transfer pipelines and Camellia pumping station

No ASS indicators were observed during geotechnical drilling or screening along the brine and transfer pipelines (Jacobs, 2025b). Soils are classified as Class 4 ASS along the brine and transfer pipelines and at Camellia pumping station. As such, the risk of encountering ASS at depths shallower than 2 m below the natural ground surface is considered low. Where excavations are deeper than 2 m, ASS may be encountered.

5.5.4 Brine pipeline (relined section)

No ASS screening or testing was undertaken along the relined section of brine pipeline.

With the exception of areas immediately surrounding Vineyard Creek and the Parramatta River, soils along the relined section of brine pipeline are considered Class 5. That is, ASS are not typically present.

At Vineyard Creek, proposed works involve relining the existing rising main. Excavation in the vicinity of Vineyard Creek, should this occur, may encounter ASS. It is noted that preliminary investigations indicate the existing rising main is structurally sound and as such the relining methodology is subject to change. At the Parramatta River the existing rising main is above ground and, therefore, ASS does not need to be considered.

5.6 Aquifers

A review of the available information (refer to summary of previous investigations in Section 2) indicates:

- In impact assessment areas, where surficial fill or alluvium is present (refer Figure 5-5), groundwater is likely present as a shallow unconfined aquifer (less than 5 mbgl) within these fill and alluvial sediments. Impact assessment areas where shallow groundwater was observed include along the brine and transfer pipelines north of Rosehill Gardens Racecourse, at the WRRF site, in SOPA Pod A carpark and Meadowbank Park. Shallow groundwater levels observed within the fill and alluvial sediments are considered to represent a perched aquifer system.

  Along the river release pipeline, it is interpreted that the perched aquifer pinches out to the west approaching Silverwater, where the thickness of fill and alluvium decreases.

- Along the western section of the river release pipeline between the WRRF and SOPA Pod A carpark, groundwater was not observed during drilling. In these areas, Ashfield Shale is also mapped at the ground surface (refer Figure 5-5).

  It is noted that that the typical nature of the residual soils derived from Ashfield Shale (low permeability clay) encountered along the western portion of the river release pipeline may not have allowed for groundwater observation during drilling. Existing geotechnical data available from Douglas Partner borehole logs completed as part of Sydney Metro West Stage 2, indicate the potential for a perched aquifer to exist in these areas. Logs note an approximate depth to groundwater of 2.5 mbgl or 1 m below the fill/residual soil interface (Douglas Partners, 2009).

5.7 Groundwater recharge and discharge

Local soils are characterised as being of poor drainage and, as such, groundwater recharge through infiltration of rainfall will be limited. This is further compounded by the urban environment and high percentage of paved areas and similarly impermeable surfaces increasing runoff and limiting potential for infiltration.

The regional water table is expected to be a subdued imitation of surface topography with groundwater flow and discharge toward lower lying areas and surface drainage lines.

5.8 Groundwater levels and flow

Where available, groundwater level information was sourced from current site investigations undertaken by Jacobs (2024a, 2024d, 2025e, 2025f). Groundwater level observations during monitoring of wells, as part of DSIs, were considered representative of groundwater levels across project sites. At the WRRF, data from continuous groundwater level monitoring undertaken by Jacobs was also used to inform the conceptualisation of groundwater levels at the site. Where DSI data was limited, groundwater observations made during geotechnical investigations (e.g. water-strike) were used to provide additional understanding of site wide conditions (Jacobs, 2024e; Jacobs, 2025a; Jacobs, 2025b). Current site investigation data has been supplemented by existing geotechnical data (Douglas Partners, 2009) and information available from NSW state monitoring bores to provide an indication of groundwater levels along areas where data from site investigations was not available.

The following sections discuss the interpreted groundwater level and anticipated groundwater flow direction across project sites (WRRF, brine and transfer pipelines, river release pipeline and, the relined section of the brine pipeline). The interpreted regional groundwater flow direction across the impact assessment area and broader locale is shown in Figure 5-9.

It is noted that the SEARs require a description of groundwater levels across the site under a range of wet and dry conditions. Continuous groundwater level monitoring has been undertaken at the WRRF since 15 August 2024 (Jacobs, 2024d). Site specific groundwater level data was not available prior to August 2024. Based on the CRD chart presented in Figure 5-1, the period from August 2024 to June 2025 is considered to be likely a wetter than average period. Understanding of groundwater levels in drier periods is therefore limited. Understanding of groundwater level variation across the pipelines and at Camellia pumping station is also limited as continuous groundwater level monitoring has not been undertaken at these sites.

With this in mind, however, results from the continuous groundwater level monitoring at the WRRF undertaken to date indicate no consistent observable change in groundwater levels in response to rainfall over the short-term to medium-term (order of weeks to months) (Jacobs, 2024d). This is understandable given the relatively low permeability of material at the site (refer to Section 5.9) and likely limited infiltration from the surface.

Furthermore, as the period of sampling was wetter than average, this has provided a conservative approach to the assessment. It is possible that groundwater inflows would be less than estimated if the project is constructed in a dry period.

5.8.1 WRRF

At the WRRF, groundwater levels were observed to range between 0.6 mbgl and 5 mbgl. Observations were made prior to raising of the site. Typical groundwater levels lie between 0.6 mbgl and 4 mbgl (Jacobs, 2024d). Groundwater is observed within the fill and/or alluvial sediments in the project area. Groundwater levels observed in monitoring wells on 28 January 2025 are provided in Table 5-3 and shown in Figure 5-7.

Groundwater contour mapping prepared as part of ongoing site investigations, interpret the groundwater flow direction across the WRRF site to be generally toward south-south-east; that is, towards Duck River. The estimated hydraulic gradient is also relatively low, between 0.003 and 0.011 m/m (Jacobs, 2024d).

Table 5-3: Summary of observed groundwater levels at the WRRF (measured on 28 January 2025)

Well ID	Easting	Northing	Ground surface elevation	Groundwater level		Groundwater observed within
	m	m	mAHD	mbgl	mAHD	
WRRF-BH102	317704	6255158	4.1	1.4	3.7	In clay ALLUVIUM
WRRF-BH103	317806	6255271	5.0	1.0	3.0	In clay ALLUVIUM
WRRF-BH104	317991	6255248	5.0	1.8	3.2	In clay ALLUVIUM
WRRF-BH105	317884	6255163	4.9	1.5	2.6	In clay ALLUVIUM
WRRF-BH106	317929	6255091	5.0	3.9	1.1	In clay ALLUVIUM
WRRF-GW101	318076	6255250	5.0	1.1	3.9	In clay ALLUVIUM
WRRF-GW107	318159	6255194	5.1	5.0	0	In clay ALLUVIUM
WRRF-GW108	318161	6255086	5.0	0.9	4.1	Typically in clay ALLUVIUM, occasionally in clay FILL
WRRF-GW109	318013	6254868	4.8	0.6	4.4	In silty clay FILL
WRRF-GW110	318026	6254996	5.2	1.4	2.7	In clay FILL
WRRF-GW111A	318142	6255089	5.2	1.9	3.3	In clay ALLUVIUM (assumed)
WRRF-GW112	317697	6255064	4.0	1.8	2.8	In sandy clay FILL
WRRF-GW113	317894	6255268	5.0	3.6	1.0	In clay ALLUVIUM
WRRF-GW114	317756	6254900	4.6	2.5	2.3	In clay ALLUVIUM
WRRF-GW115	317973	6254868	4.6	3.2	1.7	In clay ALLUVIUM
WRRF-GW116	317894	6254748	5.3	3.9	1.4	In clay ALLUVIUM
WRRF-GW117	317739	6254810	4.1	1.0	3.9	Typically in clay ALLUVIUM, occasionally in clay FILL
WRRF-GW118	317892	6254847	5.0	2.3	2.9	In clay ALLUVIUM

Notes: 1. Coordinates provided in MGA202, Zone 56

2. Ground surface level based on survey completed on 9/01/2024. Note that a portion of the site is proposed to be raised with natural material, and ground surface levels will change in future.

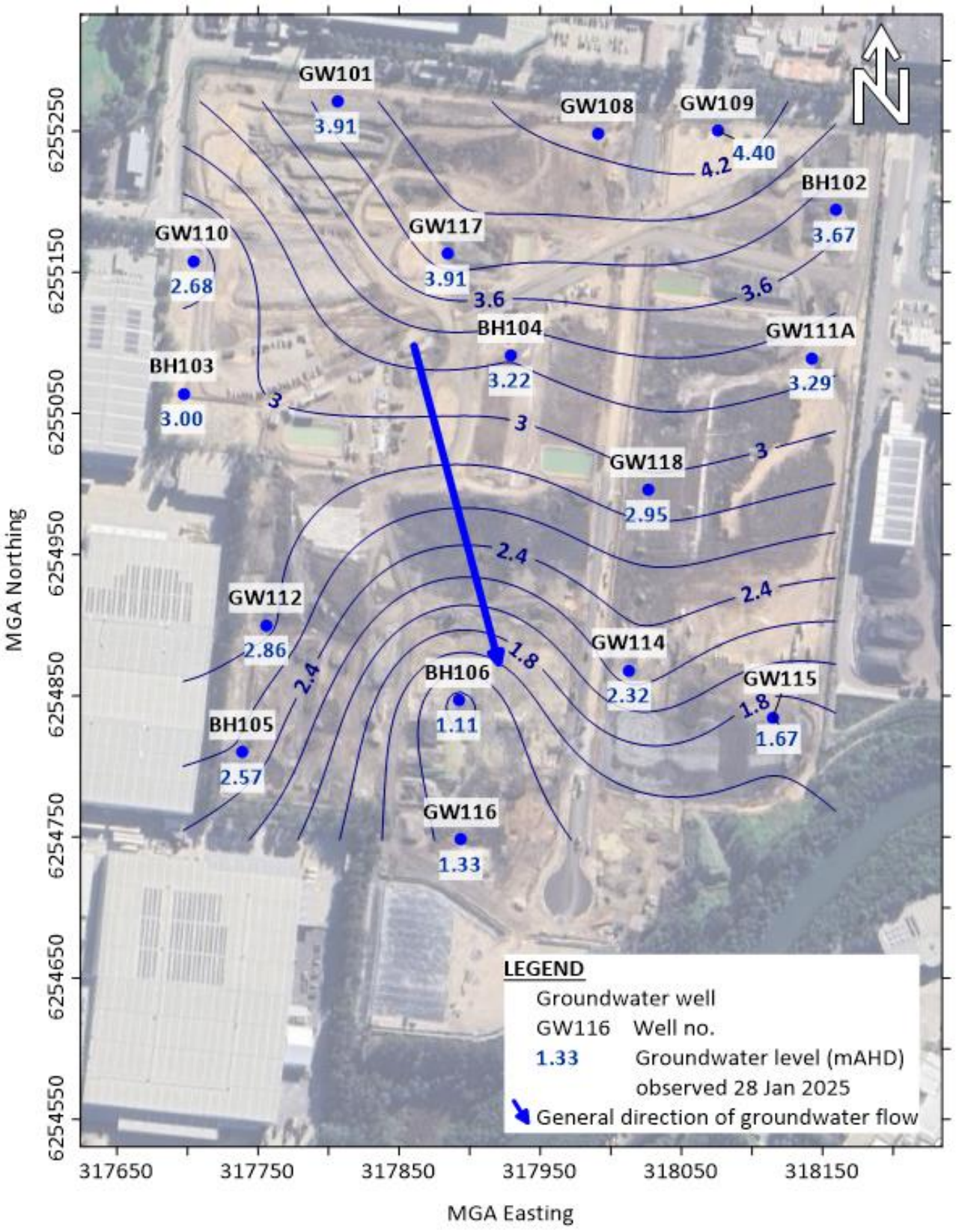


Figure 5-7: Groundwater levels observed on 28/1/2025 and interpreted groundwater contours - WRRF

5.8.2 River release pipeline

During geotechnical drilling, groundwater strikes were recorded in 7 of the 27 investigation locations along the river release pipeline (Jacobs, 2025a). Locations where groundwater ingress during drilling was noted included pavement holes, boreholes and boreholes intended for groundwater monitoring well installation. Groundwater monitoring wells (piezometers) were installed at 7 locations; however, groundwater was not observed during drilling / installation of 4 of the 7 wells. Groundwater gauging undertaken 4 months after installation, as part of the DSI, recorded groundwater levels in 5 of the 7 wells (i.e. 2 remained dry) (Jacobs, 2025f). A summary of groundwater observations is provided in Table 5-4. Groundwater level observations from installed piezometers and geotechnical investigation locations are shown in Figure 5-8.

Groundwater levels were typically observed between 1.5 mbgl and 2.4 mbgl, with the exception of two boreholes where groundwater was observed between 5 mbgl and 6 mbgl. It is noted that groundwater ingress was observed at a depth of 9 mbgl during drilling of RRP-BH-119. This reading was interpreted to be affected by drilling fluids and is not considered representative of actual groundwater levels at that location. Along the eastern section of the river release pipeline between the Newington wetlands/SOPA Pod A carpark and Meadowbank, groundwater was typically observed within the fill or alluvial material and is considered to represent a perched aquifer system within areas of anthropogenic fill.

During geotechnical investigations in October, 2024 groundwater was not observed along the western portion of the river release pipeline between the WRRF and SOPA Pod A carpark (Jacobs, 2025a). During the DSI in February, 2025, groundwater was observed in two groundwater monitoring wells installed along this section of alignment (RRP-BH-102 and RRP-BH-108) (Jacobs, 2025f). It is likely that the nature of the residual soil and/or extremely weathered siltstone (low permeability clay) combined with the drilling methodology, did not allow for groundwater observation during drilling. Existing data obtained from geotechnical logs in the area indicate groundwater presence within the residual soil, at an approximate depth of 2.5 mbgl or 1 m below the fill/residual soil interface (Douglas Partners, 2009). Based on this and current understanding of groundwater levels along other project sites, the groundwater level along the western portion of the river release pipeline is considered to lie at a depth of between 1.5 m from the base of the fill (approximately 1.7 mbgl) and 3.5 mbgl.

Groundwater flow is anticipated to be dictated by the topography along the alignment and surrounding area. Given the topography along the river release pipeline is largely flat, the groundwater flow direction is interpreted to flow toward the nearest waterway.

Table 5-4: Summary of groundwater observations along the river release pipeline

ID	Type	Easting	Northing	Ground surface elevation	Groundwater level		Date of observation	Groundwater interpreted within
		m	m	mAHD	mbgl	mAHD		
RRP-BH-102	Piezometer	318167	6254459	9.3	3.5	5.8	25/02/2025	Highly weathered siltstone
RRP-BH-108	Piezometer	319193	6254104	3.5	5.1	-1.6	25/02/2025	Highly weathered siltstone
RRP-BH-119	Piezometer	320874	6254251	5.1	9.0	-3.9	24/10/2024	In clay ALLUVIUM
					6.1	-1	25/02/2025	
RRP-BH-123	Pavement hole	321222	6254557	4.4	2.4	2	23/10/2024	In sandy clay ALLUVIUM
RRP-BH-124	Piezometer	321302	6254613	3.9	2.3	1.6	29/10/2024	In sandy clay/silty sand FILL
					1.9	2	26/02/2025	

ID	Type	Easting	Northing	Ground surface elevation	Groundwater level		Date of observation	Groundwater interpreted within
		m	m	mAHD	mbgl	mAHD		
RRP-BH-126	Drillhole	321812	6255394	5.4	6	-0.6	29/10/2024	In clay ALLUVIUM
RRP-BH-127	Drillhole	322168	6255871	1.9	2	-0.1	21/10/2024	In sandy clay FILL, at interface with sandy clay marine deposits
RRP-BH-128	Piezometer	322578	6256430	2.8	2	0.8	10/10/2024	In sand FILL, 0.5 m above interface with clayey sand marine deposits
					2.1	0.7	26/02/2025	
RRP-BH-130	Pavement hole	322871	6256325	1.6	1.5	0.1	09/10/2024	At interface of silty sand FILL and sandstone

Notes: Coordinates provided in MGA202, Zone 56

5.8.3 Brine and transfer pipeline and Camellia pumping station

Along the brine and transfer pipeline alignment, groundwater was observed during drilling of three boreholes at a depth of between 3 mbgl and 6.4 mbgl. All groundwater observations were within the alluvium. One groundwater monitoring well was installed at INF-BH-102 and gauging of this well undertaken as part of the DSI recorded a groundwater level of 1.5 mbgl. Groundwater observations are summarised in Table 5-5. Groundwater level observations from installed piezometers and geotechnical investigation locations are shown in Figure 5-8.

Drilling fluids were used during coring of INF-BH-102, INF-BH-103 and SPM-BH-101. As a result of this method, groundwater level observations may not be representative of hydrogeological conditions. For the purposes of this assessment, the groundwater level along the brine and transfer pipeline alignment and at Camellia pumping station was assumed to be 1.5 mbgl (the level observed in INF-BH-102 during contaminated land investigations in March, 2025).

Groundwater flow is anticipated to be dictated by the topography along the alignment and surrounding area. Considering the relatively flat topography along the brine and transfer pipelines, groundwater flow along the southern portion of the alignment is anticipated to be south-south-east, towards Duck River. Groundwater flow along the northern portion of the brine and transfer pipelines is assumed to be towards the Parramatta River.

Table 5-5: Summary of groundwater observations along the brine and transfer pipeline alignment and at Camellia pumping station

ID	Type	Easting	Northing	Ground surface elevation	Groundwater level		Date of observation	Groundwater observed within
				mAHD	mbgl	mAHD		
INF-BH-102	Piezometer	316964	6256163	3.3	3	0.3	13/12/2024	In sandy clay ALLUVIUM
					1.5	1.8	12/03/2025	
INF-BH-103	Drillhole	317297	6255758	7.2	3.2	4	12/12/2024	At interface of clay ALLUVIUM sandy clay ALLUVIUM
SPM-BH-101	Drillhole	317089	6256211	4.2	6.4	-2.2	5/8/2024	In clay ALLUVIUM

Notes: Coordinates provided in MGA202, Zone 56

5.8.4 Brine pipeline (relined section)

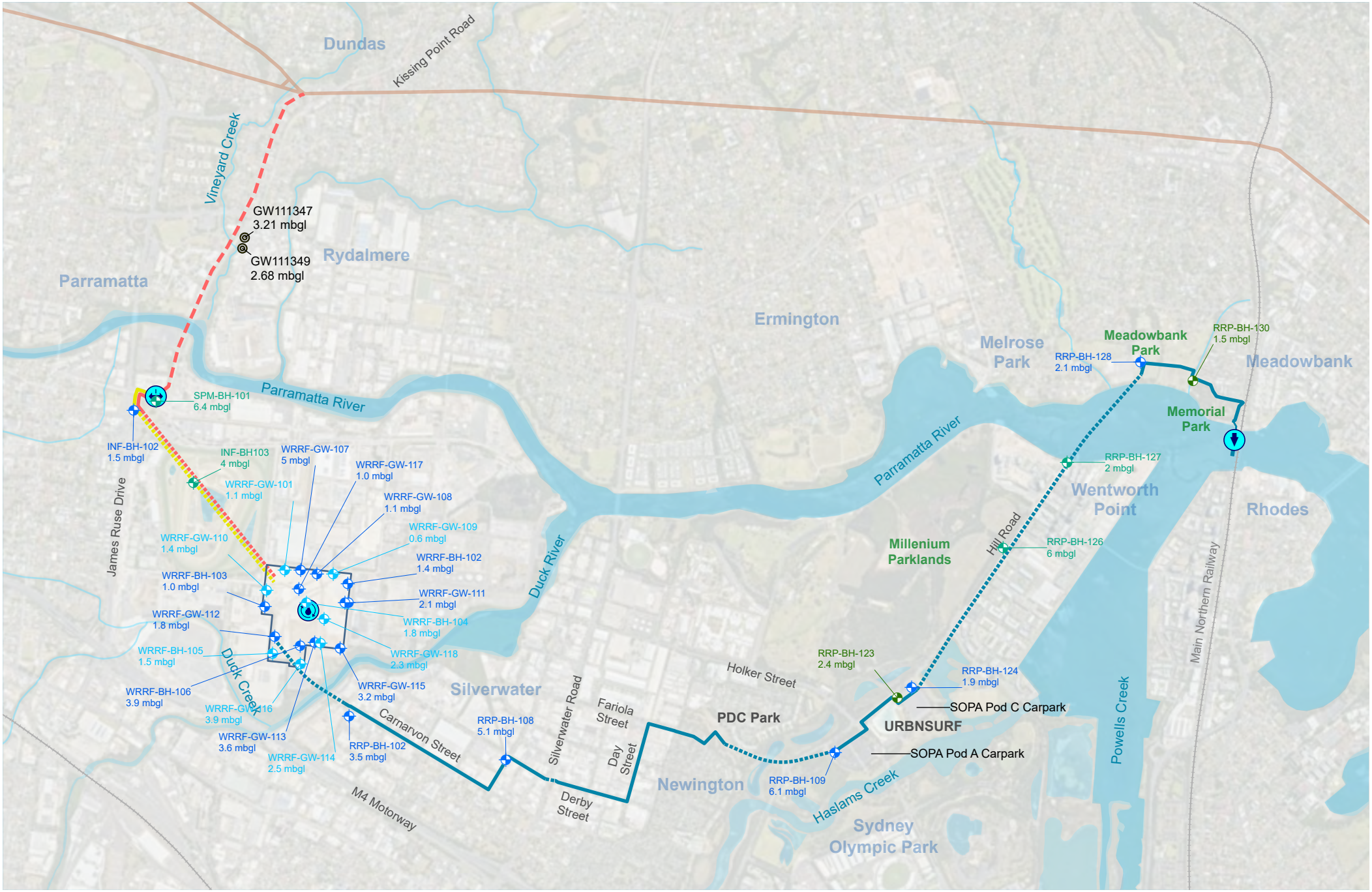
Water levels for the relined section of the brine pipeline were derived from two NSW monitoring bores - GW111347 and GW111349, as no groundwater level observations from current site investigations were available. GW111347 and GW111349 are located approximately 60 m east of the relined section of the brine pipeline, where the alignment crosses Vineyard Creek, and groundwater in these bores were measured at 2.7 mbgl and 3.2 mbgl A summary of the NSW monitoring bore data is provided in Table 5-6. Groundwater level observations from the NSW monitoring bores are shown in Figure 5-8.

Based on NSW monitoring bore data, as well as geological mapping and assumed ground conditions, there is potential for shallow groundwater to exist as part of a perched system within surficial residual soils along the alignment, or within the alluvium associated with Vineyard Creek. Based on current understanding of site conditions and for the purposes of this assessment, groundwater was assumed to lie at a depth of 2 mbgl along the length of the relined section of the brine pipeline.

Table 5-6: Summary of NSW monitoring bore data along the relined section of the brine pipeline

NSW Bore ID	Easting	Northing	Ground surface elevation	Groundwater level		Groundwater observed within
	m	m	mAHD	mbgl	mAHD	
GW111347	317582	6257123	12.1	3.21	8.89	In clay ALLUVIUM
GW111349	317569	6257063	11.55	2.68	8.87	In sandy clay ALLUVIUM

Notes: Data sourced from WaterNSW Real-time database (WaterNSW, 2024)



Camellia-Rosehill WRRF
Camellia pumping station
River release structure

Proposed pipelines
Brine pipeline
Transfer pipeline
River release pipeline

Pipeline construction method
Open trench
Trenchless
Relining

NSW Monitoring Bores
Geotechnical borehole
Groundwater well
Groundwater well with data logger
Pavement hole

Figure 5-8 Groundwater levels observed during site investigations and in NSW monitoring bores

0 500 1000 1500 m

Data sources: State of NSW (Spatial Services), NSW Department of Planning and Environment
Basemap: MetroMap 2025
Scale: 1:27,500 @ A4
GDA2020 MGA Zone 56

N



Camellia-Rosehill WRRF
Camellia pumping station
River release structure

Proposed pipelines
Brine pipeline
Transfer pipeline
River release pipeline

Pipeline construction method
Open trench
Trenchless
Relining

Presumed groundwater flow direction

Figure 5-9 Assumed direction of groundwater flow across the Project area

0 500 1000 1500 m

N

Data sources: State of NSW (Spatial Services), NSW Department of Planning and Environment
Basemap: MetroMap 2025
Scale: 1:27,500 @ A4
GDA2020 MGA Zone 56

5.9 Hydraulic properties

Jacobs undertook rising head tests at the WRRF site in August 2024 (Jacobs, 2024d). Eight wells were tested. These wells were screened in alluvium alone, and across the fill and alluvium. The estimated hydraulic conductivity values from the tests range from 1×10^{-4} m/day to 1.2×10^{-3} m/day, with a mean value of 4×10^{-4}m/day and a median value of 3.5×10^{-4} m/day. These results are consistent with values reported by GHD (2024, 2022a), which indicate that hydraulic conductivity of the alluvial sediments across the WRRF range from 5×10^{-5} m/day to 6×10^{-3} m/day. Refer to the Hydrogeological Monitoring Report (Jacobs, 2024d) for analysis of rising head test results.

No hydraulic property data was available from current site investigations for the river release pipeline, brine and transfer pipelines or the relined section of the brine pipeline.

For the purposes of the groundwater impact assessment, the adopted hydraulic conductivity of materials likely encountered during excavation of project infrastructure anticipated to require dewatering (refer Section 7) have been assumed. Adopted values of hydraulic conductivity are presented in Section 8.1.3. The adopted values provide a conservative estimate based on permeability testing and were adopted to reflect uncertainty in ground conditions and construction methodology.

Based on the geological profile of the relined section of the brine pipeline, it is likely that any surficial residual soils encountered along the alignment are derived from Hawkesbury Sandstone. The permeability of such materials has been noted to be of the order of 0.1 m/day (Heath, 1983; Freeze and Cherry,1979).

5.10 Groundwater quality and contamination

The project impact assessment area, particularly areas covered by the river release pipeline and WRRF, have a long history of mixed industrial development. The PSI and DSI undertaken by Jacobs along the brine and transfer pipelines (between the WRRF and Camellia pumping station) and river release pipeline indicate that contamination is present within soils and groundwater along both alignments and/or adjacent areas (Jacobs, 2025c; Jacobs, 2025d; Jacobs, 2025f; Jacobs, 2025g). The DSI undertaken by Jacobs at the WRRF site also indicates that contamination is present within soils, groundwater and vapour at the site (Jacobs, 2024a).

Assessment of groundwater quality as part of DSIs completed for the WRRF site, river release pipeline and brine and transfer pipelines were undertaken with reference to adopted SAC. The adopted SAC are summarised in Section 5.10.1 and Table 5-7.

Groundwater quality results from sampling during DSIs at the WRRF site, along the river release pipeline and along the brine and transfer pipelines are summarised in Section 5.10.2, Section 5.10.3 and Section 5.10.4, respectively.

Groundwater sampling or groundwater quality testing has not been undertaken along the relined section of the brine pipeline between Camellia pumping station and the NSOOS and as such the groundwater quality is unknown.

Potential groundwater quality impacts associated with construction and operation of project elements have been assessed within the groundwater impact assessment and are provided in Section 9 and Section 11. A review of groundwater quality against discharge/disposal criteria is provided in Section 10.

5.10.1 Adopted Site Assessment Criteria (SAC)

The contaminated land DSIs were prepared, in part, to inform controls required for the management of contamination during construction and operation of the WRRF and other project sites. To assess groundwater quality and review potential health and environmental exposure risks associated with groundwater contamination, analytical test results of contaminants of potential concern (CoPCs) and PFAS were compared against a set of health and ecological based investigation levels referred to as SAC. SAC were considered to

be appropriate for the proposed land use and main potential receptors of concern (i.e. commercial/industrial land users, construction workers, operational staff and off-site users and receptors of Duck River). That is, the SAC have been set at levels that provide confidence that contaminant concentrations below the SAC will not adversely affect human health and/or off-site receptors (under the current and future land use scenarios).

As Duck River is a potential receiving environment for groundwater flow from the Camellia-Rosehill precinct, and considering the river could be used for recreational purposes, guidelines for the protection of recreational water users were adopted as SAC for assessing human health exposure risks from groundwater. It is noted that while Duck Creek may receive groundwater from the surrounding environment, construction or operation of the project is not anticipated to alter existing flow regimes.

Table 5-7 includes the adopted SAC used to assess potential contamination in groundwater across the impact assessment area. Adopted SAC were developed as part of the project SAQP (Jacobs, 2024c) and were used across project DSIs. For consistency across project investigations, the same SAC have been adopted for the groundwater impact assessment.

Table 5-7: Adopted SAC for assessment of groundwater contamination

Investigation Criteria	Adopted Guidelines
Protection of human health - CoPCs	▪ Australian Drinking Water Guidelines, Version 3.8 updated September 2022 (NHMRC, 2022) ▪ Where guideline levels were not available from NHMRC (2022), the ANZECC (2000) Recreational Water Quality and Aesthetic Guidelines were adopted Where guideline levels are not available in ANZECC (2000), drinking water investigation levels with a multiplication factor of ten from the NEPM (NEPC, 2013) were applied
Protection of human health - PFAS	PFAS NEMP (2020) guidelines for the protection of recreational water users - based on the NHMRC (August, 2019) Guidance of Per and Polyfluoroalkyl Substances (PFAS) in Recreational Water (NHMRC, 2019).
Ecological protection - CoPCs	▪ ANZG (2018) guidelines for 95% species protection for marine water ▪ Where the guideline does not provide these criteria or the guideline considers the 95% protection level is inappropriate, the following were applied: - The 99% protection levels given in the guidelines for contaminants considered to be bioaccumulative (e.g., cadmium, mercury, nickel) - NEPC (2013) groundwater investigation levels The ANZG (2018) guidelines do not provide criteria for TPH (C10 – C36). For this analyte, the Dutch Intervention Guideline (RIVM, 2000) for mineral oil (600 ug/L) were adopted.
Ecological protection – PFAS	▪ PFAS NEMP (2020) guideline values for PFOS and PFOA in surface water for the protection of aquatic ecosystems. Groundwater guideline values for ecological protection have not been established. For the purposes of assessing contamination, the guidelines for surface water were adopted for groundwater.

Notes: PFAS NEMP (2023) guidelines were officially released in March, 2025. Guideline values used in the SAC are unchanged from the PFAS NEMP (2020)

5.10.2 WRRF

Groundwater contamination identified at the WRRF site has been attributed to the former refinery and associated activities previously undertaken at the current WRRF site. Groundwater sampling and analysis of wells installed across the WRRF site indicated that concentrations of selected heavy metals, TPH, TRH, BTEX, PAH and PFAS compounds exceeded the human health and/or the ecological SAC. Increased levels of groundwater contamination appear to primarily occur towards the south of the site in downgradient monitoring wells, however exceedances of SAC at other locations are also noted.

A total of 16 shallow and two deep groundwater monitoring wells were installed across the site during the investigation program. Four groundwater monitoring events (GMEs) have been undertaken at the WRRF site between July 2024 and February 2025. Groundwater quality field parameters and analytical results from the GME conducted between the 9th and 11th of July 2024 were reported in the DSI (Version D, issued 21/1/2025) (Jacobs, 2024a). Field and analytical results from the July 2024 monitoring round are summarised in Table 5-8 and Table 5-9, respectively. Analytes detected at a concentration below the laboratory limit of reporting (LOR) are not included in Table 5-9. Results from primary samples only are reported (i.e. duplicate samples not reported). The full tabulation of analytical groundwater results is included in Appendix B.

Groundwater quality field results can be summarised as:

- The pH measured at the majority of well locations was acidic (ranging from 4.17 to 6.34)
- Majority of groundwater monitoring wells reported electrical conductivity (EC) greater than 13,000 µS/cm, with values ranging from 2,946 µS/cm to 24,232 µS/cm
- Total dissolved solids (TDS) calculated from EC using a multiplication factor of 0.64 ranged from 1,884 mg/L to 15,508 mg/L
- Redox potential was low or negative in the majority of monitoring wells, indicating a typically reducing environment in groundwater
- Dissolved oxygen (DO) ranged from 0.35 mg/L to 3.07 mg/L across the site
- Odours (hydrocarbon / solvent) were observed in groundwater sampled from seven monitoring wells
- No specific spatial trend in electrical conductivity, redox potential or dissolved oxygen can be drawn from the monitoring data as levels were variable across the site

Table 5-8: Summary of groundwater quality field parameters - WRRF

Location	Date	Temperature (°C)	DO (mg/L)	EC (µS/cm)	pH	Redox Potential (mV)	TDS (calculated) (mg/L)	Field Observations
WRRF-GW-101	9/7/24	18.1	0.55	12,927	4.64	136.6	8,273	Clear, no odour
WRRF-BH-102	9/7/24	20.4	0.85	13,516	5.08	-264.0	8,650	Clear, no odour
WRRF-BH-103	8/7/24	18.7	2.1	14,131	4.18	172.8	9,044	Clear
WRRF-BH-104	11/7/24	18.0	0.56	4,095	5.01	-92.7	2,621	Clear, hydrocarbon / solvent odour
WRRF-BH-105	12/7/24	21.6	1.55	24,136	5.67	-230.2	15,447	Slightly cloudy to clear, no odour

Location	Date	Temperature (°C)	DO (mg/L)	EC (µS/cm)	pH	Redox Potential (mV)	TDS (calculated) (mg/L)	Field Observations
WRRF-BH-106	11/7/24	19.7	1.62	9,889	4.17	-122.2	6,329	Pale brown, cloudy, moderately turbid, hydrocarbon odour
WRRF-GW-107	12/7/24	19.4	1.87	16,880	4.91	35.2	10,803	Pale brown, slightly cloudy, no odour
WRRF-GW-108	9/7/24	20.3	0.85	24,232	4.78	-126.5	15,508	Cloudy to clear, slight hydrocarbon odour
WRRF-GW-109	9/7/24	16.6	1	7,159	5.59	33.9	4,582	Clear
WRRF-GW-110	8/7/24	19.3	0.95	21,538	5.36	46.6	13,784	Clear, low turbidity
WRRF-GW-111	10/7/24	19.2	0.73	21,238	5.14	-265.4	13,592	Slightly cloudy to very pale brown, no odour
WRRF-GW-112	12/7/24	19.8	0.50	13,098	6.11	-254.9	8,383	Pale brown to yellow, hydrocarbon odour
WRRF-GW-113	12/7/24	19.1	3.07	22,594	5.45	14.7	14,460	Clear, low turbidity, moderate sweet solvent odour
WRRF-GW-114	10/7/24	20.3	0.90	2,943	5.25	-264.5	1,884	Slightly cloudy to clear, solvent odour
WRRF-GW-115	10/7/24	19.8	0.35	21,549	6.1	-288.6	13,791	Cloudy to pale grey/brown, no odour
WRRF-GW-116	11/7/24	18.6	2.67	21,527	4.43	-196.0	13,777	Slightly cloudy to clear, slight solvent odour
WRRF-GW-117	9/7/24	19.1	1.58	11,710	4.78	95.2	7,494	Clear
WRRF-GW-118	10/7/24	18.7	2.56	18,660	6.34	31	11,942	Clear, low turbidity

Below is a summary of groundwater quality results and key findings of the WRRF DSI (Jacobs, 2024a):

- pH (laboratory) at all locations was below the lower pH range (6.5) of the adopted health SAC. The generally acidic conditions are considered representative of local groundwater conditions and not significantly influenced by site conditions

Heavy metals

- Concentrations of copper, nickel and zinc exceeded the ecological SAC at the majority of groundwater monitoring well locations

  Given concentrations of copper, nickel and zinc are similar across the site, results may be indicative of general background water quality. However, as copper and zinc exceedances in soil were reported in fill material only (i.e. not natural soils), results may also be indicative of heavy metal leaching from on-site fill materials

- Lead exceeded the ecological SAC at two monitoring well locations adjacent to the eastern site boundary within the southwestern portion of the site. Lead also exceeded the ecological SAC at one location adjacent to the northern (upgradient) site boundary. No other exceedances of lead were observed within groundwater samples

  The source of elevated lead is thought to be from fill materials located within the southwestern portion of the site

- Hexavalent chromium exceeded the ecological SAC in one interlab duplicate sample. Hexavalent chromium was reported below the LOR in all other samples

- The DSI noted the potential for off-site migration of heavy metals within groundwater from wells located in the vicinity of the southeastern site boundary. Surface water monitoring results in Duck Creek indicate concentrations of copper and zinc above the ecological SAC. Reported concentrations were less than concentrations reported from on-site groundwater monitoring wells.

Hydrocarbons

- TPH (C10-C36) exceeded the ecological SAC at five locations across the site

- Benzene exceeded the human health SAC at two monitoring well locations located within the southern portion of the site adjacent to the southeastern (down gradient) site boundary. Benzene was not reported above the human health or ecological SAC at any other groundwater monitoring well location.

- Toluene exceeded the ecological SAC at two monitoring wells. The wells are located in the northwestern portion of the site and adjacent to the southeastern (down gradient) site boundary. No other exceedances of toluene were observed

- Naphthalene exceeded the ecological SAC at two monitoring wells. The wells are located in the centre and adjacent to the southeastern (down gradient) site boundary. No other exceedances of naphthalene were observed

- Phenanthrene exceeded the ecological SAC at four monitoring well locations across the site

- The source of hydrocarbon contamination is considered to be localised and limited to areas surrounding the wells where exceedances were observed. The detection of elevated hydrocarbon concentrations in both shallow and deep groundwater samples indicates potential vertical and lateral connectivity from secondary contamination sources in soil. Given the low permeability of fill and alluvial material on-site and the shallow groundwater gradient, the source of the hydrocarbon contamination may have been associated with historical release of product on-site in the vicinity of the southern boundary (potentially from a former Tank Farm onsite)

- Results of the historical groundwater quality trend assessment indicated that the most significant changes in contaminant concentrations between 1999 and 2024 include:

  - Increased concentrations of toluene and TRH C6-C9 in the southeastern portion of site
  - Increased concentrations of toluene, TRH C6-C9 and TRH C10-C14 in the vicinity of the southern boundary

  The assessment was based on the maximum concentration change equal to or greater than 50% of the highest concentration and three or greater orders of magnitude change

PFAS

- PFOS exceeded the ecological SAC at six monitoring well locations. The wells are located predominantly towards the south of the site
- PFOS + PFHxS exceeded the human health SAC at one monitoring well location located adjacent to the southeastern (down gradient) site boundary. PFOS + PFHxS was not reported above the SAC at any other groundwater monitoring well location

  The source of PFAS contamination is considered likely to be associated with on-site sources including the former aqueous film-forming foam (AFFF) tank (located in the southern portion of the site) and/or other unconfirmed historical sources such as extinguisher release, car surface waxes etc.
- Given PFAS compounds were detected above SAC adjacent to hydraulic down gradient site boundaries, there is potential for off-site contaminant migration. PFAS compounds (i.e. PFOS) were detected at concentrations above the ecological SAC in both upgradient and downgradient surface water sample locations within Duck River. PFAS concentrations in surface water receiving environments are, therefore, also likely to be affected by inputs from the urban catchment surrounding and discharging to Duck River.

Table 5-9: Summary of groundwater quality analytical results (sampled July 2024) - WRRF

Compound	Unit	Human Health (µg/L)	Ecological (µg/L)	Concentration																
				WRRF BH 102	WRRF BH 103	WRRF BH 104	WRRF BH 105	WRRF BH 106	WRRF GW 101	WRRF GW 107	WRRF GW 108	WRRF GW 109	WRRF GW 110	WRRF GW 111	WRRF GW 112	WRRF GW 113	WRRF GW 114	WRRF GW 115	WRRF GW 116	WRRF GW 117	WRRF GW 118
Arsenic	µg/L	**70**		2	1	<1	<1	7	<1	4	2	<1	<1	3	5	1	2	<1	1	<1	<1
Cadmium	µg/L	**20**	**0.7**	0.1	0.1	<0.1	0.4	0.5	0.1	0.1	0.1	0.1	0.2	0.5	<0.1	0.2	<0.1	0.2	0.7	0.1	0.4
Chromium (III+VI)	µg/L		**4.4**	<1	<1	<1	<1	11	1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
Copper	µg/L	**20,000**	**1.3**	**2**	**9**	1	**3**	**11**	**6**	**15**	**6**	<1	**2**	**4**	<1	**9**	<1	<1	**9**	**3**	<1
Lead	µg/L	**100**	**4.4**	<1	2	<1	<1	**8**	<1	3	**6**	<1	<1	<1	<1	<1	<1	<1	**7**	<1	<1
Magnesium	mg/L			216,000	278,000	46,000	626,000	220,000	229,000	318,000	504,000	123,000	516,000	494,000	494,000	506,000	21,000	480,000	467,000	232,000	356,000
Nickel	µg/L	**200**	**7**	**44**	**57**	**10**	**68**	**78**	**44**	**131**	**71**	**19**	**43**	**89**	7	**75**	2	**54**	**56**	**54**	**22**
Zinc	µg/L		**15**	**439**	**194**	**84**	**126**	**1,600**	**258**	**314**	**245**	**229**	**133**	**301**	**31**	**139**	**30**	**394**	**501**	**286**	**86**
Benzene	µg/L	**10**	**700**	<1	<1	<10	<1	**4**	<1	<1	<1	<1	<1	<1	<1	**19**	**389**	<1	**1**	<1	<1
Ethylbenzene	µg/L	**3,000**	**80**	<2	<2	17	<2	7	<2	<2	2	<2	<2	<2	<2	47	**111**	<2	25	<2	<2
Toluene	µg/L	**8,000**	**180**	10	<2	<10[#13]	<2	3	**290**	<2	<2	5	7	<2	<2	<2	**1,510**	<2	<2	<2	<2
Xylene (o)	µg/L			<2	<2	41	<2	2	<2	<2	<2	<2	<2	<2	<2	61	264	<2	<2	<2	<2
Xylene Total	µg/L	**6000**		<2	<2	41	<2	32	<2	<2	<2	<2	<2	<2	<2	89	870	<2	<2	<2	<2
Total BTEX	µg/L			10	<1	58	<1	46	290	<1	2	5	7	<1	<1	155	2,880	<1	26	<1	<1
Acenaphthene	µg/L			<1	<1	<4.8	<1	<1	<1	<1	1.1	<1	<1	<1	<1	5.2	<1	<1	<1	<1	<1
Fluorene	µg/L			<1	<1	14.5	<1	<1	<1	<1	1.8	<1	<1	<1	2.3	19.1	<1	<1	<1	2.4	<1
Naphthalene	µg/L		**50**	<1	<1	**348**	<1	15.5	<1	<1	<1	<1	<1	<1	4	**307**	2.7	<1	<1	<1	<1
Phenanthrene	µg/L		**0.6**	<1	<1	**31.9**	<1	<1	<1	<1	**2.3**	<1	<1	<1	**1.5**	**37.2**	<1	<1	<1	<1	<1
PAHs (Sum of total)	µg/L			<0.5	<0.5	394	<0.5	15.5	<0.5	<0.5	5.2	<0.5	<0.5	<0.5	7.8	368	2.7	<0.5	<0.5	2.4	<0.5
TRH >C6 - C10	µg/L			<20	<20	210	<20	330	590	<20	30	<20	<20	<20	30	440	6,340	<20	300	<20	<20
TRH >C10 - C16	µg/L			<100	<100	3,110	<100	730	<100	<100	300	100	<100	<100	440	3,460	420	<100	320	300	<100
TRH >C16 - C34	µg/L			<100	<100	1,360	<100	360	<100	<100	160	<100	<100	<100	630	810	<100	<100	<100	170	<100
TRH >C10 - C40 (Sum of total)	µg/L			<100	<100	4,470	<100	1,090	<100	<100	460	100	<100	<100	1,070	4,270	420	<100	320	470	<100
TRH >C6 - C10 less BTEX (F1)	µg/L			<20	<20	<200	<20	280	300	<20	30	<20	<20	<20	30	280	3,460	<20	270	<20	<20
TRH >C10 - C16 less Naphthalene (F2)	µg/L			<100	<100	1,760	<100	700	<100	<100	300	100	<100	<100	420	3,100	410	<100	320	300	<100
TPH C6 - C9	µg/L			<20	<20	<200	<20	260	590	<20	<20	<20	<20	<20	20	310	6,380	<20	220	<20	<20
TPH C10 - C14	µg/L			<50	<50	2,460	<50	620	50	<50	150	90	<50	<50	210	2,960	670	<50	310	180	<50
TPH C15 - C28	µg/L			<100	<100	2,070	<100	520	<100	<100	310	<100	<100	<100	760	1,650	<100	<100	190	310	<100
TPH C10 - C36 (Sum of total)	µg/L		**600**	<50	<50	**4,530**	<50	**1,140**	50	<50	460	90	<50	<50	**970**	**4,610**	**670**	<50	500	490	<50

Compound	Unit	Human Health (µg/L)	Ecological (µg/L)	Concentration																
				WRRF BH 102	WRRF BH 103	WRRF BH 104	WRRF BH 105	WRRF BH 106	WRRF GW 101	WRRF GW 107	WRRF GW 108	WRRF GW 109	WRRF GW 110	WRRF GW 111	WRRF GW 112	WRRF GW 113	WRRF GW 114	WRRF GW 115	WRRF GW 116	WRRF GW 117	WRRF GW 118
Alkalinity (total) as $CaCO_3$	mg/L			46	3	44	74	<1	<1	6	6	62	54	28	177	63	68	140	1	8	187
Anions Total	meq/L			143	152	39.3	243	112	130	175	248	91.3	225	211	121	226	26.5	217	214	135	191
Bicarbonate Alkalinity as $CaCO_3$	mg/L			46	3	44	74	<1	<1	6	6	62	54	28	177	63	68	140	1	8	187
Calcium	mg/L			42	39	34	135	172	42	31	52	70	95	110	119	158	13	409	89	39	187
Cations Total	meq/L			128	144	38.5	232	92.6	127	158	231	78.6	220	226	106	212	27.8	215	208	117	189
Chloride	mg/L			4,130	4,810	1,140	7,930	2,370	3,980	5,500	8,090	2,850	7,280	6,910	4,050	7,350	505	6,980	7,020	3,410	5,690
pH	pH units	**6.5-8.5**		**4.64**	**4.18**	**5.01**	**5.67**	**4.17**	**4.64**	**4.91**	**4.78**	**5.59**	**5.36**	**5.14**	**6.11**	**5.45**	**5.25**	**6.1**	**4.43**	**4.78**	**6.34**
Electrical Conductivity (lab)	µS/cm			13,600	-	4,380	-	-	13,100	-	-	-	-	-	-	-	-	-	-	12,500	-
Ionic Balance	%			5.74	2.81	1.08	2.27	9.42	1.12	5.24	3.61	7.48	1.11	3.34	6.69	3.25	2.37	0.48	1.28	7.16	0.41
Potassium	mg/L			5	5	2	18	8	6	7	5	6	10	8	34	13	<1	29	13	4	8
Sodium	mg/L			2,480	2,730	758	3,980	1,510	2,430	2,990	4,290	1,490	3,970	4,120	1,820	3,720	585	3,540	3,800	2,200	3,460
Sulfate as SO4 - Turbidimetric	mg/L			1,250	782	303	838	2,160	835	968	949	464	896	745	140	831	525	818	763	1,850	1,280
PFOS	µg/L		**0.00023**	<0.01	<0.01	<0.01	**0.02**	**0.02**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.02**	**0.86**	**0.08**	<0.01	<0.01	**0.02**
PFOA	µg/L	**10**	**19**	<0.01	<0.01	0.02	<0.01	0.04	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	1.64	0.03	<0.01	<0.01	0.01
PFPeA	µg/L			<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	1.65	<0.02	<0.02	<0.02	<0.02
PFHxA	µg/L			<0.02	<0.02	0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	1.8	<0.02	<0.02	<0.02	<0.02
PFHxS	µg/L			<0.01	<0.01	0.04	0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2.83	0.04	<0.01	<0.01	0.02
PFHpA	µg/L			<0.02	<0.02	0.05	<0.02	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	2.67	0.02	<0.02	<0.02	<0.02
Sum (PFHxS + PFOS)	µg/L	**2**		<0.01	<0.01	0.04	0.03	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	**3.69**	0.12	<0.01	<0.01	0.04
Sum of WA DWER PFAS (n=10)	µg/L	**70**		<0.01	<0.01	0.13	0.03	0.21	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	0.03	13.5	0.17	<0.01	<0.01	0.05
Exceeds Ecological SAC																					
Exceeds Human Health SAC																					

Notes:
Perfluorooctanesulfonic acid – PFOS, Perfluorooctanoic acid – PFOA, Perfluoroheptanoic acid – PFPeA, Perfluorohexanoic acid - PFHxA, Perfluorohexanesulfonic acid – PFHxS, Perfluoroheptanoic acid – PFHpA

5.10.3 River release pipeline

Desktop investigations conducted as part of the river release pipeline PSI identify the potential for contamination at locations corresponding to former landfills/managed waste emplacements (in Silverwater and Sydney Olympic Park), commercial/industrial sites (in Silverwater), brickworks, abattoirs and landfilling (associated with the Sydney Olympic Park precinct development).

As part of the river release pipeline DSI (Jacobs, 2025f), groundwater monitoring wells were installed at 7 of the 27 borehole locations, which were advanced during geotechnical investigation works (Jacobs, 2025a).

During the DSI groundwater quality field parameters and samples for laboratory analysis were collected. Sampling occurred on the 27th and 28th of February 2025. Samples for laboratory analysis were collected at 5 of the 7 wells (2 were dry). Field parameters were collected in 4 of the 7 wells, noting that RRP-BH-108 was pumped dry to fill the sample bottles and measuring of field parameters could not be completed. Field results are summarised in Table 5-10. Analytical results from the February 2025 monitoring round are summarised in Table 5-11. Analytes detected at a concentration below the laboratory limit of reporting (LOR) are not included in Table 5-11. Results from primary samples only are reported (i.e. duplicate samples not reported). The full tabulation of analytical groundwater results is included in Appendix B. Analytical groundwater results are included in Appendix B.

Groundwater quality field results can be summarised as:

- The pH measured at RRP-BH-102, located at Carnarvon Street, was acidic. The pH was generally neutral at other wells
- EC ranged from 1,740 µS/cm (RRP-BH-102) to 58,041 µS/cm (RRP-BH-119). Groundwater monitoring wells installed within the Sydney Olympic Park Precinct and Meadowbank Park reported the highest EC. The DSI suggests high EC results could be attributable to the estuarine/marine environments local to Sydney Olympic Park and Meadowbank Park
- TDS calculated from EC using a multiplication factor of 0.64 ranged from 1,114 mg/L to 37,146 mg/L
- Redox potential was negative in all monitoring wells, with the exception of RRP-BH-102, indicating a typically reducing environment in groundwater
- DO ranged from 0.78 mg/L to 2.55 mg/L. The highest DO was recorded in RRP-BH-102

Analytical groundwater quality results indicate exceedances at select wells against adopted ecological SAC for cadmium, copper, nickel, zinc, ammonia (as N), PFOS and/or the sum of PFHxS + PFOS.

Groundwater with elevated levels of various contaminants is also expected at other areas of the alignment due to the contamination sources identified in the scope of the PSI (including various legacy landfill sites, reclaimed lands, and current and historical industrial sites).

Table 5-10: Summary of groundwater quality field parameters – River release pipeline

Location	Date	Temperature (°C)	DO (mg/L)	EC (µS/cm)	pH	Redox Potential (mV)	TDS (calculated) (mg/L)	Field Observations
RRP-BH-102	28/2/2025	24	2.55	1,740	3.86	296.5	1,114	Clear, no odour, no turbidity.
RRP-BH-108	26/2/2025	-	-	-	-	-	-	Pumped dry to fill sample bottles. Not enough water to measure field parameters.
RRP-BH-117	27/2/2025	-	-	-	-	-	-	Dry
RRP-BH-119	27/2/2025	24.6	0.78	58,041	6.66	-59.6	37,146	Yellow, low turbidity, no odour.
RRP-BH-124	27/2/2025	28.5	1.14	15,992	6.71	-102.5	10,235	Olive green, no odour, low turbidity.
RRP-BH-128	27/2/2025	23.2	1	30,128	6.35	-16.6	19,282	Pale orange, no odour, no turbidity.
RRP-BH-134	27/2/2025	-	-	-	-	-	-	Dry

Table 5-11: Summary of groundwater quality analytical results (sampled February, 2025) - RRP

Compound	Unit	Human Health (µg/L)	Ecological (µg/L)	Concentration				
				RRP BH 102	RRP BH 108	RRP BH 119	RRP BH124	RRP BH 128
Arsenic	µg/L	**70**		1	<1	<10	3	<10
Cadmium	µg/L	**20**	**0.7**	**11**	0.4	<1	<1	<1
Chromium (III+VI)	µg/L		**4.4**	2	<1	<10	<1	<10
Copper	µg/L	**20,000**	**1.3**	**63**	<1	<10	<1	<10
Lead	µg/L	**100**	**4.4**	1	<1	<10	<1	<10
Magnesium	mg/L			39,000	316,000	1,960,000	358,000	1,050,000
Nickel	µg/L	**200**	**7**	**1,880**	**12**	**15**	3	<10
Zinc	µg/L		**15**	**209**	**31**	<50	6	<50
1,2,4-trimethylbenzene	µg/L			5	<5	<5	<5	<5
Xylene (o)	µg/L			**3**	<2	<2	<2	<2
Xylene Total	µg/L	**6000**		**3**	<2	<2	<2	<2
Total BTEX	µg/L			**3**	<1	<1	<1	<1
Naphthalene	µg/L		**50**	**8.2**	<1	<1	<1	<1
PAHs (Sum of total)	µg/L			**8.2**	<1	<1	<1	<1
TRH >C10 - C16	µg/L			**230**	<100	<100	<100	<100
TRH >C10 - C40 (Sum of total)	µg/L			**230**	<100	<100	<100	<100
TRH >C10 - C16 less Naphthalene (F2)	µg/L			**220**	<100	<100	<100	<100
TPH C10 - C14	µg/L			**100**	<50	<50	<50	<50
TPH C15 - C28	µg/L			**240**	<100	<100	<100	<100
TPH C10 - C36 (Sum of total)	µg/L		**600**	**340**	<50	<50	<50	<50

Compound	Unit	Human Health (µg/L)	Ecological (µg/L)	Concentration				
				RRP BH 102	RRP BH 108	RRP BH 119	RRP BH124	RRP BH 128
Alkalinity (total) as CaCO3	mg/L			<1	317	847	1,420	470
Ammonia as N	mg/L		**0.5**	0.08	0.22	**32**	**20.5**	**1.41**
Anions Total	meq/L			21.1	210	814	212	504
Bicarbonate Alkalinity as CaCO3	mg/L			<1	317	847	1,420	470
Calcium	mg/L			10	108	852	489	480
Cations Total	meq/L			18.9	199	868	194	481
Chloride	mg/L			550	6,680	25,500	6,430	15,400
Ionic Balance	%			5.45	2.76	3.24	4.25	2.32
Nitrate (as N)	mg/L			<0.01	0.17	<0.01	<0.01	0.02
Nitrite (as N)	mg/L			<0.01	0.01	<0.01	<0.01	<0.01
Potassium	mg/L			1	67	475	102	262
Sodium	mg/L			349	3,820	15,000	3,170	8,360
Sulphate as SO4 - Turbidimetric	mg/L			268	760	3,730	90	2,870
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L			<0.001	0.002	0.001	<0.001	<0.001
PFOS	µg/L		**0.00023**	**1.91**	**0.0078**	**0.0106**	**0.0003**	**0.0060**
PFOA	µg/L	**10**	**19**	0.362	0.0086	0.0047	<0.0005	0.0007
PFPeA	µg/L			0.122	0.0236	<0.0005	0.0014	<0.0005
PFHxA	µg/L			0.489	0.0130	0.0110	0.0017	<0.0005
PFHxS	µg/L			1.90	0.0064	0.0041	<0.0005	0.0011
PFHpA	µg/L			0.130	0.0016	0.0014	<0.0005	<0.0005
PFBS	µg/L			0.362	<0.0005	<0.0005	0.0013	<0.0005

Compound	Unit	Human Health (µg/L)	Ecological (µg/L)	Concentration				
				RRP BH 102	RRP BH 108	RRP BH 119	RRP BH124	RRP BH 128
PFBA	µg/L			0.176	0.0118	<0.002	<0.002	<0.002
Sum (PFHxS + PFOS)	µg/L	**2**		**3.81**	0.0142	0.0147	0.0003	0.0071
Sum of WA DWER PFAS (n=10)	µg/L	**70**		5.45	0.0748	0.0328	0.0047	0.0078
Exceeds Ecological SAC								
Exceeds Human Health SAC								

Notes:

Perfluorooctanesulfonic acid – PFOS, Perfluorooctanoic acid – PFOA, Perfluoroheptanoic acid – PFPeA, Perfluorohexanoic acid - PFHxA, Perfluorohexanesulfonic acid – PFHxS, Perfluoroheptanoic acid – PFHpA, Perfluorobutanesulfonic acid – PFBS, Perfluorobutanoic acid - PFBA

5.10.4 Brine and transfer pipelines

As part of the brine and transfer pipelines DSI (Jacobs, 2025g), one groundwater monitoring well was installed at INF-BH-102. INF-BH-102 was drilled during geotechnical works (Jacobs, 2025b) and is located in the Rosehill Gardens Racecourse overflow parking area near the corner of James Ruse Drive and Grand Avenue, Rosehill (see Figure 5-8).

INF-BH-102 was sampled on 14 March, 2025 as part of the DSI (Jacobs, 2025g). Groundwater quality field parameters and samples for laboratory analysis were taken. The groundwater quality parameters recorded during the sampling event are summarised in Table 5-12.

Groundwater analytical results from the interlab duplicate sample at INF-BH-102 indicated that the concentration of PFOS exceeded the adopted SAC (PFAS NEMP 2.0 interim marine criteria for 99% protection of species). The reported PFOS concentration from the interlab duplicate sample was 0.0004 µg/L, above the SAC guideline value of 0.00023 µg/L. The concentration of PFOS reported in the primary and intralab duplicate sample were below the LOR.

All other analytical groundwater results were either below the LOR or respective SAC.

The groundwater sampled at INF-BH-102 is considered to be representative of the quality likely encountered along the remainder of the brine and transfer pipelines, with the exception of the elements located on the WRRF site. The groundwater quality at the WRRF site is discussed in Section 5.10.2.

Table 5-12: Summary of groundwater quality field parameters - brine and transfer pipelines

Location	Date	Temperature (°C)	DO (mg/L)	EC (µS/cm)	pH	Redox Potential (mV)	TDS (calculated) (mg/L)	Field Observations
INF-BH-102	14/3/2025	25.9	4.9	4,073	6.2	-55.6	2,607	Opaque, light sediment load, HC odour

5.10.5 Camellia pumping station

Groundwater monitoring wells were not installed at Camellia pumping station. Groundwater quality results at the pumping station were therefore not available. Based on the hydrogeology of the area between Camellia pumping station and the WRRF, quality results obtained from sampling at INF-BH-102 were considered representative of the likely quality at the pumping station itself. Refer to Section 5.10.4 for relevant groundwater quality discussion.

5.10.6 Brine pipeline (relined section)

As of August 2025, no groundwater contamination information was available for the relined section of the brine pipeline.

For the purposes of this assessment, earthworks along this section of pipeline were assumed to be limited to excavation of access points along the existing rising main to provide access for relining equipment. Preliminary investigations indicate that the existing rising main is structurally sound. Relining works may therefore be minor and may not interact with groundwater.

Confirmation of the construction methodology is required to determine whether additional understanding of groundwater quality and contamination along this section of the brine pipeline is required.

5.11 Surface water quality

Surface water sampling was undertaken in Duck River as part of the WRRF DSI (Jacobs, 2024a). Analytical results indicated exceedances of copper, zinc, and PFAS compounds against ecological SAC. Concentrations of copper and zinc in surface water were less than reported concentrations on the WRRF site and exceeded ecological SAC at the downstream sampling location only. Marginally higher PFAS concentrations were reported in the downstream sampling location compared to upstream, however both samples exceeded ecological SAC.

Surface water analytical results are included in Appendix C.

5.12 Groundwater-sensitive receptors

Groundwater-sensitive assets and receptors, including GDEs/HEVAEs, licenced groundwater users, and waterways, have been identified within the vicinity of the GPOP WCM impact assessment area. Section 5.12.1, Section 5.12.2 and Section 5.12.3 discuss the location of these receptors.

5.12.1 Groundwater Dependent Ecosystems and High Ecological Value Aquatic Ecosystems

The occurrence of both potential aquatic and potential terrestrial GDEs were assessed through the National GDE Atlas (BoM, 2024a). Potential GDEs identified through the BoM national database were then cross-checked using the NSW HEVAE framework (NSW Government and DCCEEW, 2024). GDEs identified through the BoM GDE Atlas were classified based on national assessment. As such, GDEs have not been ground truthed.

The BoM GDE Atlas classifies ecosystems based on their potential for interaction with groundwater. The term potential is used to reflect the uncertainty of the national assessment which identifies ecosystems as groundwater dependent using desktop methods:

- **High Potential:** Ecosystems are likely to be interacting with groundwater. Groundwater is likely to be present, and the ecosystem is likely to be using it, at least, intermittently. Either the majority of datasets or the most reliable datasets analysed indicate a high potential for groundwater interaction.
- **Moderate Potential**: Ecosystems may interact with groundwater. Groundwater is possibly present, and the ecosystem may use it. Ecosystems are classified to have 'moderate' potential for groundwater interaction where datasets are conflicting, but where the datasets analysed are considered to be equally good indicators of groundwater interaction.
- **Low Potential:** Ecosystems are unlikely to be interacting with groundwater. Groundwater is unlikely to be present, or if it is present, the ecosystem is unlikely to use it. Either all datasets or the most reliable datasets analysed suggest groundwater interaction is unlikely.

Areas not classified have either not been assessed or are unlikely to interact with shallow groundwater.

There were no aquatic GDEs identified within the project impact assessment area.

Seventeen (17) high potential terrestrial GDEs were identified within 500 m of project infrastructure (WRRF, pipelines or the Camellia pumping station) under the national assessment. The GDEs are described as:

- Estuarine Mangrove Forest: This GDE is associated with the mangrove systems of the Parramatta River, Duck River and Haslams Creek/Bicentennial Park. It occurs predominantly to the south and north of the river release pipeline, and to the east of the WRRF site.
- Cumberland River Flat Forest
- Hinterland Sandstone Gully Forest
- Sydney Hinterland Transition Woodland

The Cumberland River Flat Forest, Hinterland Sandstone Gully Forest and Sydney Hinterland Transition Woodland typically occur to the north of the impact assessment area, within 500 m of the relined section of the brine pipeline.

The NSW HEVAE framework indicates the presence of ecosystems with low and medium ecological value within 500 m of the WRRF, river release pipeline and relined section of the brine pipeline. These ecosystems generally overlap Estuarine Mangrove Forests mapped along the Duck River and Parramatta River that were classified by the BoM national assessment to have high potential for groundwater dependence. There were no ecosystems considered as having high ecological value (defined by the NSW HEVAE framework) mapped within the project impact assessment area.

The location of high potential terrestrial GDEs (as defined by the BoM) as well as low and medium classified HEVAEs are shown in Figure 5-10.

5.12.2 Licenced groundwater bores

According to the BoM Groundwater Explorer (BoM, 2024b) and WaterNSW Real-time database (WaterNSW, 2024), there is one licenced groundwater supply bore listed as functioning within 500 m of the river release pipeline. Bore details are summarised in Table 5-13. The location of the bore is shown in Figure 5-11.

No other licenced extraction bores were identified within the project impact assessment area. No basic landholder rights bores were identified within the project impact assessment area.

The BoM Groundwater Explorer also maps 105 monitoring bores, listed with either functioning (95) or unknown (10) status, within 500 m of project infrastructure (WRRF, pipelines or the Camellia pumping station).

Table 5-13: Third-party groundwater users within 500m of project infrastructure

NSW Bore ID	Easting	Northing	Purpose	Bore depth (mbgl)	Location
GW072314	322576	6256534	Irrigation. Likely used to irrigate L H Waud Sports Field	5.5	100 m north of the river release pipeline, within Meadowbank Park

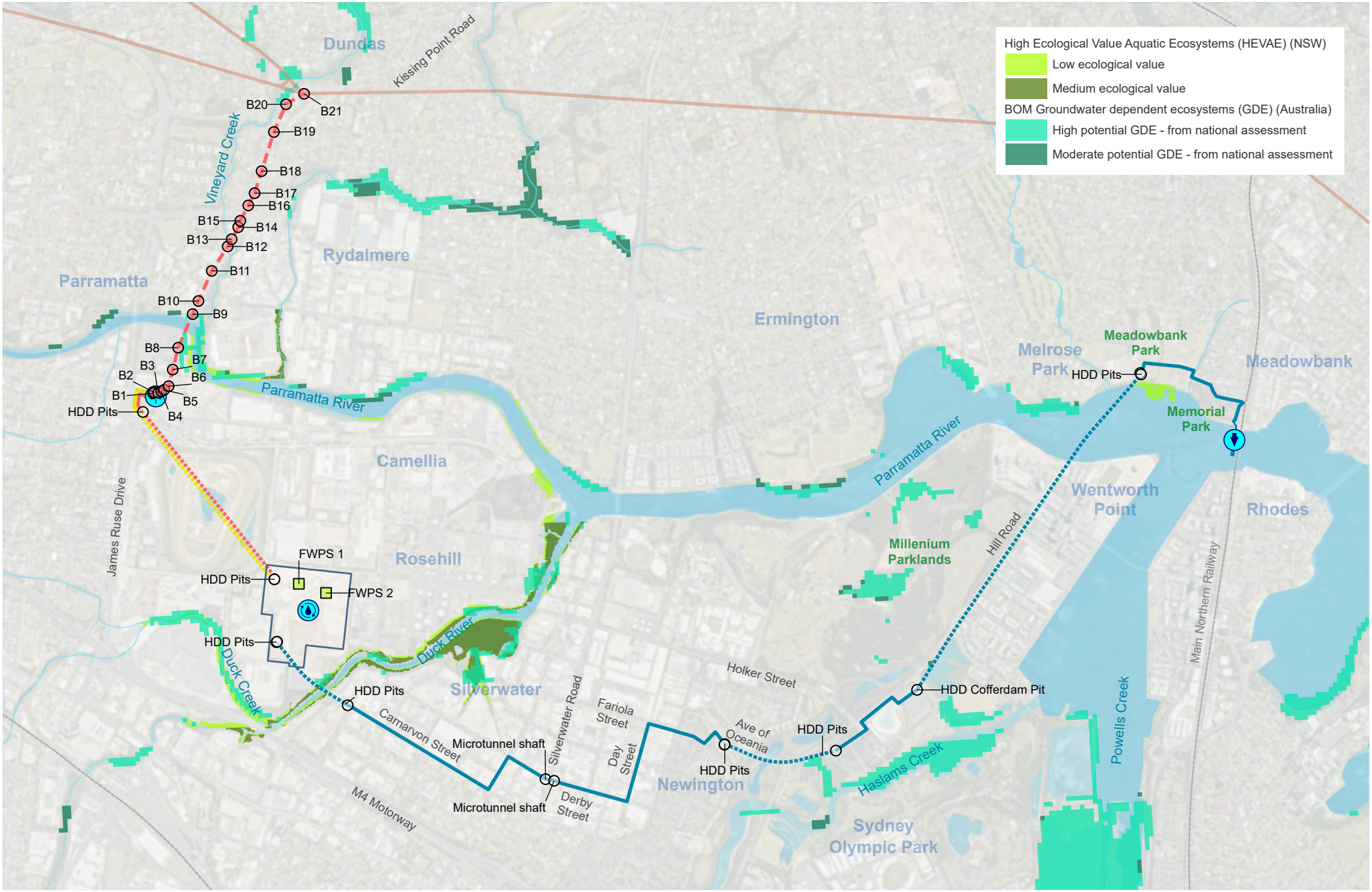


Figure 5-10 BOM potential GDEs and NSW HEVAEs identified within 500m of the project



Figure 5-11 Licensed groundwater extraction bores identified within the Project area

5.12.3 Groundwater dependent culturally significant sites

The Greater Metropolitan Region Groundwater Sources WSP (2023) does not list any groundwater dependent culturally significant sites in the vicinity of the project impact assessment area.

5.12.4 Wetlands

The Sydney Olympic Park Authority are responsible for management of several wetlands under the Sydney Olympic Park Biodiversity Management Plan and *Sydney Olympic Park Authority Act 2001*. The project assessment area crosses the Narawang and Nuri wetlands, which are key constructed wetland systems that support biodiversity and water management. It is understood that the Narawang and Nuri wetlands are lined and as such are not anticipated to interact with the regional groundwater system.

5.12.5 Groundwater dependent surface flows

There are no identified groundwater dependent surface flows in the vicinity of the project impact assessment area.

5.12.6 Waterways

Permanent surface water features in the vicinity of the project impact assessment area include:

- Vineyard Creek – runs parallel to the relined section of the brine pipeline and flows toward the Parramatta River
- Paramatta River – is crossed by the brine pipeline (relined section) and the river release pipeline. The relined section of the brine pipeline crosses the river above ground. The river release pipeline is proposed to be constructed by HDD beneath the Parramatta River. The river release pipeline is also proposed to discharge treated water into the Parramatta River via the river release structure that extends from the shore at Meadowbank, near John Whitton Bridge
- Duck River – is situated on the southern boundary of the WRRF site. The river release pipeline is proposed to be constructed by HDD beneath the river. The Duck River flows northeast toward the Parramatta River
- Haslams Creek – runs parallel to the river release pipeline and generally flows northeast into Homebush Bay and toward the Parramatta River
- Homebush Bay – is located to the southeast of the river release pipeline and generally receives flows from Duck River and Haslams Creek.

The listed permanent surface water features flow into, and are connected to, the Parramatta River. These features are tidal and act as a constant head boundary. That is, the degree of groundwater-surface water interaction is limited, and the Parramatta River is the ultimate receiving environment for groundwater and surface water flows.

Any other minor drainage lines/features present in the vicinity of the project are considered to be ephemeral and losing streams, and generally only flow during times of above average rainfall. The risk of potential impacts to such features was, therefore, considered negligible.

6. Hydrogeological conceptual model

Based on the existing environment and indicative subsurface conditions presented in Section 5, a hydrogeological conceptual model for the project was prepared. The model shows that:

- The impact assessment area lies within the Sydney Basin Central Groundwater Source. Groundwater is managed under the Greater Metropolitan Region Groundwater Sources WSP (2023). The Sydney Basin Central Groundwater Source is categorised as a 'less productive' porous rock groundwater source
- The impact assessment area lies within a temperate climate zone with distinct seasons throughout the year, and experiences a moderate level of rainfall
- The project impact assessment area is underlain by two distinct geological profiles, defined by either an Ashfield Shale or Hawkesbury Sandstone bedrock
- The WRRF, brine and transfer pipelines and western section of river release pipeline (between the WRRF and SOPA Pod A carpark) are characterised by (with increasing depth below ground surface):
  - 1 m to 2 m of clay / sandy clay fill, thicker toward Newington / reclaimed wetland areas
  - Clay / silty clay alluvium of variable thickness (3 m to 13 m). Alluvium is not present along the majority of the western section of river release pipeline, with the exception of reclaimed wetland areas
  - 1 m to 3 m of clay or sandy clay residual soil, likely derived from Ashfield Shale. Residual soil directly underlies fill where no alluvium is present
  - Ashfield Shale, occurring from a shallower depth along the western section of river release pipeline (top of unit occurs at a depth of around 3 m to 5 mbgl) and deeper at the WRRF and along the brine and transfer pipelines (top of unit occurs at a depth of 10 m to 12 mbgl). The Ashfield Shale transitions from extremely weathered (recovered as clay) to fresh at around 10 m to 15 mbgl
- The eastern section of river release pipeline (between SOPA Pod A carpark and the river release structure at Parramatta River, Meadowbank) is characterised by (with increasing depth below ground surface):
  - 3 m to 5 m of clay / sandy clay / gravelly clay fill
  - 12 m to 15 m of clay, or to a lesser degree clayey sand, alluvium. Notably thicker than in other project impact assessment areas. Alluvium is not present directly adjacent to the Parramatta River
  - 10 m to 13 m of marine deposits at locations adjacent to the Parramatta River. Marine deposits comprise sandy clay and clay
  - Hawkesbury Sandstone, typically occurring from a top of unit depth of 13 mbgl to 18mbgl. At the Parramatta River near John Whitton Bridge, Hawkesbury Sandstone occurs from 1.5 to 2mbgl, directly beneath the fill
- Based on geological mapping, the relined section of the brine pipeline is assumed to be underlain by alluvium/residual soils of variable thickness, overlying Hawkesbury Sandstone (see Figure 5-5)
- Groundwater likely occurs within a shallow unconfined perched aquifer system within fill/alluvium and/or residual soils across the majority of the project impact assessment area. At the WRRF, and along the brine and transfer pipelines and eastern river release pipeline, groundwater is generally observed to occur within the fill/alluvium. Along the western river release pipeline and relined section of the brine pipeline, groundwater is expected to occur within the residual soil
  - At the WRRF, groundwater levels have been observed between 0.6 mbgl and 5 mbgl (0 mAHD to 4.4 mAHD). Groundwater tends to deepen towards Duck River, located to the south of the site
  - Along the brine and transfer pipelines, groundwater was observed between 1.5 mbgl and 6.4 mbgl at Camellia pumping station (-2.2 mAHD to 3.2 mAHD)

  - Along the western section of the river release pipeline, groundwater was observed at 3.5 mbgl (5.8 mAHD) and 5.1 mbgl (-1.6 mAHD). Based on existing data and groundwater observations, the groundwater level along the western portion of the river release pipeline is considered to lie at a depth of between 1.5 m from the base of the fill (approximately 1.7 mbgl) and 3.5 mbgl
  - Along the eastern river release pipeline, groundwater was typically observed between 1.5 mbgl and 2.4 mbgl (-0.1 mAHD to 2 mAHD). While groundwater was observed up to 6.1 mbgl (-1 mAHD) at one location, this level was not considered representative of general groundwater conditions
  - Groundwater along the relined section of the brine pipeline is assumed to lie at approximately 2 mbgl, conservatively based on two groundwater level measurements from NSW monitoring bores (3.21 mbgl and 2.68 mbgl)
- The primary aquifer recharge mechanism was considered to be infiltration via rainfall. However, considering the low permeability of soils and the large percentage of paved areas, recharge is likely limited across the impact assessment area
- Groundwater discharge was assumed to occur toward lower lying areas and surface drainage lines, with the ultimate receptor being the Parramatta River.
- Groundwater flow across the project impact assessment area is likely to be primarily influenced by topography and/or nearby surface water features. Groundwater flow at the WRRF, along the southern section of the brine and transfer pipelines, and along the western section of the river release pipeline, is assumed to flow toward the Duck River. Groundwater flow along the northern section of the brine and transfer pipelines, along the eastern section of the river release pipeline and along majority of the relined section of the brine pipeline is assumed to be primarily toward the Parramatta River
- The Parramatta River is the ultimate receiving environment for groundwater and surface water flows
- Hydraulic testing undertaken at the WRRF indicates that hydraulic conductivity of the alluvial aquifer at the site ranges from 1×10^{-4} m/day to 1.2×10^{-3} m/day
- For the purposes of the groundwater impact assessment, adopted hydraulic conductivity values have been assumed based on (1) hydraulic testing, and (2) conservative estimates of the material observed during geotechnical investigations (Jacobs, 2024d; Jacobs, 2025a; Jacobs, 2025b). Values were assumed due to uncertainty in ground conditions and construction methodology. Refer to Section 8.1.3 for discussion on adopted hydraulic conductivity values
- In the absence of hydraulic testing along the pipelines, the hydraulic conductivity of alluvium, where encountered along the alignment, was assumed to be 0.1 m/day for clay dominant soils or up to 1 m/day for sand dominant soils
- The hydraulic conductivity of the residual soils, where encountered, was assumed to be lower than that of the alluvium. The hydraulic conductivity of residual soils was assumed to be 0.04 m/day when derived from Ashfield Shale, and 0.1 m/day when derived from Hawkesbury Sandstone (Heath, 1983; Freeze and Cherry,1979). There were 17 terrestrial GDEs classified as high potential identified within 500 m of project infrastructure (WRRF, pipelines or the Camellia pumping station) (BoM, 2024a). GDEs are typically associated with:
  - The Estuarine Mangrove Forest ecosystems present along sections of the Parramatta River, Duck Creek or within the Newington / Sydney Olympic Park / Bicentennial Park wetland areas
  - Forested/woodland areas to the north and east of the relined section of the brine pipeline

  It is noted that these BoM potential GDEs were based on national assessment and have not been ground truthed. Refer to terrestrial biodiversity assessment for further details on GDE.
- The NSW HEVAE framework shows ecosystems with low and moderate ecological value within 500m of the project impact assessment area (NSW Government and DCCEEW, 2024). These ecosystems generally overlap with the high potential GDEs mapped on the BoM GDE Atlas (BoM, 2024a)

- No BoM potential Aquatic GDEs were mapped on the BoM GDE Atlas within the project impact assessment area (BoM, 2024a)
- One WaterNSW-registered third-party groundwater bore was identified within 500 m of the river release pipeline. The groundwater supply bore was listed as an irrigation bore and is likely used to irrigate L.H. Waud Sports Field, approximately 100 m north of the river release pipeline at Meadowbank Park. No other licenced extraction bores were identified within the project impact assessment area
- The project assessment area crosses the Narawang and Nuri wetlands, which are key constructed wetland systems that support biodiversity and water management as part of the Sydney Olympic Park Biodiversity Management Plan. The Narawang and Nuri wetlands are understood to be lined, and as such are not anticipated to interact with the regional groundwater system
- Groundwater-surface water interaction is limited as permanent surface water features across the impact assessment area are considered tidal and directly connected to the Parramatta River
- Any other minor drainage lines/features present in the vicinity of the project were considered ephemeral and to be losing streams when flowing
- ASS (either PASS or AASS) may be present across the impact assessment area:
  - Soils at the WRRF at depths equal to or greater than 1.5 mbgl may be considered ASS (Jacobs, 2024a). Excavation below the raised site extent or in areas outside of the raised extent may encounter ASS
  - Along the river release pipeline ASS screening and observations indicated potential for ASS near excavation locations in Silverwater, Newington, the SOPA Pod A and C carparks and in Meadowbank. These locations are also generally considered Class 2 ASS and as such it is likely for ASS to be encountered during excavation works. Additional sampling is recommended prior to construction to confirm the presence of ASS (Jacobs, 2025f)
  - No ASS indicators were observed along the brine and transfer pipelines or at Camellia pumping station. The risk of encountering ASS at depths shallower than 2 m below the natural ground surface is low.
  - With the exception of areas immediately surrounding Vineyard Creek, ASS are not considered likely to occur along the relined section of the brine pipeline
- Groundwater quality across the impact assessment area is known to be contaminated
  - The DSI at the WRRF (Jacobs, 2024a) found that groundwater on site contains concentrations of selected heavy metals, TRH, BTEX, PAH and PFAS compounds exceeding human health and/or the ecological SAC. Increased levels of groundwater contamination appear to primarily occur towards the south of the site in downgradient monitoring wells. Contamination may be reflective of background groundwater quality, but is also considered to be influenced from previous on-site sources
  - The pH measured at the majority of well locations at the WRRF was acidic (ranging from 4.17 to 6.34), and was also outside of the adopted human health SAC range (Jacobs, 2024a)
  - Groundwater sampling conducted along the river release pipeline indicated exceedances against the adopted SAC of cadmium, copper, nickel, zinc, ammonia as N and PFOS (Jacobs, 2025f)
  - Along the brine and transfer pipeline alignment between the WRRF and Camellia pumping station, groundwater analytical results for PFOS exceeded adopted SAC in one interlab duplicate sample only. All other analytical groundwater results were either below the LOR or respective SAC (Jacobs, 2025g)
  - As of August 2025, no site investigations have been undertaken along the relined section of the brine pipeline. Groundwater quality data was, therefore, not available for this section of the brine pipeline (relined section)
- Surface water sampling in Duck River indicated exceedances of copper, zinc, and PFAS against ecological SAC

- Raising of the WRRF site with natural material is not expected to cause a perceptible change in groundwater level, nor saturation of soils that were previously unsaturated at the site (Jacobs, 2025e)
- Raising of the WRRF site is considered to present a negligible risk of impact to contaminated groundwater movement (Jacobs, 2025e)

7. Assessment of groundwater interaction

Groundwater inflow into project excavations is expected to occur where excavation extends below the water table, and where the construction methodology does not prevent groundwater ingress. Due to the relatively shallow depth to groundwater across the project impact assessment area (between 0.6 mbgl and 6.1 mbgl) and proposed excavation depths, there is potential for groundwater to be intercepted during excavation of:

- FWPS 1 and FWPS 2 at the Camellia-Rosehill WRRF
- Open trench sections along the river release pipeline between:
  - Carnarvon Street and Silverwater Road
  - Silverwater Road and PDC Park
  - SOPA Pod A carpark and SOPA Pod C carpark
  - Meadowbank Park and the river release outlet at Parramatta River near John Whitton Bridge
  - The outfall header at the John Whitton Bridge and the headwall at the discharge point in the Parramatta River
- Open trench section along the brine and transfer pipelines between Rosehill Gardens Racecourse and Camellia pumping station
- Open trench section at Camellia pumping station where the transfer pipelines connects to existing wet well structures
- Shaft excavations of the river release pipeline HDD pits at the WRRF

  Excavations comprise two HDD pits approximately 15 m by 4 m in footprint and 2 m in depth, and are located toward the south-west corner of the WRRF
- Shaft excavations along the river release pipeline at:
  - The microtunnel launch and retrieval sites on Derby Street, east and west of Silverwater Road.

    The launch and retrieval shafts are proposed to be 5 m by 5 m in footprint and 10 m in depth. According to the 100% Concept Design (dated 27 May, 2025), shafts are proposed to be constructed with sheet pile walls to the top of rock (approximately 6 m to 7 mbgl). Below this depth the rock face is to be sprayed with shotcrete. The floor of the excavation was assumed to be concrete lined and, therefore, practically impermeable to groundwater ingress. For the purposes of this assessment, sheet pile walls and shotcrete were assumed to reduce rates of groundwater inflow by 90%
  - The HDD pits located at PDC Park

    Excavations comprise two HDD pits approximately 15 m by 4 m in footprint and 2 m in depth
  - The HDD cofferdam pit located at SOPA Pod C carpark

    According to the 100% Concept Design (dated 27 May, 2025) works consist of construction of one cofferdam, or sheet pile walled structure, that is approximately 50 m by 4 m. The floor of the excavation was assumed to be concrete lined and, therefore, practically impermeable to groundwater ingress. For the purposes of this assessment, sheet pile walls were assumed to reduce rates of groundwater inflow by 90%.
  - The HDD pits located at Meadowbank Park

    Excavations comprise two HDD pits approximately 15 m by 4 m in footprint and 2 m in depth
- Shaft excavations along the brine and transfer pipelines in the Rosehill Gardens Racecourse overflow carpark area

  Excavations comprise three HDD pits approximately 15 m by 4 m in footprint and 2 m in depth

- Access points for the relining of the existing rising main (to form the northern part of the brine pipeline) between Camellia pumping station and the NSOOS; access points 1 to 8 and access points 10 to 21 (access point 9 is above ground – refer Table 3-6)

The location of excavations where groundwater interception is anticipated are presented in Figure 7-1, Figure 7-2, Figure 7-3, Figure 7-4, Figure 7-5 and Figure 7-6.

Section 7.2, Section 7.3, Section 7.4, Section 7.5 and Section 7.6 summarise the potential groundwater interception at excavations at the WRRF, along the river release pipeline, brine and transfer pipelines, at Camellia pumping station and along the relined section of brine pipeline, respectively.

7.1 Assumptions

This assessment was based on available reference and concept designs (see Section 2) and as such includes representative samples across the area. Due to limitations in the available data, certain assumptions were necessary to proceed with the assessment. The following assumptions provide a conservative estimate of potential groundwater interception at each excavation location:

- At the WRRF, the groundwater level measured in the closest bore to each excavation location was adopted to estimate the potential groundwater head encountered at each excavation
- Where available, the most recent and/or shallowest groundwater level observed near each excavation was adopted at that excavation location
- Groundwater was not observed during drilling along the western section of the river release pipeline. During the DSI completed 4 months after drilling, groundwater was observed between 3.5 mbgl and 5.1 mbgl. As a conservative assumption, the groundwater level at project excavations along this section of the river release pipeline was assumed to be 3.5 mbgl
- At PDC Park where nearby groundwater level observations were not available, the groundwater level was assumed to lie 1.5 m below the base of the fill
- For open trenched excavations, the shallowest groundwater level along each trench and maximum excavation floor level was adopted to provide the most conservative assumption of potential groundwater head
- Groundwater level data from current site investigations was not available along the relined section of the brine pipeline. Based on understanding of the geological mapping and the two WaterNSW monitoring bore measurements (see Table 5-6), the groundwater table was assumed to be 2 mbgl along this section of the brine pipeline.

Based on available groundwater level data and concept designs, excavation of the following elements was considered unlikely to interact with groundwater. As such, groundwater inflow is not anticipated at these locations and they have not been included in the groundwater impact assessment (Section 8 and Section 10):

- Excavations where the proposed floor level lies above the groundwater level (refer to Section 3)
- Excavation of HDD pits at the WRRF site for the launch of the brine and transfer pipelines.

  According to the 100% Concept Design (dated 23 May, 2025), the pits are located within the raised extent toward the north-west corner of the WRRF. The excavation depth of 2 m below the top of raised site level is not anticipated to reach the groundwater level. As such, groundwater inflow to these HDD pits have not been included in the groundwater impact assessment.
- HDD sections of the river release pipeline and brine and transfer pipelines.

  According to the river release pipeline constructability report (Agonis, 2024), the HDD methodology uses drilling muds to maintain pressure at the face of the drill head and within the tunnel as it is advanced. The outward pressure from the drilling muds prevents groundwater ingress from the surrounding formation.

HDD sections are also understood to remain open and ungrouted at the surface, meaning that pressure buildup will not occur as the open annulus allows for natural pressure dissipation. As a result, the risk of fracturing the surrounding formation during HDD is low.

Additives in the drilling mud also prevent losses to the formation due to increasing the viscosity and density.

As such, the HDD sections have not been included in this assessment as potential risks arising from interaction with the surrounding groundwater environment were considered low. Groundwater take from HDD sections was considered insignificant and the risk of contaminated the existing groundwater environment from the use of drilling fluids was also considered low.

It was assumed that this HDD methodology would be adopted across all project HDD sections (i.e. also along the brine and transfer pipelines).

- The micro-tunnelled section of river release pipeline beneath Silverwater Road.

  The micro-tunnelled section is proposed to be constructed by pipe-jacking. Pipe-jacking involves advancing (pushing) the concrete encased pipe through the formation. The concrete encased 'pipe-jack' is impermeable to groundwater ingress and has, therefore, not been considered in this assessment.

7.2 WRRF

At the Camellia-Rosehill WRRF, groundwater interception is anticipated during excavation of:

- FWPS 1 and FWPS 2
- Two HDD pits for the launch of the river release pipeline HDD section between the WRRF and Carnarvon Street.

Based on the WRRF Final Reference Design report, excavation of all other project elements at the WRRF would be conducted above the groundwater level. Groundwater interaction at these locations is, therefore, considered unlikely.

Table 7-1 details the potential groundwater head at FWPS 1, FWPS 2 and the river release pipeline HDD pits located on the WRRF site. In this case, groundwater head is a measure of the difference between the groundwater level at the site and the base of each excavation. Adopted excavation depths are based on the Camellia WRRF Reference Design, dated 1 August 2025. Groundwater levels were based on data measured during the GME conducted on the 28th of January 2025. To provide a conservative estimate of groundwater head at the FWPS locations, the shallowest observed groundwater level towards the north of the site, measured at WRRF-GW-109 was adopted at these locations. For the river release pipeline HDD pits located in the southwest corner of the site, the groundwater level in the nearest bore (WRRF-GW-112) was assumed to be representative of conditions at this location.

Prior to excavation works, part of the WRRF site is proposed to be raised with natural material to an engineered level of 6.8 mAHD. The adopted excavation depth of FWPS 1 and FWPS 2 is, therefore, relative to the top of this natural material. The HDD pits for the river release pipeline are located outside of the raised extent. As such, excavation depths included in Table 7-1 are relative to the pre-raising ground level (4.6 mAHD at WRRF-GW-112 toward the south-west of the site).

The location of excavations at the WRRF where groundwater interception is anticipated during construction are shown in Figure 7-1.

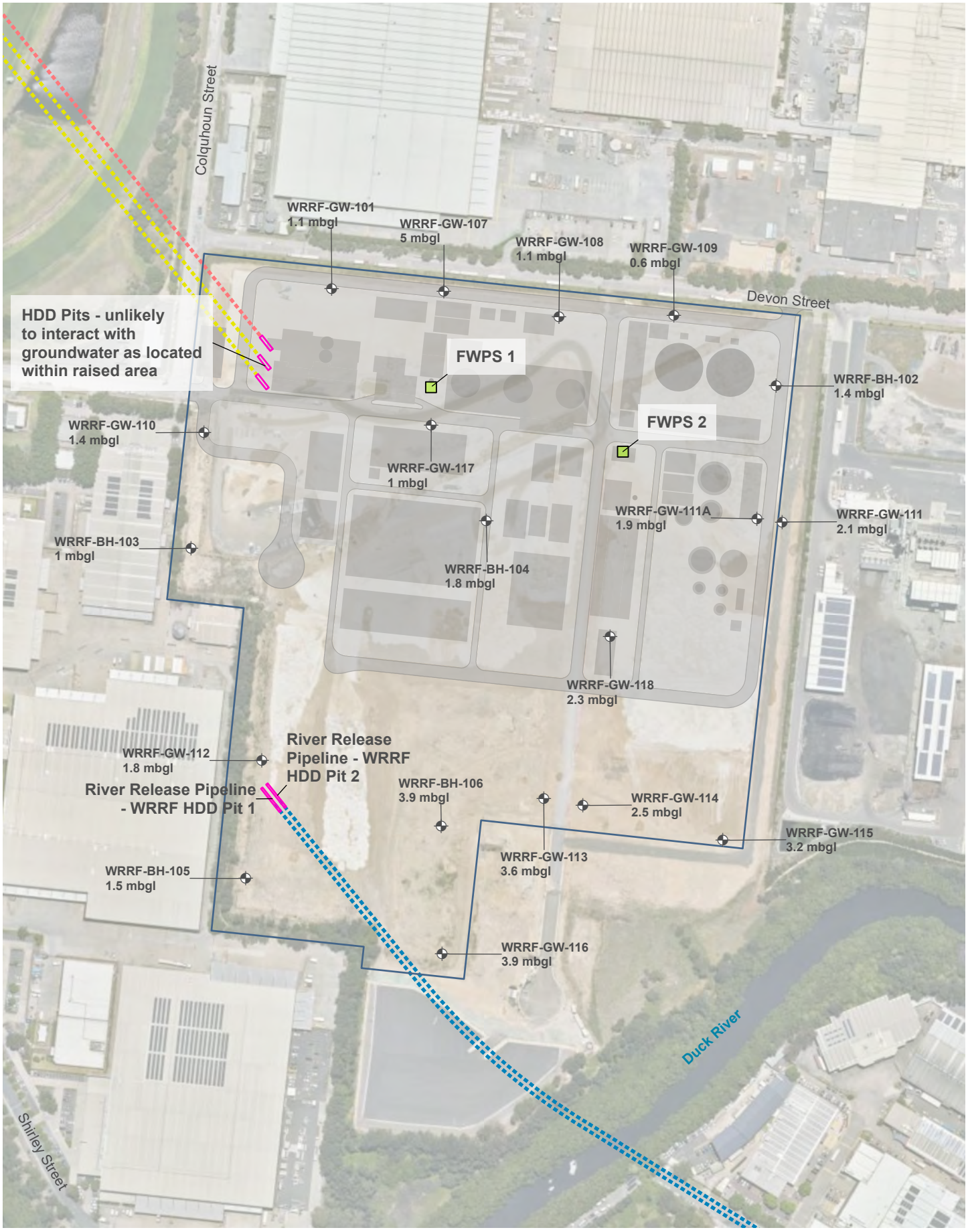
Table 7-1: Excavations anticipated to intercept groundwater - WRRF

Project Element	Type	Final ground surface	Adopted excavation depth		Assumed groundwater level	Potential groundwater head in excavation	Location of groundwater level measurement[3]
		mAHD	mbgl	mAHD	mAHD	m	
FWPS 1	Shaft	6.8[1]	6.8[2]	0	4.4	4.4	WRRF-GW-109
FWPS 2	Shaft	6.8[1]	6.8[2]	0	4.4	4.4	WRRF-GW-109
River release pipeline -WRRF HDD pit 1	Shaft	4.6	2	2.6	2.8	0.2	WRRF-GW-112
River release pipeline -WRRF HDD pit 2	Shaft	4.6	2	2.6	2.8	0.2	WRRF-GW-112

Notes: 1. Final ground surface at FWPS 1 and 2 is the proposed elevation of the raised surface as excavation of FWPS 1 and 2 will occur after those works

2. Assumed excavation depth measured from the top of the raised surface

3. Groundwater measurement as of 28 January 2025



Camellia-Rosehill WRRF

Indicative WRRF layout

Indicative shaft locations

Foul water pumping station (FWPS)

River release pipeline - HDD (Trenchless)

Brine pipeline - HDD (Trenchless)

Transfer pipeline - HDD (Trenchless)

Groundwater well

Figure 7-1 Excavations anticipated to intercept groundwater – WRRF

0 200 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:4,000 @ A4
GDA2020 MGA Zone 56

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7.3 River release pipeline

Table 7-2 details the potential groundwater head during construction of project elements along the river release pipeline where excavation is anticipated to extend below assumed groundwater levels.

The estimated groundwater head at river release pipeline shaft elements was based on the difference between the assumed groundwater level at each location and the base of each excavation. For trenches, estimated groundwater head was based on the shallowest assumed groundwater level and the maximum trench depth along each section. Where available, the shallowest groundwater level observed during site investigations closest to a particular element was adopted as the assumed groundwater level for that location. At PDC Park where nearby groundwater level observations were not available, the groundwater level was assumed to lie 1.5 m below the base of the fill. This assumption was based on understanding of the likely regional hydrogeological conditions along the alignment (refer to Section 5.8.2). Adopted excavation depths are based on the 100% Concept Design, dated 27 May 2025.

Based on the Concept Design, excavation of all other project elements along the river release pipeline are assumed to be conducted above groundwater. Groundwater interaction at these locations is, therefore, considered unlikely.

The location of excavations along the river release pipeline where groundwater interception is anticipated during construction are shown in Figure 7-2, Figure 7-3 and Figure 7-4.

Table 7-2: Excavations anticipated to intercept groundwater - river release pipeline

Project Element	Type	Adopted excavation depth (mbgl)	Assumed groundwater level (mbgl)	Potential groundwater head in excavation (m)	Location of groundwater level measurement
River release pipeline – trench 1 Carnarvon Street to Silverwater Road	Trench	5	3.5	1.5	RRP-BH-102
River release pipeline – trench 2 Silverwater Road to PDC Park	Trench	5	3.5	1.5	RRP-BH-102
River release pipeline – trench 3 SOPA Pod A carpark to SOPA Pod C carpark	Trench	6	1.9	4.1	RRP-BH-124
River release pipeline - trench 4 Meadowbank Park to river release pipeline outfall header	Trench	7	1.5	5.5	RRP-BH-130

Project Element	Type	Adopted excavation depth (mbgl)	Assumed groundwater level (mbgl)	Potential groundwater head in excavation (m)	Location of groundwater level measurement
River release pipeline - trench 5 Containing the outfall pipes between the outfall header and the concrete headwall at the river release outfall structure	Trench	3.5	0.5[1]	3	Assumed to be high tide level of Parramatta River (1.5mAHD or 0.5mbgl below land surface) based on proximity to Parramatta River
River release pipeline - WRRF HDD pits	Refer to Table 7-1				
River release pipeline - Silverwater Rd east shaft	Shaft	10	3.5	6.5	RRP-BH-102
River release pipeline - Silverwater Rd west shaft	Shaft	10	3.5	6.5	RRP-BH-102
River release pipeline – PDC Park HDD pit 1	Shaft	2	1.7	0.3	Assumed – 1.5 m below base of fill in RRP-BH-116
River release pipeline – PDC Park HDD pit 2	Shaft	2	1.7	0.3	Assumed – 1.5 m below base of fill in RRP-BH-116
River release pipeline – Pod C Carpark HDD cofferdam pit	Shaft	6.5	1.9	4.6	RRP-BH-124
River release pipeline – Meadowbank Park HDD pit 1	Shaft	2	1.5	0.5	RRP-BH-130
River release pipeline – Meadowbank Park HDD pit 2	Shaft	2	1.5	0.5	RRP-BH-130

Notes: Groundwater level at the river release outfall structure was based on an average ground surface elevation across the outfall structure of 2 mAHD and an assumed high-tide water level of 1.5 mAHD

River Release Pipeline - WRRF HDD Pit 2

River Release Pipeline - WRRF HDD Pit 1

Duck River

HDD pits - 2m depth (groundwater interception not anticipated)

RRP-BH-102 3.5 mbgl

Duck Creek

Clyde

Newton Street North

Skarratt Street North

Carnarvon Street

Sutton Street

Salisbury Street

Derby Street

Silverwater

RRP-BH-108 5.1 mbgl

Vore Street

Holker Street

Fariola Street

Egerton Street

Silverwater Road East Shaft

Silverwater Road West Shaft

Churchill Street

Stanley Street

Asquith Street

Stubbs Street

M4 Motorway

Auburn

Parramatta Road

Melton Street North

Wetherill Street North

Silverwater Road

Camellia-Rosehill WRRF

Indicative shaft locations

Groundwater well

Pavement hole

River release pipeline

Open trench

Trenchless

Figure 7-2 Excavations anticipated to intercept groundwater – River release pipeline

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:6,000 @ A3
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Blaxland Riverside Park
Millenium Parklands
RRP-BH-126
6 mbgl
Verona Drive
Savona Drive
Nuvolari Place
Baywater Drive
Amalfi Drive
Stromboli Strait
Wentworth Point
Silverwater
Sydney Olympic Park
RRP-BH-124
1.9 mbgl
Pod C Carpark HDD cofferdam pit
RRP-BH-123
2.4 mbgl
SOPA Pod C Carpark
URBNSURF
Holker Street
Bennelong Parkway
Newington
Monterey Street
Mockridge Avenue
Dey Street North
Wat Avenue
Clarke Street
PDC Park
PDC Park HDD Pit 2
PDC Park HDD Pit 1
RRP-BH-119
6.1 mbgl
Avenue Of Oceania
SOPA Pod A Carpark
Haslams Creek
Egerton Street
Newington Boulevard
Hill Road
Wentworth Common

Indicative shaft locations
Geotechnical borehole
Groundwater well
Pavement hole
River release pipeline
Open trench
Trenchless

Figure 7-3 Excavations anticipated to intercept groundwater – River release pipeline

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025
Scale: 1:6,000 @ A3
GDA2020 MGA Zone 56

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○ Indicative shaft locations

Geotechnical borehole
Groundwater well
Pavement hole

River release pipeline
Open trench
Trenchless

River release structure
Concrete mattress
Geosynthetic concrete mattress or textile
River release structure

Figure 7-4 Excavations anticipated to intercept groundwater – River release pipeline

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025

Scale: 1:6,000 @ A3
GDA2020 MGA Zone 56

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7.4 Brine and transfer pipelines

Along the brine and transfer pipelines, there is potential for groundwater to be intercepted during construction of the trenched section that runs from the HDD pits located in the Rosehill Gardens Racecourse overflow carpark area and Camellia pumping station, as well as the HDD pits themselves.

Table 7-3 details the potential groundwater head estimated during construction of the HDD pits and section of open trench.

The estimated groundwater head along the trench section was based on the difference between the shallowest observed groundwater level along the alignment (observed in INF-BH-102 during the DSI), and the maximum trench excavation depth. The estimated head at the HDD pits located in the Rosehill Gardens Racecourse overflow carpark area was based on a maximum excavation depth of 2 mbgl and the observed groundwater level in INF-BH-102. This methodology gives the most conservative estimate of groundwater head across project elements. Maximum excavation depths are based on the 100% Concept Design, dated 23 May 2025.

Groundwater interaction during construction of the HDD section of the brine and transfer pipeline beneath Rosehill Gardens Racecourse was assumed to be limited. The HDD methodology along the brine and transfer pipelines was assumed to be the same as that along the river release pipeline. As such, the outward pressure of drilling muds used during tunnelling prevents groundwater ingress from the surrounding formation and any groundwater take was assumed to be insignificant. The HDD sections were assumed to remain open at the surface during drilling, preventing pressure buildup and limiting the risk of fracturing the formation. Additives increase the viscosity and density of drilling muds, reducing the risks of losses to the formation. The risk of contaminating the existing groundwater environment from the use of drilling muds is therefore also considered negligible.

The location of project elements section of open trenching along the brine and transfer pipelines where groundwater interception is anticipated during construction is shown in Figure 7-5.

Table 7-3: Excavations anticipated to intercept groundwater - brine and transfer pipelines

Project Element	Type	Adopted excavation depth (mbgl)	Assumed groundwater level (mbgl)	Potential groundwater head in excavation (m)	Location of groundwater level measurement
Brine and transfer alignment – trench 1 Rosehill Gardens Racecourse to Camellia pumping station	Trench	3.5	1.5	2	INF-BH-102
Brine and transfer alignment Rosehill Gardens Racecourse overflow carpark HDD pit 1	Shaft	2	1.5	0.5	INF-BH-102
Brine and transfer alignment Rosehill Gardens Racecourse overflow carpark HDD pit 2	Shaft	2	1.5	0.5	INF-BH-102
Brine and transfer alignment Rosehill Gardens Racecourse overflow carpark HDD pit 3	Shaft	2	1.5	0.5	INF-BH-102



Figure 7-5 Excavations anticipated to intercept groundwater – Brine and transfer alignment

7.5 Camellia pumping station

Connection of the brine and transfer pipelines at the existing Camellia pumping station involves open trenching. There is potential for groundwater interception during construction of these trenched connections.

Table 7-4 details the potential groundwater head estimated during construction of the trenches that connect the transfer pipelines and brine pipeline to the existing wet well at Camellia pumping station.

The estimated groundwater head was based on the difference between the observed groundwater level in INF-BH-102 and the maximum trench excavation depth. The maximum trench depth is based on the 100% Concept Design, dated 23 May 2025.

While groundwater was observed at 6.4 mbgl during drilling of SPM-BH-101, the use of fluids during drilling may have meant that the groundwater observation was not representative of actual hydrogeological conditions. As such, the groundwater level measured during contaminated land investigations in the closest installed groundwater monitoring well (INF-BH-102) was assumed to be consistent with the groundwater level at the Camellia pumping station.

Table 7-4: Excavations anticipated to intercept groundwater – Camellia pumping station

Project Element	Type	Adopted excavation depth (mbgl)	Assumed groundwater level (mbgl)	Potential groundwater head in excavation (m)	Location of groundwater level measurement
Camellia pumping station – trench 1 Connection of transfer pipelines to existing pumping station wet well	Trench	6.5	1.5	5	INF-BH-102
Camellia pumping station – trench 2 Connection of brine pipeline to existing pumping station wet well	Trench	6	1.5	4.5	INF-BH-102

7.6 Brine pipeline (relined section)

Table 7-5 details the potential groundwater head during construction of pipe relining access points along the existing rising main between Camellia pumping station and the NSOOS where excavation is anticipated to extend below assumed groundwater levels. The relined rising main will form the northern part of the brine pipeline between Camellia pumping station and the NSOOS.

No site investigation data was available for this section of the brine pipeline. As such, the groundwater level was assumed to be 2 mbgl, based on observations in two NSW monitoring bores situated along the alignment (refer Section 5.8.4).

The estimated groundwater head was based on the difference between this assumed groundwater level and the assumed floor level of access points. The floor level of access points was based on the indicative invert level of the existing rising main estimated from historical drawings provided by Sydney Water, plus an additional 1 m allowance for relining equipment.

It is noted that this is a worst case assessment of groundwater head based on the existing rising main requiring a complex relining methodology. The relining methodology was not confirmed as at August 2025

and will be confirmed during detailed design. Preliminary investigations indicate that the pipeline is structurally sound. Relining works may therefore be minor and may not interact with groundwater.

The location of relining access points along the existing rising main between Camellia pumping station and the NSOOS where groundwater interception is anticipated are shown in Figure 7-6.

Table 7-5: Excavations anticipated to intercept groundwater – relined section of brine pipeline

Project Element	Type	Approx. chainage (m)	Ground surface level (mAHD)	Existing pipe invert level (mAHD)	Adopted excavation depth (mbgl)[1]	Assumed groundwater level (mbgl)	Potential groundwater head in excavation (m)
Access point 1	Relining access point	0	4.4	0	5.4	2	3.4
Access point 2	Relining access point	3	4.4	0	5.4	2	3.4
Access point 3	Relining access point	11	4.2	0.1	5.1	2	3.1
Access point 4	Relining access point	34	4.0	0.2	4.8	2	2.8
Access point 5	Relining access point	53	3.7	0.2	4.6	2	2.6
Access point 6	Relining access point	61	3.4	0	4.4	2	2.4
Access point 7	Relining access point	70	3.2	0	4.2	2	2.2
Access point 8	Relining access point	100	2.9	0	3.9	2	1.9
Access point 9	Relining access point	443	2.0	2.4	N/A - pipe above ground	2	N/A
Access point 10	Relining access point	485	7.8	4.5	4.3	2	2.3
Access point 11	Relining access point	596	9.7	3.0	7.7	2	5.7
Access point 12	Relining access point	629	8.1	2.1	7.0	2	5.0
Access point 13	Relining access point	654	7.0	2.1	5.8	2	3.8
Access point 14	Relining access point	777	8.5	5.2	4.3	2	2.3
Access point 15	Relining access point	930	8.5	5.9	3.6	2	1.6
Access point 16	Relining access point	1002	11.8	10.5	2.3	2	0.3

Project Element	Type	Approx. chainage (m)	Ground surface level (mAHD)	Existing pipe invert level (mAHD)	Adopted excavation depth (mbgl)[1]	Assumed groundwater level (mbgl)	Potential groundwater head in excavation (m)
Access point 17	Relining access point	1028	15.1	13.0	3.2	2	1.2
Access point 18	Relining access point	1182	16.9	14.0	3.9	2	1.9
Access point 19	Relining access point	1307	16.6	14.1	3.5	2	1.5
Access point 20	Relining access point	1673	15.5	12.9	3.6	2	1.6
Access point 21	Relining access point	1760	17.1	13.4	4.7	2	2.7

Notes: 1. Adopted excavation floor depth was assumed to 1 m below the existing pipe invert level

2. Access point 9 is proposed to be above ground and as such no groundwater interception was anticipated



Figure 7-6 Excavations anticipated to intercept groundwater – Brine pipeline

8. Assessment of groundwater drawdown and inflow

8.1 Methodology

Analytical modelling was undertaken to estimate groundwater drawdown and inflows to the Project excavations that were anticipated to intercept groundwater (see Section 7). The methodology for estimating potential groundwater drawdown due to construction dewatering is provided in Section 8.1.1. Potential groundwater inflows to excavations and estimated groundwater take during dewatering are provided in Section 8.1.2.

An analytical modelling approach was adopted as:

- The project area geology is relatively simple, comprising two key units (Ashfield Shale and Hawkesbury Sandstone with relative residual soils) with no known significant faults or other significant geological structures in the area
- Project excavations are relatively shallow (maximum depth 10 mbgl) and will, therefore, not intersect thick portions of saturated aquifer (refer to Section 7)
- The duration of project excavations is anticipated to be relatively short and impermanent
- Groundwater inflows and drawdown are expected to be relatively minor

Parameters adopted in the groundwater drawdown and inflow assessment are included in Section 8.1.4. Adopted hydraulic conductivity values are provided in Section 8.1.3.

The analytical model provides a conservative (i.e. 'worst case') estimation of groundwater interaction, drawdown and inflow. The model is based on several assumptions noted in Section 8.1.5, which are also considered 'worst case'. As the project progresses, changes to the design may be necessary which could change the magnitude of the identified groundwater impacts. In addition, it is possible that unexpected hydrogeological conditions may be encountered due to previously unknown heterogeneities in the subsurface. The analytical model should be reviewed should the design be altered in the detailed design phase, or should additional site-specific hydrogeological information come to light.

8.1.1 Groundwater drawdown assessment

The following method was used to assess drawdown associated with excavations anticipated to intersect the water table (summarised in Section 7). The Sichardt formula (outlined in Powers, 1992) was used to estimate groundwater drawdown extent:

$$\mathrm{R} = 3000\ (H - h_{ex})\ \sqrt{K}$$

Where,

R	Extent of drawdown from the edge of the excavation footprint (m)
K	Horizontal hydraulic conductivity (m/s)
H	Head at boundary (m)
h_{ex}	Head in the excavation (m) – i.e. (H- h_{ex}) is the expected drawdown at the excavation

8.1.2 Groundwater inflow assessment

8.1.2.1 Trenched excavations

The flow rate into the pipeline alignment trench(s) is based on an approach presented by Mansur and Kaufman (1962) which considers both the Dupuit-Forcheimer and the Thiem solutions for steady state flow in an unconfined aquifer. The approach is approximated as:

> *Inflow ≈ 2 × linear flow into sides of excavation (unconfined aquifer) + 2 × radial flow into each semi-circle end of excavation*

Groundwater flow into each of the long sides of the excavation, Q_S, is approximated using the Dupuit-Forcheimer solution:

$$Q_S = K \frac{(H^2 - h_{ex}^2)}{L_0} a$$

Inflow into each end of the excavation, Q_E, is approximated using the Thiem solution for steady radial flow (Thiem, 1906), in its simpler form, as:

$$Q_E = \pi K D \frac{(H - h_{ex})}{\ln\left\{\frac{2L_0}{b}\right\}}$$

Where,

K	Equivalent horizontal hydraulic conductivity (m/s)
D	thickness of the aquifer (m)
L_0	Distance to the constant head boundary (m)
a	Trench length (m)
b	Trench width (m)
H	Head at constant head boundary (m)
H_{ex}	Head in the excavation (m)
Q_s	Flowrate into the sides of the excavation [calculated] (m^3/s)
Q_E	Flowrate into each end of the excavation [calculated] (m^3/s)
Q	Total flowrate into the trench [calculated] (m^3/s)

8.1.2.2 Shaft excavations

The following methods were used to assess inflows to shaft excavations that were interpreted to intersect the water table (refer to Section 7).

Potential groundwater inflow to rectangular shaft excavations was estimated considering the Thiem solution for steady state flow (Thiem, 1906). Rectangular shaft excavations include the launch and retrieval shafts for trenchless sections of the river release pipeline and brine and transfer pipelines (both HDD and micro-tunnelled sections), as well as any below ground access points along the relined section of brine pipeline.

The inflow into an approximately rectangular shaft is estimated using the following formula:

$$Q_E = 2\pi KD \frac{(H - h_{ex})}{\ln\left\{\frac{R}{r_{eq}}\right\}}$$

Where,

Q	Flow rate into the shaft excavation (m^3/s)
K	Equivalent horizontal hydraulic conductivity (m/s)
D	Thickness of aquifer (m)
H	Head at boundary (m)
h_{ex}	Head in the excavation (m)
R	Distance to constant head boundary (m)
r_{eq}	Radius of the excavation, or equivalent radius where the excavation is not circular (m). For the rectangular shaft excavations, r_{eq} was calculated using: $$r_{eq} = \sqrt{\frac{ab}{\pi}}$$ Where a and b are the short and long sides of the excavation, respectively

For the two FWPS excavations at the WRRF, anticipated groundwater inflow was interpreted to be radial, as excavations are likely to be square in footprint. As such, the Dupuit solution for radial flow into the sides of a circular excavation (unconfined flow) (Mansur and Kaufman, 1962) was used to estimate groundwater inflow to the FWPS excavations:

$$Q = \pi K \frac{(H^2 - h_{ex}^2)}{\ln\left(\frac{R}{r_{eq}}\right)}$$

Where,

Q	Flow rate into the shaft excavation (m^3/s)
K	Equivalent horizontal hydraulic conductivity (m/s)
H	Head at boundary (m)
h_{ex}	Head in the excavation (m)
R	Distance (radial) to constant head boundary (m)
r_{eq}	Radius of the excavation, or equivalent radius where the excavation is not circular (m). For the FWPS excavations, req was calculated using: $$r_{eq} = \sqrt{\frac{2a}{\pi}}$$ Where a is the length of the square excavation.

8.1.3 Adopted hydraulic conductivity

As outlined in the hydrogeological conceptual model (refer Section 5.11), the impact assessment area is interpreted to overlie a layered saturated stratigraphic profile. The groundwater table is interpreted to likely occur as an unconfined shallow system perched within shallow fill, alluvial or residual soil sediments (depending on excavation location). For the purposes of this impact assessment, hydraulic conductivity estimates were first adopted for each interpreted stratigraphic layer (see Table 8-1). An equivalent hydraulic conductivity for each excavation that was predicted to receive groundwater was then calculated based on the adopted hydraulic conductivity values. The calculated equivalent hydraulic conductivity was then used to estimate Project inflows and potential impacts.

Hydraulic testing (rising head tests) undertaken by Jacobs (Jacobs, 2024d) at the WRRF site estimated the hydraulic conductivity of the clay alluvium at the site to range between 1×10^{-4} m/day to 1.2×10^{-3} m/day, with a median of 3.5×10^{-4} m/day. To provide a conservative estimate of groundwater inflow and drawdown to excavations at the WRRF the maximum value of hydraulic conductivity (1.2×10^{-3} m/day) was adopted.

Borehole logs indicate that the alluvium and residual soil units may differ in composition and hydraulic properties along pipeline alignments. In the absence of hydraulic testing results along the pipeline alignments (river release pipeline, brine and transfer pipelines and the relined section of brine pipeline) an upper estimate of hydraulic conductivity was adopted for each saturated unit based on interpretation of the material encountered as described on the geotechnical borehole logs. Hydraulic conductivity values in the literature were adopted for the units based on material descriptions. The upper estimates adopted provide a conservative approach to assessing project inflows, drawdown and potential impacts. It is possible that the hydraulic conductivity of saturated units may be lower.

The hydraulic conductivity values adopted in the impact assessment are summarised in Table 8-1.

Table 8-1: Assumed hydraulic conductivity values for saturated units

Project site	Saturated Unit	Description	Adopted value (m/day)	Source
WRRF	Fill and alluvium	Sandy clay/Clayey sand fill and CLAY alluvium	1.2×10^{-3} (0.0012)	Hydraulic testing undertaken by Jacobs (Jacobs, 2024d)
WRRF, river release pipeline, brine and transfer pipelines	HWR – Highly Weathered Rock	Highly weathered siltstone or sandstone, with core loss noted in some logs	0.1	Bertuzzi (2014); McNally (2004)
WRRF, western section of river release pipeline (between WRRF and SOPA Pod A carpark), brine and transfer pipelines	FR – Fresh Shale	Ashfield Shale	0.004	Bertuzzi (2014); McNally (2004)
River release pipeline, brine and transfer pipelines	Fill 1	Sandy CLAY/Clayey SAND/SAND with variable gravel composition	1.0	Assumed – based on geotechnical logs (Jacobs, 2024d)
River release pipeline, brine and transfer pipelines	Fill 2	CLAY	0.1	Assumed – based on geotechnical logs (Jacobs, 2024d)
River release pipeline, brine and transfer pipelines	A1 – Alluvium.	Sandy CLAY/Clayey SAND with trace fine to medium grained gravel	1.0	Assumed – based on hydraulic testing results and geotechnical logs (Jacobs, 2024d)
River release pipeline brine and transfer pipelines	A2 – Alluvium.	CLAY	0.1	Assumed – based on hydraulic testing results and geotechnical logs (Jacobs, 2024d)
Western section of river release pipeline (between WRRF and SOPA Pod A carpark), brine and transfer pipelines	RS1/XWS – Residual Soil/Extremely Weathered Shale	CLAY with trace fine grained sand or gravel noted in some locations. Derived from Ashfield Shale.	0.04	Assumed– based on geotechnical logs (Jacobs, 2024d) Heath (1983) Freeze and Cherry (1979)
Relined section of brine pipeline	RS2 – Residual Soil.	Likely sandy CLAY, derived from Hawkesbury Sandstone	0.04	Assumed– based on geological mapping Heath (1983) Freeze and Cherry (1979)

Project site	Saturated Unit	Description	Adopted value (m/day)	Source
Eastern section of river release pipeline adjacent to Parramatta River (Between SOPA to Pod A carpark and Parramatta River)	MD – Marine Deposits	Sandy CLAY/CLAY with fine to coarse grained sand bands	1.0	Assumed– based on geotechnical logs (Jacobs, 2024d)
Eastern section of river release pipeline (between SOPA Pod A carpark and Parramatta River)	FR – Fresh Sandstone	Hawkesbury Sandstone	0.01	Bertuzzi (2014); McNally (2004)

8.1.3.1 Equivalent hydraulic conductivity

Due to limited hydraulic testing data across the impact assessment area, an equivalent hydraulic conductivity value (K_{eq}) representing the transmissivity of all water-bearing units above excavation floor level was estimated at each project excavation.

The equivalent hydraulic conductivity was estimated using the following formula:

$$K_{eq} = \frac{1}{d}\sum_{i=1}^{n} K_i d_i$$

Where,

K_i is the adopted hydraulic conductivity of the saturated stratigraphic unit, included in Table 8-1

d_i is the saturated thickness of the saturated stratigraphic unit

d is the total saturated thickness of all saturated stratigraphic units, and

n is the total number of saturated layers present at each excavation location.

The following assumptions were used to assign parameters to each saturated unit:

- The adopted hydraulic conductivity values for each saturated unit as outlined in Table 8-1
- The saturated thickness of each unit at individual excavation locations was estimated using geotechnical logs available for current site investigations (Sydney Water, 2024b)
- For the top-most saturated unit, the thickness was considered to be the distance from the observed groundwater level in the closest groundwater monitoring well to the base of that unit. Where groundwater was not observed during geotechnical investigations, an adopted groundwater level was used based on interpreted ground conditions (refer Section 5.7)
- For the bottom-most saturated unit, the thickness was considered to be the distance from the top of that unit to the base of the excavation
- For trenched excavations, the maximum excavation depth was used to estimate the saturated thickness of the bottom-most unit. This provides a more conservative assessment of the equivalent hydraulic conductivity at these locations
- The saturated units were assumed to be isotropic and have uniform hydraulic properties across impact assessment areas for the project elements outlined in Section 3.

8.1.4 Parameter values

Construction details and hydrogeological parameter values adopted for inflow estimates to trench and shaft excavations are outlined in Table 8-2.

Table 8-2: Parameters adopted in inflow and drawdown calculations

Parameter		Adopted value	Source
Equivalent hydraulic conductivity (m/day)	WRRF	Refer Table 8-3 and Table 8-8	Refer Section 8.1.3 and Table 8-1
	River release pipeline	Refer Table 8-4 and Table 8-9	
	Brine and transfer pipelines	Refer Table 8-5 and Table 8-10	
	Brine pipeline (relined section)	Refer Table 8-7 and Table 8-12	

Parameter		Adopted value	Source
Thickness of aquifer (unconfined) (m)		Depth (height) from the observed groundwater level to the excavation base	Based on geotechnical logs – refer Appendix A
Distance to the constant head boundary (m)		Sum of the calculated equivalent radius of each excavation and the calculated drawdown extent - refer Section 8.1.1	Sichardt (outlined in Powers, 1992)
Shaft excavation footprint (m x m)	FWPS 1 and FWPS 2	5 m by 5 m	100% Concept Design
	Micro-tunnel shafts	12 m by 4 m	
	SOPA Pod C carpark HDD cofferdam pit	50 m by 4 m	
	HDD pits (except for the SOPA Pod C carpark HDD cofferdam) and access points along the relined brine pipeline	15 m by 4 m	
Trench excavation width (m)	River release pipeline	2.2	100% Concept Design
	Brine and transfer pipelines	2.8	
	Brine pipeline connection at Camellia pumping station	2.6	
	Transfer pipelines connection at Camellia pumping station	3	
Trenching rate (m/day)	River release pipeline	25 Trenches assumed to be constructed in 25 m sections, with each section open for one day at a time.	Assumed – based on 100% Concept Design
	Brine and transfer pipelines	20 Trenches assumed to be constructed in 20 m sections, with each section open for one day at a time.	
Relining rate (m/day)	Brine pipeline (relined section)	50	Assumed based on advice from Sydney Water
Duration excavation open to receiving groundwater	WRRF	Refer Table 8-8	Assumed – based on 100% Concept Design
	River release pipeline	Refer Table 8-9	
	Brine and transfer pipelines	Refer Table 8-10	
	Brine and transfer pipelines connection at Camellia pumping station	3 months (refer Table 8-11)	
	Brine pipeline (relined section)	Refer Table 8-12	Assumed

8.1.5 Assumptions

This assessment has been based on a reference design for the WRRF and a concept design for the pipelines. However, there were limitations in sampling and data obtained. Due to the design stage of this assessment and limitations in available hydrogeological data, the following assumptions were adopted to estimate the potential groundwater drawdown and inflow to project trenches and shaft excavations:

- Aquifer material was assumed to be homogenous and uniform across impact assessment areas. As such, the permeability lithological units as defined in Section 8.1.3 was assumed to be constant for each unit across the project impact assessment areas.
- Shallow perched aquifer systems were assumed to be unconfined across the impact assessment area.
- Assumptions adopted in the assessment of groundwater interaction as detailed in Section 7.1.
- In all cases, the distance to the constant head boundary was considered to be the estimated extent of groundwater level drawdown (from the edge of each excavation). This was assessed by subtracting the equivalent radius from predicted drawdown (as outlined in Section 9.1.1).
- Along the river release pipeline, open trenching was assumed to be undertaken in 25m lengths (or subsections). Along the brine and transfer pipelines, open trenching was assumed to be undertaken in 20m lengths. Trenching rates were based on the construction methodology of each alignment considered in design. Estimated groundwater drawdown and inflow rates apply to individual trench lengths, whereas total groundwater inflow considers the cumulative volume to all trench lengths (i.e. to the entire trenched section).
- Trenchless sections of alignment (i.e. HDD/micro-tunnelled tunnels) are not expected to take significant groundwater. The HDD and micro-tunnelling construction method prevents significant inflow from the formation, as outlined in Section 7. As such, these sections have not been assessed for groundwater take/inflow.
- The concept design includes sheet pile walls during excavation at the following locations:
  - The Silverwater Road micro-tunnel shafts; located on Derby Street to the east and west of Silverwater Road
  - The HDD coffer dam pit located in the SOPA Pod C carpark
  - The trenched connection of the transfer pipelines at Camellia pumping station.

  For the purposes of this assessment, sealant was assumed to be used between each pile to provide a 90% reduction in the estimated groundwater inflow rate through the walls of the excavation. Where sheet piles are applied, it was also assumed that the floor of these excavations would be concrete lined and impermeable to groundwater inflow.

Due to the uncertainty in ground conditions, estimated drawdown extents and inflows to excavations are based on these assumptions, which have not been confirmed. Actual inflows and drawdown radii may differ if hydrogeological conditions differ from those assumed in the assessments.

8.2 Predicted extent of groundwater level drawdown

The estimated extent of groundwater level drawdown at excavations assessed to potentially intercept the water table are summarised in Section 8.2.1, Section 8.2.2, Section 8.2.3 and Section 8.2.4. These sections include estimated drawdown extent from such excavations at the WRRF, along the river release pipeline, brine and transfer pipelines, at Camellia pumping station and along the relined section of the brine pipeline (between the pumping station and the NSOOS).

8.2.1 WRRF

Table 8-3 provides the predicted groundwater drawdown extent, measured from the edge of each excavation, to excavations anticipated to intercept groundwater at the WRRF.

Table 8-3: Predicted groundwater drawdown to excavations - WRRF

Project Element	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Anticipated drawdown extent (m)
FWPS 1	Shaft	0.0012	4.4	4
FWPS 2	Shaft	0.0012	4.4	4
River release pipeline - WRRF HDD Pit 1	Shaft	0.0012	0.2	0.1
River release pipeline - WRRF HDD Pit 2	Shaft	0.0012	0.2	0.1

8.2.2 River release pipeline

Table 8-4 provides the predicted groundwater drawdown extent, measured from the edge of each excavation, to excavations anticipated to intercept groundwater along the river release pipeline.

Since sheet pile walls were assumed to be used during excavation of the two Silverwater Road micro-tunnel shafts and the HDD cofferdam pit, the anticipated drawdown extent was calculated based on a 90% reduction in groundwater inflow volume. Should sheet pile walls not be applied, the anticipated drawdown extent at these locations would be larger.

Table 8-4: Predicted groundwater drawdown to excavations – river release pipeline

Project Element	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Anticipated drawdown extent (m)
River release pipeline – trench 1 Carnarvon Street to Silverwater Road	Trench	0.1	1.5	0.5
River release pipeline – trench 2 Silverwater Road to PDC Park	Trench	0.5	1.5	7
River release pipeline – trench 3 SOPA Pod A carpark to SOPA Pod C carpark	Trench	0.1	4.1	13
River release pipeline – trench 4 Meadowbank Park to river release pipeline outfall header	Trench	0.1	5.5	17
River release pipeline -trench 5 Containing the outfall pipes between the outfall header and the concrete headwall at the river release outfall structure	Trench	1	3	25
River release pipeline - WRRF HDD Pits	Refer Table 8-3			
River release pipeline -Silverwater Rd east shaft	Shaft	0.05	6.5	0.1

Project Element	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Anticipated drawdown extent (m)
River release pipeline -Silverwater Rd west shaft	Shaft	0.06	6.5	0.1
River release pipeline – PDC Park HDD pit 1	Shaft	0.04	0.3	1
River release pipeline – PDC Park HDD pit 2	Shaft	0.04	0.3	1
River release pipeline – Pod C Carpark HDD cofferdam pit	Shaft	0.2	4.6	0.1
River release pipeline – Meadowbank Park HDD pit 1	Shaft	1	0.5	1
River release pipeline – Meadowbank Park HDD pit 2	Shaft	1	0.5	1

Notes: Drawdown extent applies to individual 25 m trench subsections

8.2.3 Brine and transfer pipelines

Table 8-5 provides the predicted groundwater drawdown extent, measured from the edge of each excavation, to excavations anticipated to intercept groundwater along the brine and transfer pipelines.

Table 8-5: Predicted groundwater drawdown to excavations - brine and transfer pipelines

Project Element	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Anticipated drawdown extent (m)
Brine and transfer alignment – trench 1 Rosehill Gardens Racecourse to Camellia pumping station	Trench	1	2	17
Brine and transfer alignment – Rosehill Gardens Racecourse overflow carpark HDD pit 1	Shaft	1	0.5	1
Brine and transfer alignment – Rosehill Gardens Racecourse overflow carpark HDD pit 2	Shaft	1	0.5	1
Brine and transfer alignment – Rosehill Gardens Racecourse overflow carpark HDD pit 3	Shaft	1	0.5	1

Notes: Drawdown extent applies to individual 20 m trench subsections

8.2.4 Camellia pumping station

Table 8-6 provides the predicted groundwater drawdown extent, measured from the edge of each excavation, to excavations anticipated to intercept groundwater at Camellia pumping station.

Sheet pile walls were assumed to be used during excavation of the trench that connects the transfer pipelines to existing structures at the pumping station. The anticipated drawdown extent was, therefore, calculated based on a 90% reduction in groundwater inflow volume. Should sheet pile walls not be applied, the anticipated drawdown extent at these locations would be larger.

Table 8-6: Predicted groundwater drawdown to excavations – Camellia pumping station

Project Element	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Anticipated drawdown extent (m)
Transfer pipeline connection at Camellia pumping station	Trench	0.1	5	0.1
Brine pipeline connection at Camellia pumping station	Trench	0.1	4.5	0.1

8.2.5 Brine pipeline (relined section)

Table 8-7 provides the predicted groundwater drawdown extent, measured from the edge of each excavation, to excavations anticipated to intercept groundwater along the relined section of the brine pipeline.

Table 8-7: Predicted groundwater drawdown to excavations – relined section of the brine pipeline

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Anticipated drawdown extent (m)
Access point 1	Relining access point	0.1	3.4	7
Access point 2	Relining access point	0.1	3.4	7
Access point 3	Relining access point	0.1	3.1	6
Access point 4	Relining access point	0.1	2.8	5
Access point 5	Relining access point	0.1	2.6	4
Access point 6	Relining access point	0.1	2.4	3
Access point 7	Relining access point	0.1	2.2	3
Access point 8	Relining access point	0.1	1.9	2
Access point 9	Relining access point	0.1	N/A – pipe access above ground	
Access point 10	Relining access point	0.1	2.3	3
Access point 11	Relining access point	0.1	5.7	14
Access point 12	Relining access point	0.1	5.0	12
Access point 13	Relining access point	0.1	3.8	8
Access point 14	Relining access point	0.1	2.3	3
Access point 15	Relining access point	0.1	1.6	1
Access point 16	Relining access point	0.1	0.3	1
Access point 17	Relining access point	0.1	1.2	4
Access point 18	Relining access point	0.1	1.9	2
Access point 19	Relining access point	0.1	1.5	1
Access point 20	Relining access point	0.1	1.6	1
Access point 21	Relining access point	0.1	2.7	4

8.3 Predicted groundwater inflows

The estimated groundwater inflow rates and total volumes at excavations assessed to potentially intercept the water table are summarised in Section 8.3.1, Section 8.2.2, Section 8.3.3 and Section 8.3.4. These sections include estimated inflow rates and total inflow volumes to such excavations at the WRRF, along the river release pipeline, brine and transfer pipelines between the WRRF and Camellia pumping station and the relined section of the brine pipeline between Camellia pumping station and the NSOOS, respectively. Total estimated inflows across the project impact assessment area are summarised in Section 8.3.6.

8.3.1 WRRF

Table 8-8 provides the estimated inflows to excavations anticipated to intercept groundwater at the WRRF.

Table 8-8: Estimated groundwater inflows to excavations - WRRF

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Inflow rate (kL/day)	Duration excavation open to receiving groundwater (days)	Estimated inflow volume (kL)
FWPS 1	Shaft	0.0012	4.4	0.3	14	5
FWPS 2	Shaft	0.0012	4.4	0.3	14	5
River release pipeline - WRRF HDD Pit 1	Shaft	0.0012	0.2	0.02	28	1
River release pipeline - WRRF HDD Pit 2	Shaft	0.0012	0.2	0.02	28	1

8.3.2 River release pipeline

Table 8-9 provides the estimated inflows to excavations anticipated to intercept groundwater along the river release pipeline.

Table 8-9: Estimated groundwater inflows to excavations - river release pipeline

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Reduction factor due to sheet piling (%)	Inflow rate (kL/day)	Duration excavation open to receiving groundwater (days)	Estimated inflow volume (kL)
River release pipeline – trench 1 Carnarvon Street to Silverwater Road	Trench	0.1	1.5	-	2	55	104
River release pipeline – trench 2 Silverwater Road to PDC Park	Trench	0.5	1.5	-	6	55	350
River release pipeline – trench 3 SOPA Pod A carpark to SOPA Pod C carpark	Trench	0.2	4.1	-	13	27	346
River release pipeline – trench 4 Meadowbank Park to river release pipeline outfall header	Trench	0.1	5.5	-	18	34	600
River release pipeline -trench 5 Containing the outfall pipes between the outfall header and the concrete headwall at the river release outfall structure	Trench	1	3	-	106	30 (3 x 20 m sections open for 10 days each)	3,191
River release pipeline – WRRF HDD Pits	Refer Table 8-8						
River release pipeline – Silverwater Rd east shaft	Shaft	0.05	6.5	90	1	60	49
River release pipeline – Silverwater Rd west shaft	Shaft	0.05	6.5	90	1	60	49
River release pipeline – PDC Park HDD pit 1	Shaft	0.04	0.3	-	0.2	34	6

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Reduction factor due to sheet piling (%)	Inflow rate (kL/day)	Duration excavation open to receiving groundwater (days)	Estimated inflow volume (kL)
River release pipeline – PDC Park HDD pit 2	Shaft	0.04	0.3	-	0.2	34	6
River release pipeline – Pod C Carpark HDD cofferdam pit	Shaft	0.2	4.6	90	2	110	197
River release pipeline – Meadowbank Park HDD pit 1	Shaft	1	0.5	-	2	110	229
River release pipeline – Meadowbank Park HDD pit 2	Shaft	1	0.5	-	2	110	229

Notes: Inflow rate applies to individual 25 m trench subsections. Inflow volume is cumulative, and applies to the entire trench length

8.3.3 Brine and transfer pipelines

Table 8-10 provides the estimated inflows to excavations anticipated to intercept groundwater along the brine and transfer pipelines.

Table 8-10: Estimated groundwater inflows to excavations - brine and transfer pipelines

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Inflow rate (kL/day)	Duration excavation open to receiving groundwater (days)	Estimated inflow volume (kL)
Brine and transfer alignment – trench 1 Rosehill Gardens Racecourse to Camellia pumping station	Trench	1	2	16	13	203
Brine and transfer alignment – Rosehill Gardens Racecourse overflow carpark HDD pit 1	Shaft	1	0.5	2	49	102
Brine and transfer alignment – Rosehill Gardens Racecourse overflow carpark HDD pit 2	Shaft	1	0.5	2	49	102
Brine and transfer alignment – Rosehill Gardens Racecourse overflow carpark HDD pit 3	Shaft	1	0.5	2	49	102

Notes: Inflow rate applies to individual 10 m trench subsections. Inflow volume is cumulative, and applies to the entire trench length

8.3.4 Camellia pumping station

Table 8-11 provides the estimated inflows to excavations anticipated to intercept groundwater at Camellia pumping station.

Table 8-11: Estimated groundwater inflows to excavations - Camellia pumping station

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Reduction factor due to sheet piling (%)	Inflow rate (kL/day)	Duration excavation open to receiving groundwater (days)	Estimated inflow volume (kL)
Transfer pipeline connection at Camellia PS	Trench	0.1	5	90	1	90	121
Brine pipeline connection at Camellia PS	Trench	0.1	4.5	90	1	90	114

8.3.5 Brine pipeline (relined section)

Table 8-12 provides the estimated inflows to excavations anticipated to intercept groundwater along the relined section of the brine pipeline.

Table 8-12: Estimated groundwater inflows to excavations – relined section of the brine pipeline

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Inflow rate (kL/day)	Duration excavation open to receiving groundwater (days)	Estimated inflow volume (kL)
Access point 1	Relining access point	0.1	3.4	6	1	6
Access point 2	Relining access point	0.1	3.4	6	1	6
Access point 3	Relining access point	0.1	3.1	5	1	5
Access point 4	Relining access point	0.1	2.8	4	1	4
Access point 5	Relining access point	0.1	2.6	4	1	4
Access point 6	Relining access point	0.1	2.4	4	1	4
Access point 7	Relining access point	0.1	2.2	3	1	3
Access point 8	Relining access point	0.1	1.9	3	7	19
Access point 9	Relining access point	0.1	N/A – pipe access above ground			
Access point 10	Relining access point	0.1	2.3	3	3	10
Access point 11	Relining access point	0.1	5.7	13	1	13
Access point 12	Relining access point	0.1	5.0	10	1	10
Access point 13	Relining access point	0.1	3.8	7	3	21
Access point 14	Relining access point	0.1	2.3	3	4	14
Access point 15	Relining access point	0.1	1.6	2	2	4
Access point 16	Relining access point	0.1	0.3	0.3	1	0.3
Access point 17	Relining access point	0.1	1.2	1	4	6

Excavation ID	Type	Equivalent hydraulic conductivity (m/day)	Estimated head in excavation (m)	Inflow rate (kL/day)	Duration excavation open to receiving groundwater (days)	Estimated inflow volume (kL)
Access point 18	Relining access point	0.1	1.9	3	3	8
Access point 19	Relining access point	0.1	1.5	2	8	16
Access point 20	Relining access point	0.1	1.6	2	2	4
Access point 21	Relining access point	0.1	2.7	4	1	4

8.3.6 Total project construction inflows

The total volume of groundwater inflow to all excavations across the GPOP WCM impact assessment area is estimated to be up to 5.2ML.

The estimated inflows are based on assumptions outlined in Section 8.1.5. There were limited hydraulic properties available for the water bearing materials at the site. The adopted equivalent hydraulic conductivity may give a more conservative estimate of groundwater inflow. Actual inflows may differ if hydrogeological conditions or construction design differs from those assumed in the assessments.

Table 8-13 provides the total estimated Project inflows to excavations.

Table 8-13: Total estimated Project inflows during construction

Project Site	Trenches		Shafts	
	Total inflow volume		Total inflow volume	
	kL	ML	kL	ML
WRRF	-	-	10	0.01
River release pipeline	4,591	4.6	766	0.8
Brine and transfer pipelines	203	0.2	306	0.3
Camellia pumping station	234	0.2	-	-
Brine pipeline (relined section)	-	-	162	0.2
Total	**5,028**	**5**	**1,245**	**1.3**
Grand Total (ML)	**5.2**			

9. Potential construction impacts

The potential construction impacts associated with excavation of project elements identified to interact with groundwater (see Section 7) are outlined in Section 9.1, Section9.2, Section 9.3 and Section 9.3.3.

Figures showing the estimated drawdown extent arising from project dewatering, as well as the mapped location of sensitive groundwater receptors and groundwater quality exceedances are included in Section 9.4.

Project elements with potential construction impacts include shaft and trench excavations. Potential impacts are likely temporary in nature and highly localised to excavation locations. As such, the risk of cumulative impacts arising from project construction is low.

Potential impacts to groundwater quality and sensitive receptors (users, GDEs and/or waterways) associated with the construction of trenchless elements were considered negligible as trenchless drilling methodologies (HDD and micro-tunnelling) will not draw water from the surrounding formation. As discussed in Section 7, trenchless sections of alignment (i.e. HDD/micro-tunnelled tunnels) are not expected to significantly interact with groundwater. HDD sections will be advanced using bentonite drilling muds surrounding the drill head and drill stem. As stable pressure is maintained during drilling, significant groundwater inflow from the surrounding formation is not anticipated. HDD sections are understood to remain open and ungrouted at the surface, meaning that pressure buildup will not occur. As a result, the risk of fracturing the surrounding formation during HDD is low.

Micro-tunnelling construction methods are understood to involve advancing the pipe as the machine is advanced, again preventing significant inflow from the formation.

Additives in the drilling mud also prevent losses to the formation due to increasing the viscosity and density of drilling fluids. The risk of contaminating the existing groundwater environment from the use of drilling muds is therefore also considered negligible.

It is noted that drilling muds/fluids, as well as any dewatered groundwater across project sites will require management as per a Construction Environmental Management Plan (CEMP). Approval to treat/discharge dewatered groundwater and drilling muds/fluids will need to be sought and managed via a Dewatering Management Protocol (DMP).

This report notes several gaps in hydrogeological data, which are summarised in Section 13. Due to gaps in available data, assumptions were adopted to proceed with the assessment of a) groundwater interaction during construction of project elements, and b) potential groundwater drawdown and inflow to project excavations: The assumptions adopted are included in Section 7.1 and Section 8.1.5, respectively. Assumptions adopted provide a conservative (i.e. 'worst case') estimation of groundwater interaction, drawdown and inflow. Where assumptions have been adopted, potential construction impacts associated with these assumptions are, therefore, also conservative ('worst case').

9.1 Groundwater quality - ASS related impacts

Groundwater related impacts to ASS occur when previously saturated soils become exposed to air, allowing material within the soils to oxidise and form sulfuric acid (Jacobs, 2024a). Construction dewatering has the potential to desaturate ASS during excavation due to the lowering of the water table. Groundwater quality within the predicted groundwater drawdown extent may, therefore, be impacted where desaturation of ASS has occurred. The extent of ASS across project sites is summarised in Section 5.5.

The potential impacts to groundwater quality due to the exposure of ASS during construction of project sites are outlined in Section 9.1.1, Section 9.1.2, Section 9.1.3 and Section 9.1.4.

At locations where ASS is encountered during excavation, onsite management of soils and groundwater may be required. Refer to Section 14 for suggested mitigation and management methods.

9.1.1 WRRF

As outlined in Section 5.5, results from the DSI completed at the WRRF indicate that soils at the WRRF below a depth of 1.5 mbgl may be considered ASS (Jacobs, 2024a). As excavation of FWPS 1, FWPS 2 and the river release pipeline HDD pits are proposed to extend below 1.5 mbgl (from the pre-raising ground surface), excavation at these locations may encounter ASS.

The duration of dewatering during excavation of the two FWPS is proposed to last 14 days. 14 days of dewatering is not considered sufficient to mobilise significant concentrations of ASS compounds from soils to groundwater. The potential for ASS related impacts to groundwater quality due to construction of the FWPS at the WRRF are, therefore, considered unlikely.

Based on the groundwater level and adopted excavation depth of the two river release pipeline HDD pits at the WRRF, there is potential for 0.7 m of ASS to be desaturated during excavation. Dewatering of these excavations, therefore, has the potential to cause ASS related impacts to groundwater (i.e., changes to groundwater quality). However, considering the low permeability of the clay fill/alluvium at the site (in the order of 0.0012 m/day), any groundwater that may have been impacted by mobilisation of desaturated ASS compounds is not expected to extend significantly beyond the vicinity of each excavation.

All other excavation works will be completed within the raised section of the site. As such, no ASS impacts to groundwater quality are anticipated.

9.1.2 River release pipeline

Results for the DSI completed along the river release pipeline indicate the potential presence of ASS along the river release pipeline at four locations (Jacobs, 2025f). Two of these locations (RRP-BH-111 and RRP-BH-116) are situated along the open trenched section between Silverwater Road and PDC Park, with RRP-BH-116 located in PDC Park. One location (RRP-BH-129) is situated along the open trenched section in Meadowbank. One location (RRP-BH-118) overlies a proposed HDD section.

Noting that the ASS testing methodology in the DSI was limited and that results should be confirmed with further site investigation (Jacobs, 2025f), it is possible that excavation may encounter ASS at the following locations:

- Open trench section 2 – between Silverwater Road and PDC Park
- The two PDC Park HDD pits
- Open trench section 4 and 5 – between Meadowbank Park and Parramatta River near John Whitton Bridge

As outlined in Section 3.2, excavation of the open trenched sections was proposed to be undertaken in 25 m sections, with each 25 m section being constructed (excavated and backfilled) in one day. Duration of dewatering will, therefore, also be limited to a maximum of one day (per 25 m section), which is not considered sufficient to mobilise ASS compounds from soils to groundwater. ASS related impacts to groundwater quality along open trenched sections of the river release pipeline are, therefore, considered unlikely.

As outlined in the groundwater drawdown and inflow assessment (see Section 8), 0.3 m of groundwater drawdown (estimated head in the excavation) with an associated drawdown radius of 1 m was estimated for each PDC Park HDD pit. Therefore, there is potential for up to 0.3 m of ASS to be desaturated. Possible impacts to groundwater are, therefore, limited and are not anticipated to extend beyond the immediate vicinity of the PDC Park HDD pits.

9.1.3 Brine and transfer pipeline alignment and Camellia pumping station

Available data does not indicate the presence of ASS along the brine and transfer pipelines, or at Camellia pumping station. As such, no ASS related impacts to groundwater are anticipated at these project sites.

9.1.4 Brine pipeline (relined section)

There was no ASS data available along the relined section of the brine pipeline between Camellia pumping station and the NSOOS. A review of ASS Risk Mapping (see Section 5.5.4) indicated a high probability of ASS at/near ground surface along a portion of Vineyard Creek where it joins the Parramatta River. It is, therefore, considered that ASS may occur at these locations, and that excavation of brine pipeline access points 7 and 8 may encounter ASS.

Given the duration of excavation dewatering at these locations ranges between 1 to 8 days, mobilisation of ASS compounds from soils to groundwater is considered unlikely. As such the risk to groundwater quality from potential ASS desaturation during relining works along the brine pipeline is considered low.

9.2 Groundwater quality - contamination

Construction dewatering has the potential to cause the following contaminated related impacts to groundwater quality through the following mechanisms:

- Contaminated groundwater inflow to excavations may be an issue due to mobilisation of contaminants from surrounding groundwater or soils (including ASS as detailed in Section 9.1). Contaminated dewatered groundwater may pose (1) a health risk to workers, and (2) require management/treatment prior discharge or removal from site. Mitigation measures are summarised in Section 14
- The excavations may act as a groundwater sink, causing surrounding contaminated groundwater (where present) to flow towards the excavation. This groundwater movement has the potential to cause groundwater to flow towards the excavation that is of a different quality than existing background conditions, potentially contaminating aquifers and impacting groundwater users

Discussion of potential contamination related groundwater quality impacts at project sites is provided in Section 9.2.1, Section 9.2.2, Section 9.2.3, Section 9.2.4 and Section 9.2.5. A comparison of dewatered groundwater quality against discharge criteria is included in Section 10.

All assessments of potential contamination related groundwater quality impacts are made with reference to adopted SAC and DSI analytical results. Adopted SAC were based on the SAQP developed by Jacobs (2024c) and are outlined in Section 5.10.1. Groundwater quality analytes at project sites are discussed in Section 5.10 (Jacobs, 2024a; Jacobs, 2025f; Jacobs, 2025g).

9.2.1 WRRF

At the WRRF, identified contaminants (see Table 5-9) have the potential to impact groundwater quality during dewatering of:

- Two large pumping stations (FWPS 1 and FWPS 2)
- The two river release pipeline HDD pits located at the WRRF

All other excavation works will be completed within the raised area. As such, no contaminated related groundwater quality impacts are anticipated for other excavation works at the WRRF.

Considering the low permeability of the clay fill/alluvium at the WRRF (in the order of 0.0012 m/day) and the small magnitude of drawdown associated with excavations (between 0.1 m and 2 m from the edge of each excavation), groundwater is not expected to be drawn from distances beyond the immediate vicinity of each excavation. As such, disruption to existing regional groundwater quality or groundwater quality at the WRRF site is not anticipated to be affected by dewatering.

Given the low hydraulic conductivity of aquifer material, the risk of disrupting groundwater flow regimes is also considered low. Changes to existing patterns of contaminant migration due to excavation dewatering are, therefore, not anticipated.

Further, the relatively short duration of dewatering (14 days to 28 days) is not considered sufficient for the mobilisation of significant concentrations of contaminants from soils. Dewatered groundwater is, therefore, considered to likely be of similar quality to the existing groundwater quality at the site.

Groundwater quality results from wells upgradient to, or in the vicinity of, excavation locations were considered representative of the quality of groundwater that may require dewatering. Heat maps prepared as part of the DSI undertaken by Jacobs at the WRRF (Jacobs, 2024a) were also screened to verify the potential quality of dewatered groundwater at excavation locations. Heat maps are included in Appendix B.

Note that, due to the heterogeneous nature of ground and groundwater contamination at the site, there remains some uncertainty as to the exact concentrations of groundwater contaminants likely to be encountered during dewatering.

Table 9-1 summarises the CoPCs that may be present in dewatered groundwater at FWPS 1, FWPS 2 and the river release pipeline HDD pits located at the WRRF. The groundwater monitoring wells included in the quality assessment at each location are also included in Table 9-1.

The full analytical groundwater quality results at the WRRF are presented in Table 5-9 (Section 5.10.2).

Table 9-1: Summary of groundwater contaminants at proposed excavation locations - WRRF

Project Element	Estimated inflow rate (kL/day)	Duration of dewatering (days)	Estimated inflow volume (kL)	CoPCs	Concentration (µg/L)	Observation wells
FWPS 1	0.3	14	5	Copper	2 to 15	WRRF-GW-110, WRRF-GW-101, WRRF-GW-107, WRRF-GW-117, WRRF- GW-108
				Lead	6	
				Nickel	43 to 131	
				Zinc	133 to 286	
				Phenanthrene	2.3	
				Toluene	258	
				pH	4.18 to 6.11	
FWPS 2	0.3	14	5	Copper	6	WRRF-GW-108, WRRF-GW-109, WRRF-BH-104, WRRF-GW-118
				Lead	6	
				Nickel	10 to 71	
				Zinc	84 to 245	
				Naphthalene	348	
				Phenanthrene	2.3 to 31.9	
				TPH C10-C36 (Sum of total)	4,530	
				pH	4.18 to 6.11	
				PFOS	0.02	

Project Element	Estimated inflow rate (kL/day)	Duration of dewatering (days)	Estimated inflow volume (kL)	CoPCs	Concentration (µg/L)	Observation wells
River release pipeline – WRRF HDD Pit 1	0.02	28	1	Copper	3 to 11	WRRF-GW-112, WRRF-BH-106, WRRF-BH-105, WRRF-GW-116
				Lead	7 to 8	
				Nickel	56 to 78	
				Zinc	31 to 1,600	
				Phenanthrene	1.5	
				TPH C10-C36	970 to 1,140	
				pH	4.18 to 6.11	
				PFOS	0.02	
River release pipeline – WRRF HDD Pit 2	0.02	28	1	Copper	3 to 11	
				Lead	7 to 8	
				Nickel	56 to 78	
				Zinc	31 to 1,600	
				Phenanthrene	1.5	
				TPH C10-C36	970 to 1,140	
				pH	4.18 to 6.11	
				PFOS	0.02	

Notes: CoPCs – contaminants of potential concern

9.2.2 River release pipeline

Along the river release pipeline, groundwater contaminants (see Section 5.10.3) may be encountered during dewatering of:

- Trench 1 – from Carnarvon Street to Silverwater Road
- Trench 2 – from Silverwater Road to PDC Park
- Trench 3 – from SOPA Pod A carpark to SOPA Pod C carpark
- Trench 4 – from Meadowbank Park to the river release pipeline outfall header
- Trench 5 – containing the outfall pipes between the outfall header and the concrete headwall at the river release outfall structure
- The two HDD pits located at the WRRF (see Section 9.2.1 for discussion)
- The micro-tunnel shafts located on Derby Street to east and west of Silverwater Road
- The two HDD pits located at PDC Park
- The HDD cofferdam pit located at SOPA Pod C Carpark
- The two HDD pits located at Meadowbank Park

As outlined in Section 3.2, excavation of the open trenched sections (trenches 1 to 4) is proposed to be undertaken in 25 m sections, with each 25 m section being constructed (excavated and backfilled) in one day. The duration of dewatering will, therefore, also be limited to a maximum of one day (for each 25 m section).

One day of dewatering is not considered sufficient to draw significant concentrations of contaminants from areas beyond the immediate vicinity of each 25 m trench section. Disruption to existing regional groundwater quality, gradients or flow patterns are also considered unlikely due to the short duration of dewatering. Mobilisation of additional contaminants from soils is also considered unlikely.

Drawdown associated with excavation of the PDC Park HDD pits and Meadowbank Park HDD pits is expected to be of small magnitude and localised (1 m from the edge of each excavation). The risk of altering regional groundwater quality is, therefore, considered low as groundwater is not expected to be drawn from distances beyond 1 m. Changes to existing groundwater gradients or flow regimes are also not anticipated.

As sheet piles are proposed to be used at the two micro-tunnel shafts alongside Silverwater Road and at the SOPA Pod C cofferdam pit, groundwater dewatering is considered to be likely of small magnitude and highly localised. Groundwater dewatering and drawdown is, therefore, not expected to detrimentally effect groundwater quality in the vicinity of these excavations. Where similar construction methods are adopted at other HDD pit locations across the river release pipeline, the risk of groundwater quality impacts would also be reduced.

Groundwater quality results from the closest sampled well to each excavation were assumed to be representative of the quality of dewatered groundwater. It is noted that groundwater quality sampling along the river release pipeline was only conducted at five locations. Understanding of the permeability and properties of aquifer materials at excavation locations is also limited as permeability testing was not completed (see Section 13 for data gaps). The exact concentrations of groundwater contaminants that may be encountered during dewatering along the river release pipeline is, therefore, uncertain.

Table 9-2 summarises the CoPCs that may be present in dewatered groundwater at excavations along the river release pipeline. The groundwater monitoring wells included in the quality assessment at each location are also included in Table 9-2.

CoPCs are based on exceedances against adopted SAC (see Section 5.10.1). Groundwater quality results along the river release pipeline are summarised in Section 5.10.3. The analytical results table is included in Appendix B.

Table 9-2: Summary of groundwater contaminants at proposed excavation locations - river release pipeline

Project Element	Estimated inflow rate (kL/day)	Duration of dewatering (days)	Estimated inflow volume (kL)	CoPCs	Concentration (µg/L)	Observation wells
River release pipeline – trench 1. Carnarvon Street to Silverwater Road	2	55	104	Cadmium	11	RRP-BH-102, RRP-BH-108
				Copper	63	
				Nickel	12 to 1,880	
				Zinc	31 to 209	
				PFOS	0.0078 to 1.91	
River release pipeline – trench 2. Silverwater Road to PDC Park	6	55	350	N/A. No groundwater quality data available		
River release pipeline – trench 3. SOPA Pod A carpark to SOPA Pod C carpark	13	27	346	Nickel	15	RRP-BH-119, RRP-BH-124
				Ammonia as N	20.5 to 32	
				PFOS	0.0003 to 0.0106	
River release pipeline – trench 4. Meadowbank Park to river release pipeline outfall header	18	34	600	Ammonia as N	1.41	RRP-BH-128
				PFOS	0.006	
River release pipeline – trench 5. Containing the outfall pipes between the outfall header and the concrete headwall at the river release outfall structure	106	30	3,197	N/A. Groundwater quality data not available. No groundwater well installed.		
River release pipeline – WRRF HDD pit 1 and WRRF HDD pit 2	Refer to Table 9-1					
River release pipeline – Silverwater Rd east and west micro-tunnel shafts	1	60	49	Nickel	12	RRP-BH-108
				Zinc	31	
				PFOS	0.0078	

Project Element	Estimated inflow rate (kL/day)	Duration of dewatering (days)	Estimated inflow volume (kL)	CoPCs	Concentration (µg/L)	Observation wells
River release pipeline – PDC Park HDD pit 1 and pit 2	0.2	34	6	N/A. No groundwater quality data available		
	0.2	34	6			
River release pipeline – Pod C Carpark HDD cofferdam pit	2	110	197	Ammonia as N	20.5	RRP-BH-124
				PFOS	0.0003	
River release pipeline – Meadowbank Park HDD pit 1 and pit 2	2	110	229	Ammonia as N	1.41	RRP-BH-128
				PFOS	0.006	

9.2.3 Brine and transfer pipelines

Along the brine and transfer pipelines, identified contaminants in groundwater may be encountered during dewatering of the open trenched section between Rosehill Gardens Racecourse and Camellia pumping station. As noted in Section 5.10.4, identified contaminants were limited to PFOS (reported to exceed SAC in one intralab duplicate sample). All other analytical results were either below LOR or adopted SAC.

Excavation of the open trenched section is proposed to be undertaken in 20 m intervals, with each 20 m section being constructed (excavated and backfilled) in one day (refer to Section 3.2.2 for an outline of proposed works). The duration of dewatering will, therefore, also be limited to a maximum of one day (for each 20 m section).

One day of dewatering is not considered sufficient to draw significant concentrations of contaminants from areas beyond the immediate vicinity of each 20 m trench section. Disruption to existing regional groundwater quality, gradients or flow patterns are also considered unlikely due to the short duration of dewatering. Mobilisation of additional contaminants from soils is also considered unlikely.

To assess the quality of dewatered groundwater along the brine and transfer pipelines, analytical results from INF-BH-102 were assumed to be representative. It is noted that groundwater quality sampling was only conducted at this location. Understanding of the permeability and properties of aquifer materials along the brine and transfer pipelines is also limited as permeability testing was not completed (see Section 13 for data gaps). The exact concentrations of groundwater contaminants that may be encountered during dewatering is, therefore, uncertain, however results presented in the DSI suggest significant concentrations of contaminant compounds other than PFOS are unlikely.

Table 9-3 summarises the CoPCs that may be present in dewatered groundwater along the open trenched section of the brine and transfer pipelines. CoPCs are based on exceedances against adopted SAC only.

Table 9-3: Summary of groundwater contaminants at proposed excavation locations - brine and transfer pipelines

Project Element	Estimated inflow rate (kL/day)	Duration of dewatering (days)	Estimated inflow volume (kL)	CoPCs	Concentration (µg/L)	Observation wells
Brine and transfer alignment – trench 1. Rosehill Gardens Racecourse to Camellia pumping station	2	13	25	PFOS	0.0004	INF-BH-102
Brine and transfer pipelines – Rosehill Gardens Racecourse overflow carpark HDD pit 1, pit 2 and pit 3	2	49	102	PFOS	0.0004	INF-BH-102
	2	49	102			
	2	49	102			

9.2.4 Camellia pumping station

At Camellia pumping station, identified contaminants in groundwater may be encountered during dewatering of the trenched connection between the transfer pipelines and existing pumping station components.

As sheet piles are proposed to be used along the sides of the open trench, groundwater drawdown is considered to be of small magnitude and highly localised. Groundwater quality beyond the immediate vicinity of the trench is, therefore, not anticipated to be impacted. Groundwater dewatering and drawdown is also not expected to detrimentally effect regional groundwater quality or flow.

For the purposes of assessing the quality of any abstracted groundwater, analytical results from INF-BH-102 were assumed to be representative of quality. INF-BH-102 is the closest sampling location to Camellia pumping station, located approximately 130 m away. Understanding of the permeability and properties of aquifer materials at the pumping station is also limited as permeability testing was not completed (see Section 13 for data gaps). The exact concentrations of groundwater contaminants that may be encountered during dewatering is, therefore, uncertain.

Table 9-4 summarises the CoPCs that may be present in dewatered groundwater at Camellia pumping station. CoPCs are based on exceedances against adopted SAC only.

Table 9-4: Summary of groundwater contaminants at proposed excavation locations - Camellia pump station

Project Element	Estimated	Duration of	Estimated	CoPCs	Concentration	Observation
Brine and transfer pipelines connection at Camellia pumping station	0.002	90	0.1	PFOS	0.0004	INF-BH-102

9.2.5 Brine pipeline (relined section)

As at August 2025, no groundwater quality data was available along the relined section of the brine pipeline.

Along the relined section of the brine pipeline, groundwater is anticipated to be intercepted at 20 of the 21 indicative access points (refer Section 7.6). The estimated drawdown extent due to construction dewatering at these points is expected to be of small magnitude and localised.

Given the anticipated low permeability of material that may be encountered during excavation (hydraulic conductivity of 0.1 m/day) combined with the likely short duration of any dewatering (between 1 and 4 days, with the exception of two access points which may require up to 1 week of dewatering – see Section 8.2.5), drawdown is interpreted to be highly localised to each excavation. The risk of potential regional scale groundwater quality impacts, or changes to existing regional flow regimes is, therefore, considered low.

9.3 Groundwater receptors

Potential impacts (if any) to groundwater users including licenced supply bores, GDEs and HEVAE, or waterways are outlined in Section 9.3.1, Section 9.3.2 and Section 9.3.3, respectively. Licenced groundwater users and GDEs/HEVAE located within 500 m of project infrastructure (WRRF, pipelines or the Camellia pumping station) are identified in Section 5.11. Waterways within the vicinity of the impact assessment area are summarised in Section 5.12.3.

9.3.1 Licenced groundwater users (supply bores)

The estimated drawdown due to construction dewatering at project excavations (shafts or trenches) does not extend to the identified licenced groundwater user (supply bore). As such, no construction impacts to licenced groundwater users due to excavation dewatering are anticipated.

9.3.2 GDEs and HEVAE

The estimated drawdown due to construction dewatering of project excavations (shafts or trenches) does not extend to any areas mapped as either potential GDEs (BoM, 2024a) or HEVAEs (NSW Government and DCCEEW, 2024). Where drawdown does not extend to any GDEs or HEVAEs, no impacts to these ecosystems are anticipated as a result of construction dewatering.

9.3.3 Wetlands

As the Narawang and Nuri wetlands are lined it is considered unlikely that they interact with the regional groundwater system. Further, the river release pipeline is to be constructed by trenchless methods at depths greater than 20 m beneath the ground surface at the wetland areas. The estimated drawdown from HDD shaft excavations does not extend to any wetlands. As such, no impacts to wetland ecosystems are anticipated as a result of groundwater related construction activities.

9.3.4 Waterways and riparian lands

No impacts to waterways or riparian lands as a result of project dewatering are expected.

The estimated drawdown extent induced by construction dewatering at project shafts and trenches does not extend to any identified waterways or riparian lands.

Changes to existing patterns of contaminant migration due to excavation dewatering at the WRRF are not anticipated due to low aquifer permeability and the small magnitude of groundwater drawdown at the site. As such, dewatering at the WRRF is not expected to significantly alter the existing water quality in Duck Creek.

No impacts to groundwater dependent surface flows are expected. Considering the assumed low hydraulic conductivity of saturated fill, alluvial and residual soil units, groundwater flow to surface water is anticipated to be very low. It is unlikely for perceptible change to waterway quality or levels to occur during the construction time frame.

The potential for geotechnical settlement to waterways associated with project construction is considered limited. Pipelines that cross waterways will be constructed using HDD at a depth of more than about 20 m below the existing surface level. The assumed strength of the formation at this depth as well as the pressure maintained by the drilling muds used during the HDD passes are considered sufficient to prevent settlement during construction. Additionally, no settlement is expected post-construction.

9.4 Figures – potential drawdown and construction impacts

This section includes figures that show the drawdown extent from project excavations estimated from the analytical assessment. Figures include the location of sensitive groundwater receptors, as well as groundwater quality exceedance results. The figures demonstrate that estimated drawdown from project dewatering does not extend to any areas of mapped GDEs, licenced groundwater users or waterways. The figures validate the finding that construction impacts (if any) are unlikely to occur beyond the immediate vicinity (i.e. drawdown area) of each excavation.

No drawdown potential or impacts are expected in the south-east corner of the WRRF site (closest to Duck River) so no figure for this area has been provided.

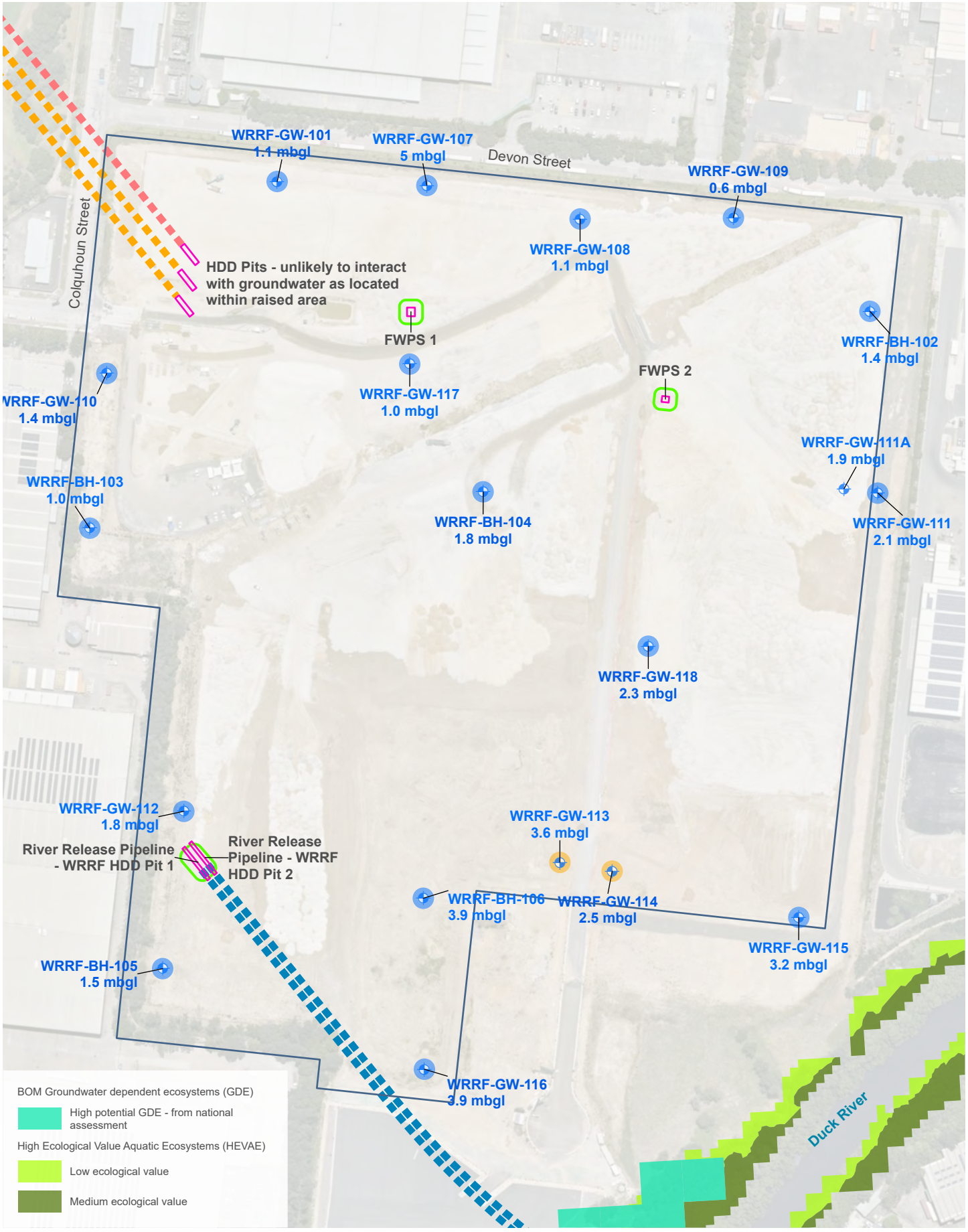
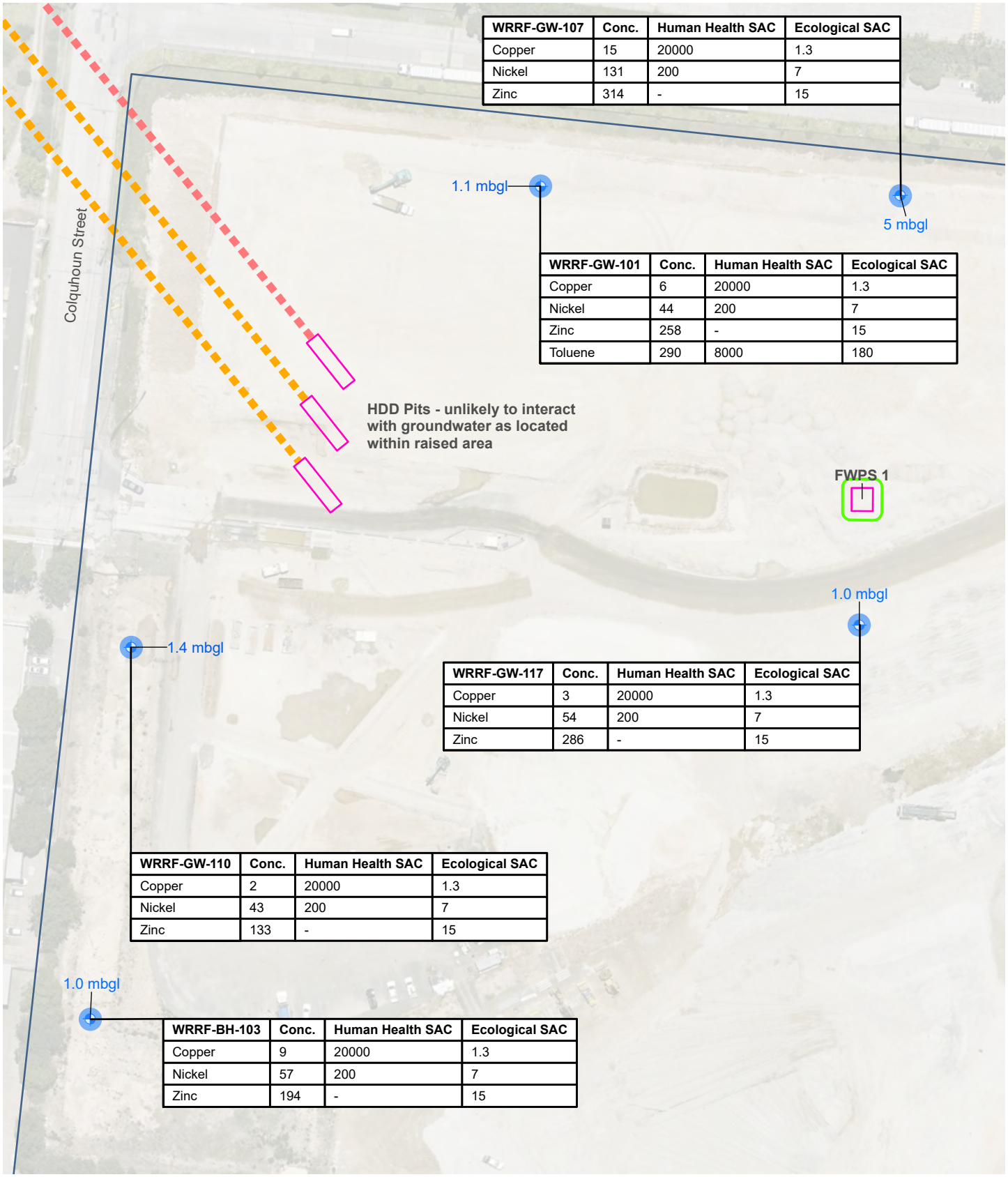


Figure 9-1 Estimated drawdown and potential impacts - WRRF (1 of 4)



WRRF-GW-107	Conc.	Human Health SAC	Ecological SAC
Copper	15	20000	1.3
Nickel	131	200	7
Zinc	314	-	15

WRRF-GW-101	Conc.	Human Health SAC	Ecological SAC
Copper	6	20000	1.3
Nickel	44	200	7
Zinc	258	-	15
Toluene	290	8000	180

WRRF-GW-117	Conc.	Human Health SAC	Ecological SAC
Copper	3	20000	1.3
Nickel	54	200	7
Zinc	286	-	15

WRRF-GW-110	Conc.	Human Health SAC	Ecological SAC
Copper	2	20000	1.3
Nickel	43	200	7
Zinc	133	-	15

WRRF-BH-103	Conc.	Human Health SAC	Ecological SAC
Copper	9	20000	1.3
Nickel	57	200	7
Zinc	194	-	15

Camellia-Rosehill WRRF
Indicative shaft locations
Estimated drawdown - shaft excavations

Brine and influent pipelines
HDD (Trenchless)
Transfer pipeline
HDD (Trenchless)

Groundwater well

Site assessment criteria (SAC)
Exceeds ecological SAC

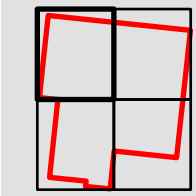
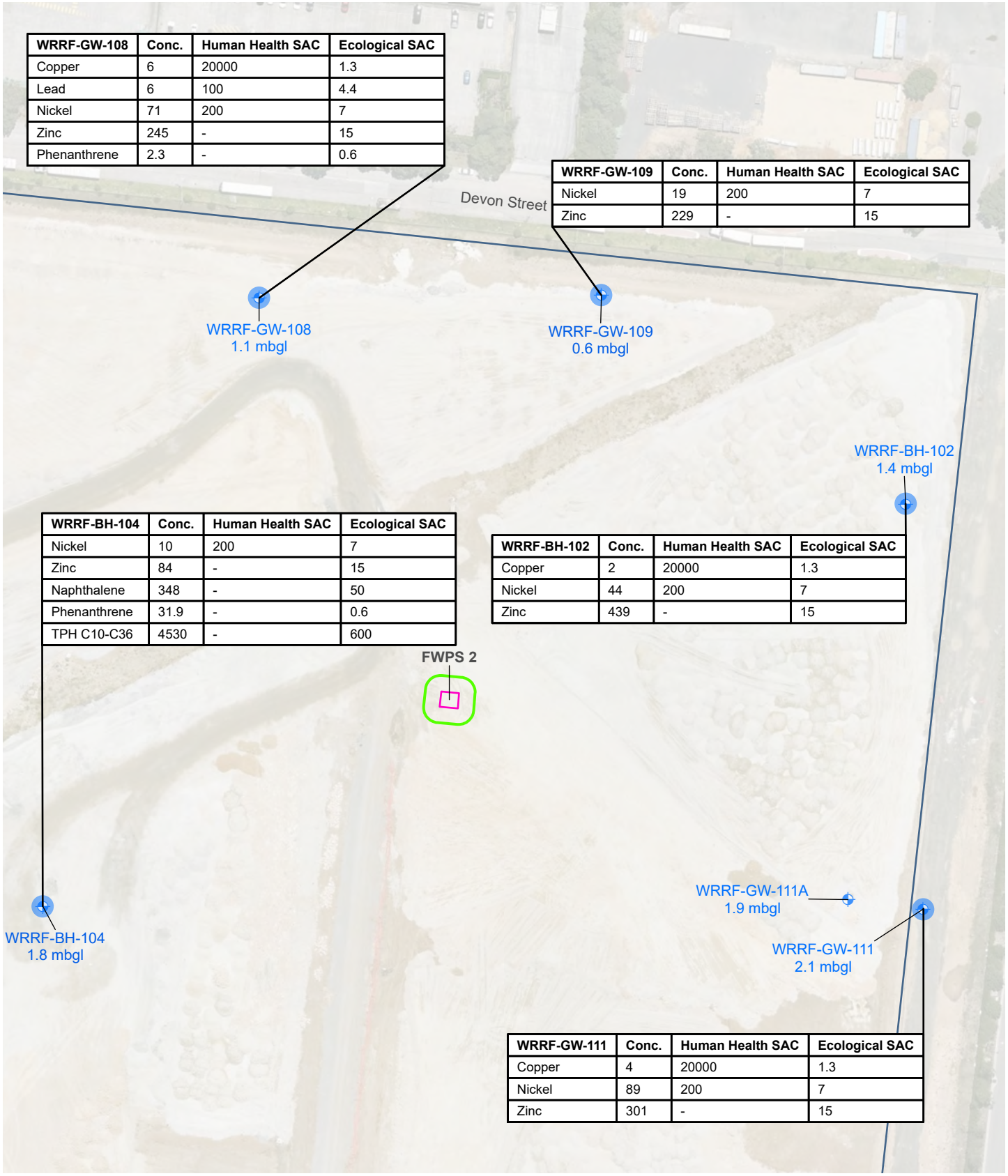


Figure 9-2 Estimated drawdown and potential impacts - WRRF (2 of 4)

0 50 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025
Scale: 1:1,300 @ A4
GDA2020 MGA Zone 56

N



WRRF-GW-108	Conc.	Human Health SAC	Ecological SAC
Copper	6	20000	1.3
Lead	6	100	4.4
Nickel	71	200	7
Zinc	245	-	15
Phenanthrene	2.3	-	0.6

WRRF-GW-109	Conc.	Human Health SAC	Ecological SAC
Nickel	19	200	7
Zinc	229	-	15

WRRF-BH-104	Conc.	Human Health SAC	Ecological SAC
Nickel	10	200	7
Zinc	84	-	15
Naphthalene	348	-	50
Phenanthrene	31.9	-	0.6
TPH C10-C36	4530	-	600

WRRF-BH-102	Conc.	Human Health SAC	Ecological SAC
Copper	2	20000	1.3
Nickel	44	200	7
Zinc	439	-	15

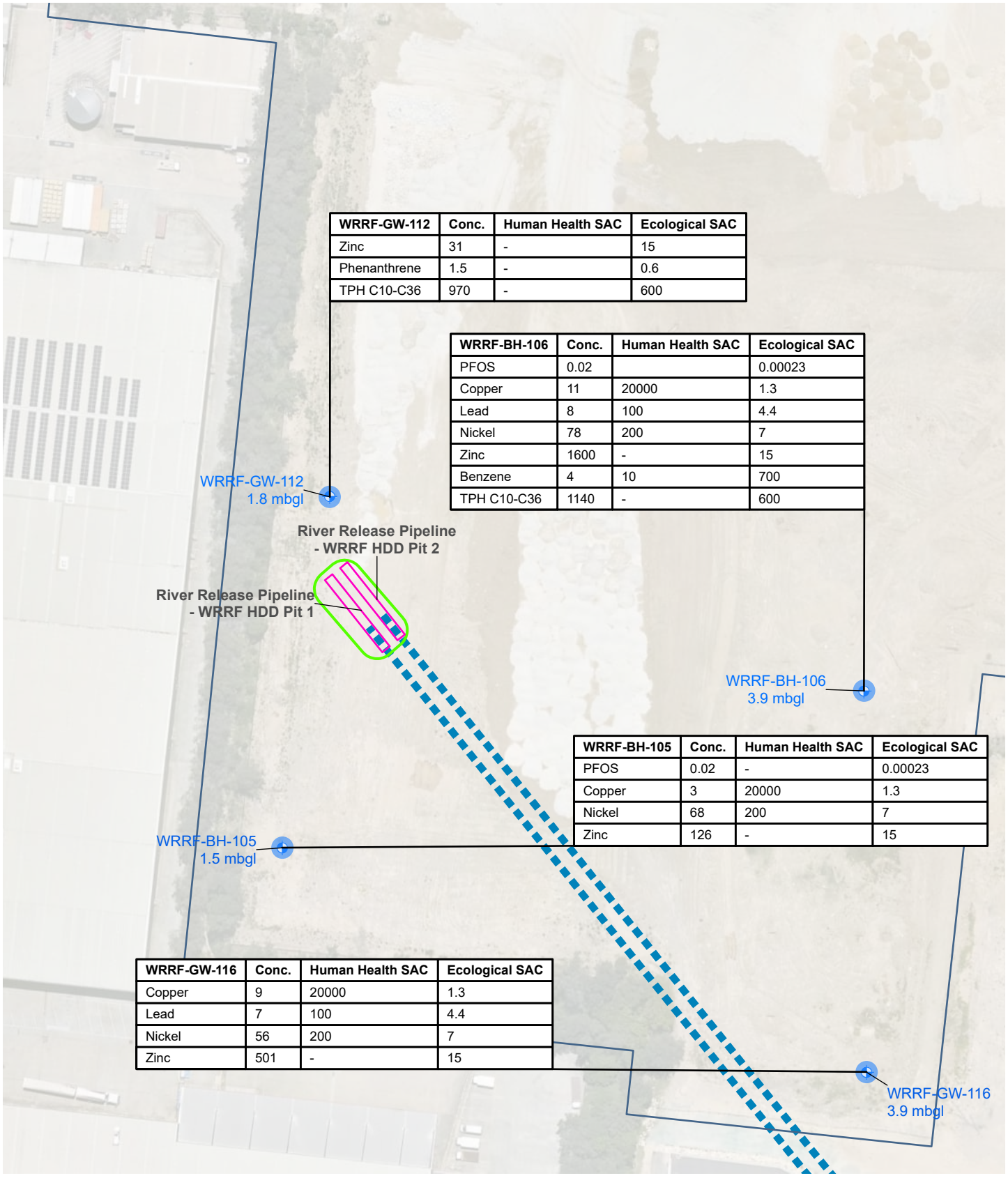
WRRF-GW-111	Conc.	Human Health SAC	Ecological SAC
Copper	4	20000	1.3
Nickel	89	200	7
Zinc	301	-	15

Camellia-Rosehill WRRF
Indicative shaft locations
Estimated drawdown - shaft excavations
Groundwater well
Site assessment criteria (SAC)
Exceeds ecological SAC

Figure 9-3 Estimated drawdown and potential impacts - WRRF (3 of 4)

0 50 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025
Scale: 1:1,400 @ A4
GDA2020 MGA Zone 56



WRRF-GW-112	Conc.	Human Health SAC	Ecological SAC
Zinc	31	-	15
Phenanthrene	1.5	-	0.6
TPH C10-C36	970	-	600

WRRF-BH-106	Conc.	Human Health SAC	Ecological SAC
PFOS	0.02		0.00023
Copper	11	20000	1.3
Lead	8	100	4.4
Nickel	78	200	7
Zinc	1600	-	15
Benzene	4	10	700
TPH C10-C36	1140	-	600

WRRF-BH-105	Conc.	Human Health SAC	Ecological SAC
PFOS	0.02	-	0.00023
Copper	3	20000	1.3
Nickel	68	200	7
Zinc	126	-	15

WRRF-GW-116	Conc.	Human Health SAC	Ecological SAC
Copper	9	20000	1.3
Lead	7	100	4.4
Nickel	56	200	7
Zinc	501	-	15

Camellia-Rosehill WRRF
Indicative shaft locations
Estimated drawdown - shaft excavations

River release pipeline
HDD (Trenchless)

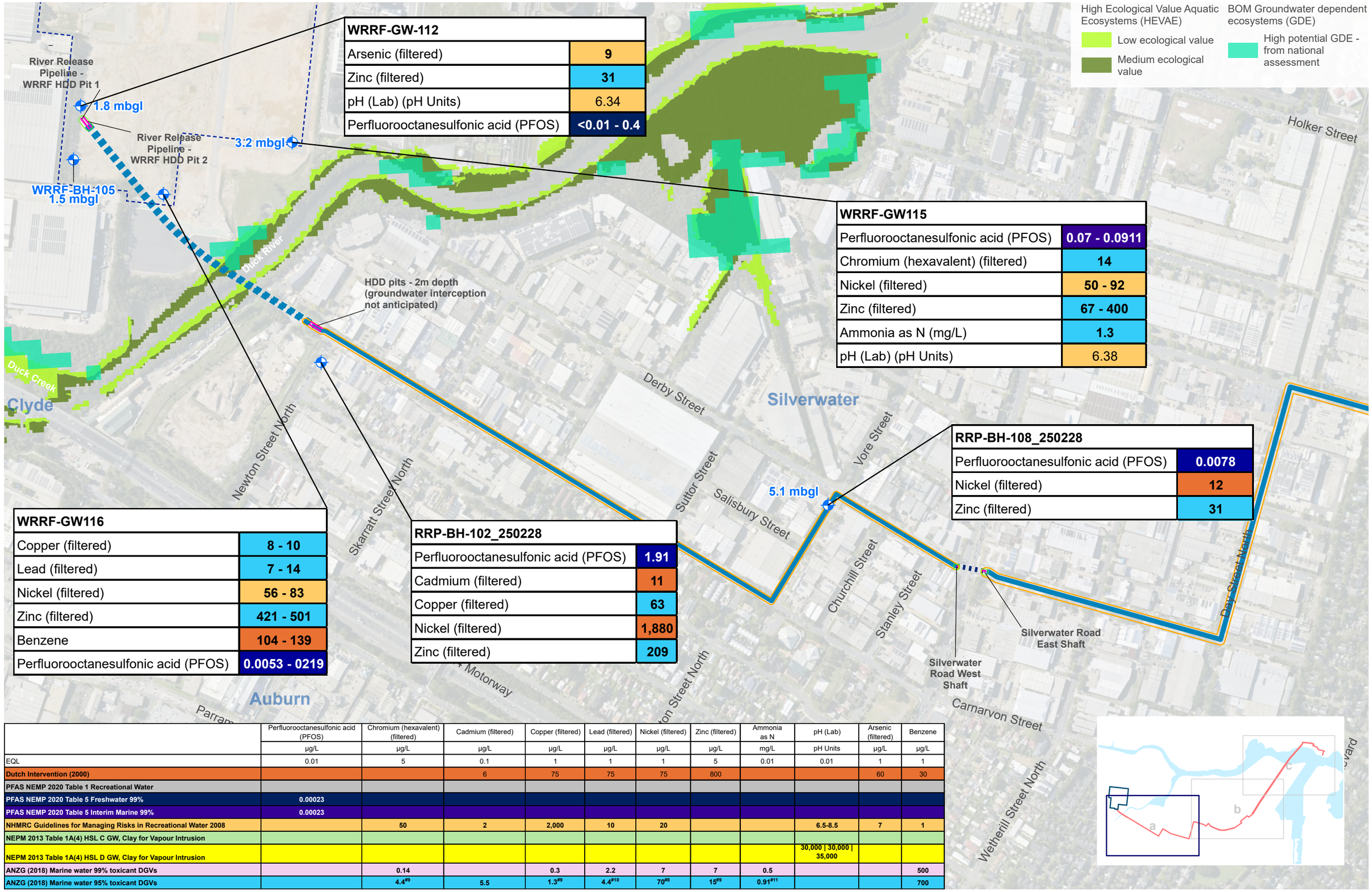
Groundwater well

Site assessment criteria (SAC)
Exceeds ecological SAC

Figure 9-4 Estimated drawdown and potential impacts - WRRF (4 of 4)

0 50 m

Data sources: DCDB/DTDB - NSW DCS 2025
Basemap: MetroMap 2025
Scale: 1:1,400 @ A4
GDA2020 MGA Zone 56



	Perfluorooctanesulfonic acid (PFOS)	Chromium (hexavalent) (filtered)	Cadmium (filtered)	Copper (filtered)	Lead (filtered)	Nickel (filtered)	Zinc (filtered)	Ammonia as N	pH (Lab)	Arsenic (filtered)	Benzene
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	pH Units	µg/L	µg/L
EQL	0.01	5	0.1	1	1	1	5	0.01	0.01	1	1
Dutch Intervention (2000)			6	75	75	75	800			60	30
PFAS NEMP 2020 Table 1 Recreational Water											
PFAS NEMP 2020 Table 5 Freshwater 99%	0.00023										
PFAS NEMP 2020 Table 5 Interim Marine 99%	0.00023										
NHMRC Guidelines for Managing Risks in Recreational Water 2008		50	2	2,000	10	20			6.5-8.5	7	1
NEPM 2013 Table 1A(4) HSL C GW, Clay for Vapour Intrusion											
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion									30,000 | 30,000 | 35,000		
ANZG (2018) Marine water 99% toxicant DGVs		0.14		0.3	2.2	7	7	0.5			500
ANZG (2018) Marine water 95% toxicant DGVs		4.4[#9]	5.5	1.3[#9]	4.4[#10]	70[#8]	15[#9]	0.91[#11]			700

Camellia-Rosehill WRRF

River Release Pipeline
- HDD (Trenchless)
- Microtunnel
- Open trench

Indicative shaft locations

Estimated drawdown - shafts excavations

Estimated drawdown - trench excavations

Existing groundwater monitoring well

Figure 9-5 Estimated drawdown and groundwater quality exceedances - River Release Pipeline (1 of 3)

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2024
Basemap: MetroMap 2024

Scale: 1:6,000 @ A3
GDA2020 MGA Zone 56

N

	Perfluorooctanesulfonic acid (PFOS)	Chromium (hexavalent) (filtered)	Cadmium (filtered)	Copper (filtered)	Lead (filtered)	Nickel (filtered)	Zinc (filtered)	Ammonia as N	pH (Lab)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	pH Units
EQL –	0.01	5	0.1	1	1	1	5	0.01	0.01
PFAS NEMP 2020 Table 5 Freshwater 99%	0.00023								
ANZG (2018) Marine water 95% toxicant DGVs		**4.4[#9]**	**5.5**	**1.3[#9]**	**4.4[#10]**	**70[#8]**	**15[#9]**	**0.91[#11]**	
ANZG (2018) Marine water 99% toxicant DGVs			**0.7[#5]**	**0.3[#6]**	**2.2[#7]**	**7[#5]**	**7[#6]**	**0.5[#8]**	

RRP-QC02_250227	
Perfluorooctanesulfonic acid (PFOS)	0.0065
Nickel (filtered)	17
Ammonia as N	5.37

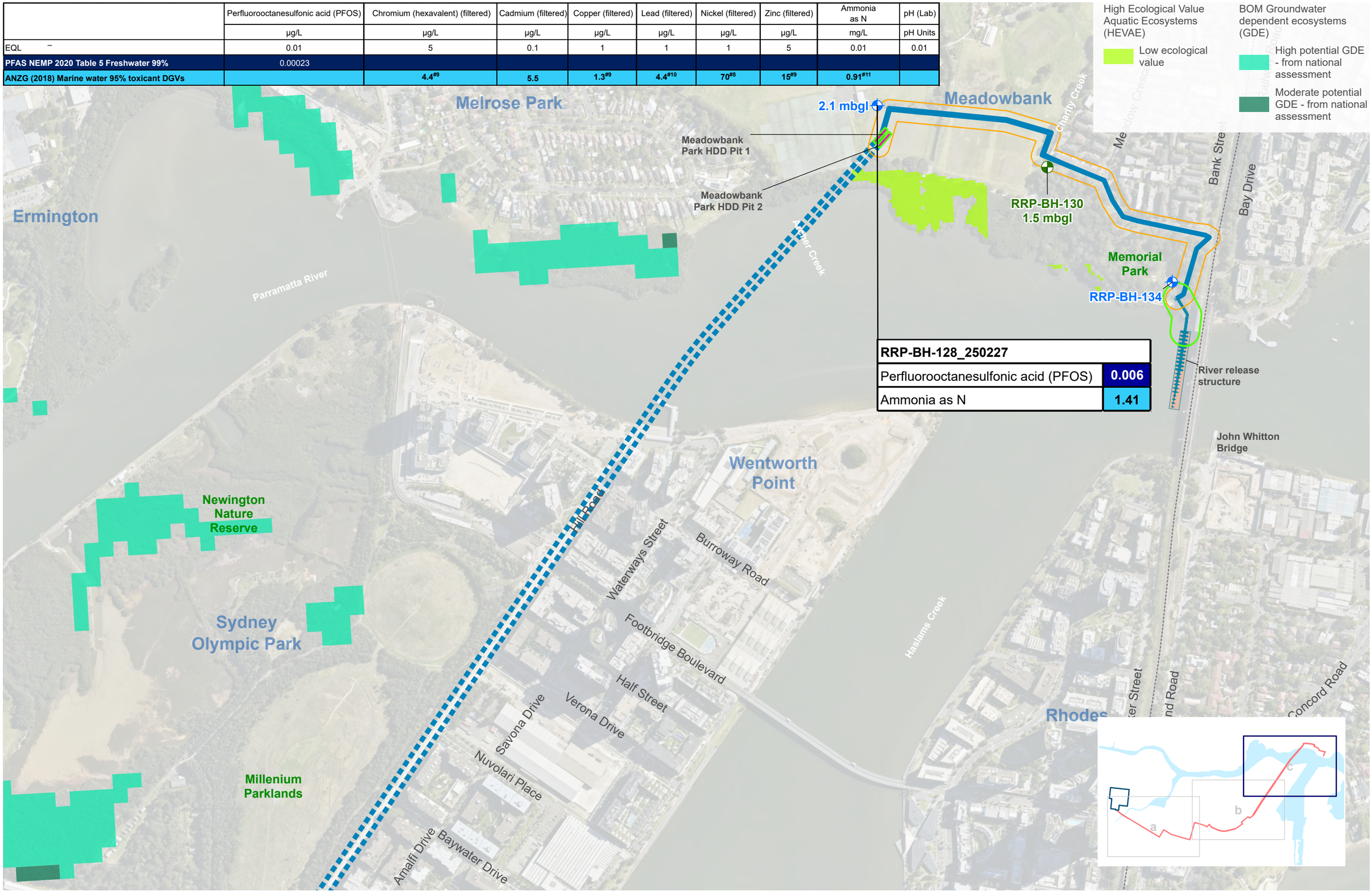
RRP-QC01_250227	
Perfluorooctanesulfonic acid (PFOS)	0.0065
Nickel (filtered)	17
Ammonia as N	5.37

RRP-BH-124_250227	
Perfluorooctanesulfonic acid (PFOS)	0.0003
Ammonia as N	20.5

RRP-BH-119_250227	
Perfluorooctanesulfonic acid (PFOS)	0.0106
Nickel (filtered)	15
Ammonia as N	32

Figure 9-6 Estimated drawdown and groundwater quality exceedances - River Release Pipeline (2 of 3)

	Perfluorooctanesulfonic acid (PFOS)	Chromium (hexavalent) (filtered)	Cadmium (filtered)	Copper (filtered)	Lead (filtered)	Nickel (filtered)	Zinc (filtered)	Ammonia as N	pH (Lab)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	pH Units
EQL	0.01	5	0.1	1	1	1	5	0.01	0.01
PFAS NEMP 2020 Table 5 Freshwater 99%	0.00023								
ANZG (2018) Marine water 95% toxicant DGVs		**4.4[#9]**	**5.5**	**1.3[#9]**	**4.4[#10]**	**70[#8]**	**15[#9]**	**0.91[#11]**	



River Release Pipeline
- HDD (Trenchless)
- Open trench

- Indicative shaft locations
- Estimated drawdown - shafts excavations
- Estimated drawdown - trench excavations
- Existing groundwater monitoring well
- Pavement hole

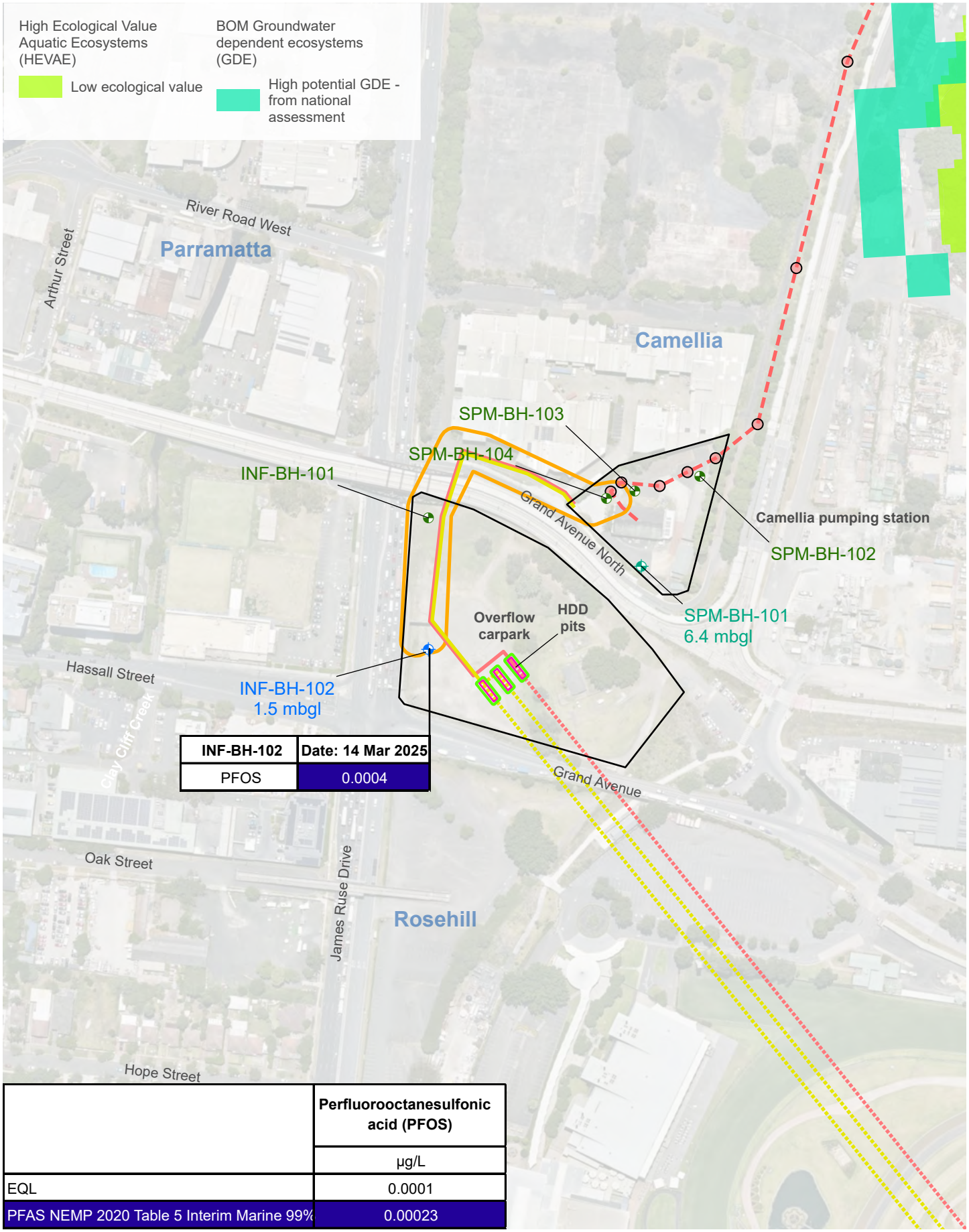
River release structure
- Concrete mattress
- Geosynthetic concrete mattress or textile
- River release structure

Figure 9-7 Estimated drawdown and groundwater quality exceedances - River Release Pipeline (3 of 3)

0 200 400 600 m

Data sources: DCDB/DTDB - NSW DCS 2024
Basemap: MetroMap 2024
Scale: 1:6,000 @ A3
GDA2020 MGA Zone 56

N



	Perfluorooctanesulfonic acid (PFOS)
	µg/L
EQL	0.0001
PFAS NEMP 2020 Table 5 Interim Marine 99%	0.00023

Figure 9-8 Estimated drawdown and potential impacts brine and transfer main alignment and Camellia pumping station

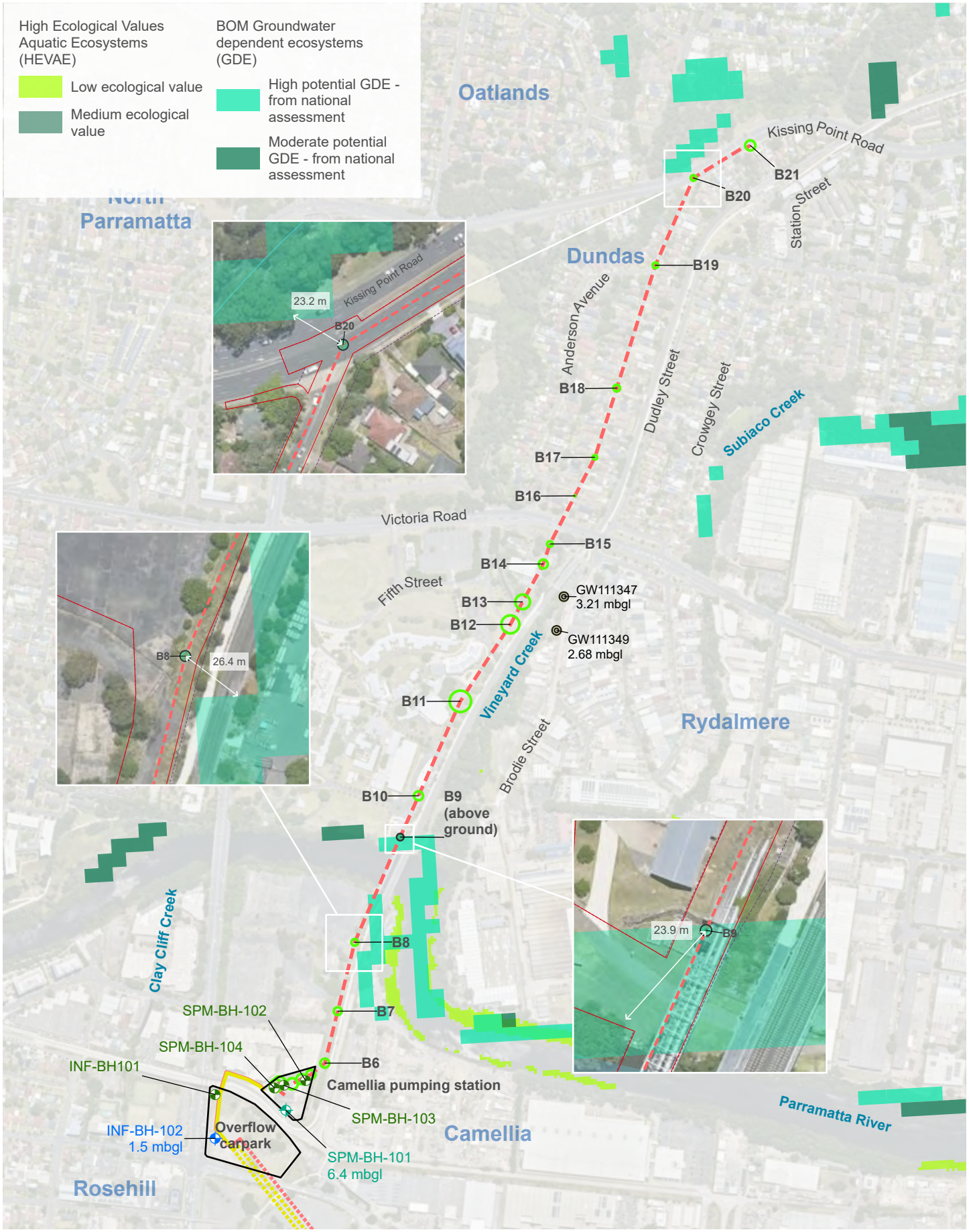


Figure 9-9 Estimated drawdown and potential impacts - relined section of the brine pipeline

9.5 Aquifer Interference Policy (AIP) minimum impacts considerations

The GPOP WCM impact assessment area lies within the Sydney Basin Central Groundwater Source of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (2023). Any minor groundwater within alluvium or residual soils overlying the porous rock is considered to be in hydraulic connection with and part of the porous rock groundwater source. Therefore, we have assumed that the lesser productive alluvium (AIP, 2012) does not have an assigned extraction limit, and any 'take' would come from the underlying porous rock source.

The aquifers in the vicinity of the project components are classed as "less productive groundwater sources". An assessment of the project construction phase against the NSW AIP Minimal Impact Considerations for less productive porous and fractured rock groundwater sources is provided in Table 9-5.

Project construction impacts to groundwater meets with the Level 1 Minimal Impact Considerations, and potential project impacts to groundwater are, therefore, acceptable with respect to the NSW AIP.

Table 9-5: Minimal Impact Considerations - Construction

Less Productive Porous and Fractured Rock Groundwater Source

Minimal Impact Consideration	Response
Water Table 1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan; or A maximum of a 2 m decline cumulatively at any water supply work.	Meets level 1 consideration. No decline in water level due to the project is predicted at any high priority groundwater dependent ecosystem, culturally significant site or water supply work.
Water Pressure 1. A cumulative pressure head decline of not more than 40% of the "post-water sharing plan" pressure head above the base of the water source to a maximum of a 2 m decline, at any water supply work	Meets level 1 consideration. No decline in water pressure due to the project is predicted at any water supply work.
Water Quality 1. (a) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity; and (b) No increase of more than 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity. (c) No mining activity to be below the natural ground surface within 200 m laterally from the top of high bank or 100 m vertically beneath (or the three dimensional extent of the alluvial water source - whichever is the lesser distance) of a highly connected surface water source that is defined as a "reliable water supply".	Meets level 1 consideration. (a) The project is not anticipated to result in a change to the beneficial use category of the groundwater source. (b) The project is not anticipated to increase long-term average salinity by more than 1% in surface water sources (c) There are no highly connected surface water sources in the vicinity of the project defined as a "reliable water supply".

10. Discharge/disposal of dewatered groundwater

Due to the levels of groundwater contamination reported across project sites, abstracted groundwater is not likely to be of suitable quality for discharge direct to the environment or via stormwater. However this will be confirmed during detailed design and opportunities to use groundwater for dust suppression or to treat and discharge to stormwater will be identified and prioritised where possible. Where groundwater is not suitable for reuse or discharge to stormwater, disposal will be required. Options for disposal are either via discharge to sewer under a trade waste agreement with Sydney Water or disposal via a third party commercial licenced waste facility.

For discharge to trade waste, water quality acceptance standards as per the *Industrial Customers - Acceptance standards and charging rates for 2025-26* would need to be met. Given the contaminants identified, it is likely that abstracted groundwater will require treatment onsite prior to trade waste disposal. Sydney Water's general acceptance standards at the time of this assessment are summarised in Table 10-1 for key compounds (may be subject to change).

Dewatering discharge quality will need to be monitored on a site-by-site basis.

As a minimum, treatment via sedimentation and settling tanks, blending with other groundwater and pH balancing is likely to be required. There is also potential for treatment of benzene and toluene to be required in abstracted groundwaters from the river release pipeline HDD pits located at the WRRF.

Table 10-1: Sydney Water Trade Waste General Acceptance Standards (2025 – 2026) – key compounds

Compound	Acceptance Standard	Likely concentration in dewatered groundwater			Treatment requirement
		WRRF	River release pipeline	Brine and transfer pipelines, and Camellia PS	
Domestic Substances					
Suspended Solids	600 mg/L	-	-	-	Primary sedimentation necessary
Nitrogen as TKN	250 mg/L	0.9	6.7	3	Meets standard
Phosphorus	50 mg/L	-	0.11	<LOR	Meets standard
Ammonia[1]	100 mg/L	1.3	0.08 to 32	<LOR to 0.36	Meets standard
Sulfate[2]	2,000 mg/L	140 to 2,160	90 to 3,730	537 to 546	Exceeded at WRRF-BH-106. May impact dewatered groundwater quality at WRRF river release pipeline HDD pits. Treatment, possibly by blending, likely required.
Total dissolved solids (TDS)[3]	500 mg/L for inland and ocean systems with limitation 10,000 mg/L for inland and ocean systems with advanced treatment to remove TDS	1,884 to 15,508	1,114 to 37,146	2,607	Exceeded (based on calculation of TDS from EC) at the WRRF and river release pipeline. Blending likely required.
Non-Domestic Substances					
Arsenic	1 mg/L	<LOR to 0.007	<LOR to 0.003	0.002 to 0.003	Meets standard
Cadmium	1 mg/L	<LOR to 0.0005	<LOR to 0.011	<LOR	Meets standard
Chromium	3 mg/L	<LOR to 0.011	<LOR to 0.002	<LOR	Meets standard
Copper	5 mg/L	<LOR to 0.015	<LOR to 0.063	<LOR	Meets standard
Lead	2 mg/L	<LOR to 0.008	<LOR to 0.001	<LOR	Meets standard
Mercury	0.03 mg/L	0.002 to 0.131	<LOR to 1.88	0.005 to 0.006	Meets standard

Compound	Acceptance Standard	Likely concentration in dewatered groundwater			Treatment requirement
		WRRF	River release pipeline	Brine and transfer pipelines, and Camellia PS	
Nickel	3 mg/L	0.03 to 1.6	<LOR to 0.209	<LOR	Meets standard
Zinc	5 mg/L	<LOR to 0.007	<LOR to 0.003	0.002 to 0.003	Meets standard
pH[4]	7-10 units	4.17 to 6.34	3.86 to 6.71	6.2	Exceeded across all project sites, pH balancing likely required
Petroleum Hydrocarbons					
Benzene	0.1 mg/L	<LOR to 0.389	<LOR	<LOR	Exceeded at WRRF in well unlikely to impact dewatered groundwater quality. Treatment may be required.
Toluene	0.5 mg/L	<LOR to 1.51	<LOR to 0.003	<LOR	Exceeded at WRRF in well unlikely to impact dewatered groundwater quality. Treatment may be required.
Ethylbenzene	1 mg/L	<LOR to 0.111	<LOR	<LOR	Meets standard
Xylene	1 mg/L	<LOR to 0.87	<LOR to 0.003	<LOR	Meets standard
Polycyclic Aromatic Hydrocarbons	5 mg/L	<LOR to 0.394	<LOR to 0.0082	<LOR	Meets standard
	Exceeded at one or more locations, treatment may be required				
	Exceeded at upgradient well or well in vicinity to project excavation, treatment may be required				

Notes:
1. Ammonia as N
2. Sulphate as SO_4- turbidimetric (filtered)
3. Calculated from EC observed during field quality testing
4. Observed during field quality testing

11. Potential operational impacts

The risks associated with any potential operational groundwater impacts are considered low. Table 11-1 provides a risk assessment for potential operational impacts should these occur. No groundwater take is anticipated during operation of the project and, as such, drawdown associated impacts to GDEs, waterways or nearby users is not anticipated.

Table 11-1: Risk assessment of potential operational impacts

Potential impact	Cause	Comment	Risk
Groundwater quality	Runoff or seepage of contaminated water from operation of vehicles, machinery or spills	Permeability of geological units across the impact assessment area is low. The project will not cause perceptible change to existing recharge mechanisms. Compacted VENM / ENM at the surface of the WRRF will likely be lower permeability than the existing underlying fill / alluvium. Recharge at the WRRF may be reduced.	Low
Groundwater flow	Underground structures acting as groundwater sinks	Permeability of geological units across the impact assessment area is low. The project will not cause perceptible change to existing regional groundwater flow regimes. Localised changes to groundwater flow may arise where groundwater seepage occurs through trench bedding. Mitigation measures for this scenario have been recommended (see Section 14). However, due to the low permeability of the surrounding formation, the effect of any seepage is unlikely to be expressed at the water table. All other permanent underground structures will be fully sealed and impermeable to groundwater flow and will, therefore, not act as sinks.	Low
Groundwater flow	Impermeable underground structures acting as barriers to groundwater flow	There is potential for installed pipelines to behave as barriers impeding shallow groundwater flow. These impacts would be limited to surficial perched water tables and are unlikely to cause perceptible change to regional aquifer behaviour. As deeper micro-tunnelled or HDD installed sections will be installed in low permeability, high strength rock, any change to flow will be very minor and is unlikely to be expressed at the water table. The project will not cause perceptible change to existing regional groundwater flow regimes.	Low
Groundwater recharge	Increased stormwater irrigation at the WRRF	Compacted VENM / ENM at the surface of the WRRF will likely be lower permeability than the existing underlying fill / alluvium. Recharge at the WRRF may be reduced.	Low
Groundwater mounding	Water leakage from installed pipelines may cause localised increases to groundwater levels	Due to the low permeability of geological units, any mounding effect will be very minor and is unlikely to be expressed at the water table	Low

12. Summary of findings

Key findings of the groundwater impact assessment include:

12.1 Groundwater interaction

Groundwater interaction during construction is expected to occur where excavation of project elements extends below the water table, and where the construction methodology does not prevent groundwater ingress, including:

- At the WRRF, there is potential for groundwater interaction during excavation of FWPS 1, FWPS 2 and the two river release pipeline HDD pits located at the facility. 4.4 m and 0.2 m of groundwater head was anticipated to be intercepted during excavation of the two FWPS and the HDD pits, respectively.
- Along the river release pipeline, there is potential for groundwater interaction during excavation of the two Silverwater Road micro-tunnel shafts, the two HDD pits in PDC Park, the HDD cofferdam pit in SOPA Pod C carpark and the two HDD pits in Meadowbank Park as well as all sections of open trenching along the alignment including the river release pipeline outfall structure between the outfall header and the headwall at the Parramatta River. Anticipated groundwater head during excavation ranges from 0.3 m (at PDC Park) to 6.5 m (at Silverwater Road).
- At the river release outfall structure, the estimated groundwater head was based on a high-tide water level in Parramatta River of 1.5 mAHD. Groundwater observations were not available for the area in Memorial Park, Meadowbank and as such adopting the river level was considered a suitable assumption.
- Along the brine and transfer pipelines, there is potential for groundwater interaction during excavation of the HDD pits in the Rosehill Gardens Racecourse overflow parking area as well as the open trenched section from the overflow carpark to Camellia pumping station. Up to 0.5 m of groundwater may be encountered during excavation of the HDD pits, and up to 2 m may be encountered along the open trenched section.
- At Camellia pumping station, the trenched connections of the brine pipeline and transfer pipelines to existing wet well infrastructure were considered likely to interact with groundwater. Between 4.5 m and 5m of groundwater head was estimated here, considering the observed groundwater level of 1.5 m at monitoring well INF-BH-102.
- Groundwater head at assumed access points along the relined section of the brine pipeline (between Camellia pumping station and the NSOOS) was estimated to range from 0.3 m to 5.7 m.

12.2 Groundwater drawdown and inflow

Groundwater drawdown and inflow is anticipated to occur at project excavations where groundwater is likely to be encountered, including:

- Potential inflows at the Silverwater Road micro-tunnel shafts, the SOPA Pod C carpark HDD cofferdam pit and trenched connections at Camellia pumping station were assumed to be reduced by 90% due to use of sheet piles and concrete lining.
- At the WRRF, drawdown was estimated to extend 2m from the edge of each FWPS excavation and 0.1 m from the edge of each river release pipeline HDD pit excavation. Total inflows were estimated to be 5 kL (0.3 kL/day) to each FWPS excavation and 1 kL (0.02 kL/day) to each river release pipeline HDD pit excavations, respectively.
- Along the river release pipeline, drawdown estimates to shaft excavations (HDD pits or micro-tunnel shafts) range from 0.1 m to 1m from the edge of each excavation. Inflow estimates to shafts range from 6 kL (0.2 kL/day) to 229 kL (2 kL/day).

- Dewatering of trenches along the river release pipeline, with the exception of the outfall structure, were estimated to draw water down from 0.5 m to 17 m from the edge of each trench subsection being actively dewatered. Groundwater inflow to trenches was estimated to range from 104 kL to 600 kL. Inflow rates ranged from 2 kL/day to 18 kL/day. Trenches were assumed to be excavated in 25 m sections per day, that is 25 m being actively dewatered each day.
- The section of river release structure between the outfall header and the headwall at the Parramatta River was assumed to be trenched. The structure was assumed to be trenched in three sections that are approximately 20 m long. It was assumed that each 20m section would be open for 10 days. The estimated inflow across these sections of the trenched outfall structure was up to 106 kL/day and drawdown was estimated to be up to 25 m from the edge of the trench.
- Along the brine and transfer pipeline alignment, drawdown to shaft excavations (HDD pits at Rosehill Gardens Racecourse overflow carpark) was estimated to be up to 1m from the edge of each excavation. Estimated groundwater inflow to the HDD pits was 102 kL (2 kL/day) to each pit. Groundwater drawdown from dewatering of the trench excavation to Camellia pumping station was estimated to extend 17 m from the edge of each section. It was assumed that open trenching would be completed in 20 m sections each day (i.e. 20 m of trench actively dewatered per day). Inflow volumes to trench excavations were estimated to be up to 203 kL, or 16 kL/day.
- At Camellia pumping station, sheet pile walls assumed along the edges of trenched connections reduce potential groundwater inflow to 114 kL to 121 kL (1.3 kL/day). Drawdown was considered negligible (0.1 m from the edge of the trench).
- Along the relined section of the brine pipeline between Camellia pumping station and the NSOOS, drawdown estimates from dewatering of relining access points range from 1 m to 14 m. Inflow volumes were estimated to range from 0.3 kL up to 21 kL. Inflow rates were estimated to range from 0.3 kL/day to 13 kL/day.

Overall, the project was estimated to require approximately 5.2 ML of dewatering over the duration of construction. This estimate is conservative and based on numerous assumptions outlined in Section 7.1, Section 8.1.5 and Section 9.

As of June 30, 2025, amendments to the WM Act allow public authorities constructing essential infrastructure to undertake the work without obtaining a WAL; however, Sydney Water are still required to keep record and report of water take to the Minister, as per the *Water Management (General) Amendment (Exemptions for Infrastructure) Regulation 2025.*

As the project is considered state significant infrastructure, under the *Environmental Planning and Assessment Act 1979* a water use approval, a water management work approval (including a WSWA) or an activity approval (other than an aquifer interference approval) are not required.

The estimated drawdown due to dewatering of project excavations (shafts or trenches) does not extend to any mapped GDEs or HEVAEs, waterways, or any licenced groundwater users. As such, no drawdown induced groundwater impacts to these sensitive groundwater receptors are anticipated.

12.3 Water quality

Groundwater sampled across project sites as part of DSI works has been found to be contaminated with select heavy metals, TPH, TRH, and PAHs, BTEX and PFAS compounds, including:

- At the WRRF, groundwater sampled from wells in the vicinity of shaft excavations recorded exceedances against adopted SAC for concentrations of copper, lead, nickel, zinc, phenanthrene, toluene, TPH C10 – C36 and/or PFOS. Considering the low permeability of the clay fill/alluvium at the site (in the order of 0.0012 m/day) as well as the relatively short duration of dewatering, the risk of mobilising contaminants from areas outside estimated drawdown extents is considered low. Disruption to existing regional groundwater quality or existing groundwater quality at the WRRF site is also not anticipated to be affected by dewatering.

- Along the river release pipeline, groundwater sampling showed exceedances against adopted SAC for cadmium, copper, nickel, zinc, ammonia as N and PFOS. Dewatering of 25 m trench sections for one day is not anticipated to impact existing regional groundwater quality, gradients or flow patterns, nor considered likely to mobilise contaminants from beyond drawdown extents. One day of dewatering is not considered long enough to cause significant impacts.
- Drawdown associated with dewatering of shaft excavations along the river release pipeline is expected to be of small magnitude and localised. Potential impacts to regional groundwater quality are, therefore, considered unlikely. Deeper excavations including the Silverwater Road micro-tunnel shafts and SOPA Pod C carpark cofferdam pit are proposed to be constructed using sheet piles and a concrete floor lining. Therefore, these locations are unlikely to act as a groundwater sinks and no impacts to groundwater quality surrounding these locations were anticipated.
- Along the brine and transfer pipelines and at Camellia pumping station, groundwater sampling indicated exceedances of PFOS against adopted SAC. Again, as trenched sections were assumed to be actively dewatered for only one day at a time, impacts to regional groundwater quality or flow regimes are unlikely. Sheet pile walls have been adopted along the walls of the connection trenches at Camellia pumping station. This methodology would reduce groundwater inflow to near negligible volumes and associated impacts to existing groundwater quality are not anticipated.

Changes to existing patterns of contaminant migration due to excavation dewatering at the WRRF are not anticipated due to low aquifer permeability and the small magnitude of groundwater drawdown at the site. As such, dewatering at the WRRF is not expected to affect the existing water quality in Duck Creek. Any contaminated groundwater extracted during construction will be managed by discharge to sewer via a Trade Waste Agreement or offsite disposal at a licensed facility.

12.4 ASS

ASS were also identified across project sites during site investigations. The limited duration (one day) of dewatering of trench sections was not considered sufficient to desaturate ASS and mobilise contaminants from soils into groundwater. ASS related groundwater quality impacts are not anticipated during construction of project trenches.

Due to the limited magnitude and extent of drawdown at project shaft excavations, the risk of ASS mobilisation beyond the immediate vicinity of each excavation is considered low.

12.5 Potential impacts

Potential groundwater related impacts meet the Level 1 Minimal Impacts Considerations of the NSW Aquifer Interference Policy, including:

- Drilling muds/fluids, as well as any dewatered groundwater across project sites will require management as per a CEMP. Approval to treat/discharge dewatered groundwater and drilling muds/fluids will need to be sought and managed via a DMP.
- Excavated material and dewatered soils should be managed in accordance with an ASS Management Plan.
- Potential construction impacts are likely to be temporary in nature and highly localised to excavation locations. As such, the risk of cumulative impacts arising from project construction is low.
- The risks associated with any potential operational groundwater impacts are considered low. No groundwater take are anticipated during operation of the project and, as such, drawdown associated impacts to GDEs, waterways or nearby users are not anticipated. Project operation is unlikely to cause perceptible change to regional groundwater systems.
- Over the 36-month anticipated project construction timeline approximately 285 ML of water was estimated to be required (95 ML/year of construction). Key water demands are anticipated for earthworks, dust suppression, flushing and testing of pipelines, and drilling water for HDD. Lesser demands are anticipated for potable usage and amenities at site offices, and vehicle washdown.

13. Limitations

13.1 Construction design

This impact assessment was based on available (current) design information (see Section 2). Design details and indicative construction methodology are subject to change in the detailed design stage.

Design changes with the most potential to affect the magnitude of identified groundwater impacts would include:

- Excavation depths and extents (e.g. increasing the depth of the pump stations at the WRRF site).
- Pipeline construction methodology (e.g. trenchless vs trenched).
- Construction scheduling and pipeline lay rate.

During detailed design, significant design changes identified above would be considered in relation to groundwater and findings reviewed as needed

13.2 Hydrogeological conditions

There was some uncertainty surrounding aquifer permeability and longer-term groundwater level trends (wet vs. dry conditions) along the river release pipeline, brine and transfer pipelines and at Camellia pumping station. However given the small volumes of groundwater to be extracted, it is unlikely that changes in these conditions would affect flow rates significantly. An observational approach will be undertaken during construction to limit the risk of groundwater related impacts due to the project.

At the end of the river release pipeline, where the pipeline joins the river release structure, there was additional uncertainty surrounding aquifer permeability, anticipated groundwater level and groundwater quality. Uncertainty in hydrogeological conditions will be addressed during detailed design through additional investigation where required and as noted previously, a conservative approach was undertaken for the assessment.

It is also noted that site investigations have not been completed along the relined section of the brine pipeline between Camellia pumping station and the NSOOS. The groundwater impact assessment for this section was based on an indicative construction methodology provided by Sydney Water that is subject to change. Site investigations along the relined section of the brine pipeline would be undertaken during detailed design should structural relining methods be required.

Where hydrogeological conditions were uncertain owing to limitations in available site investigation data, assumptions were adopted to complete the assessment. Where possible, assumptions were conservative and provide a 'worst-case' assessment of potential impacts. That is, the conservative assumptions that were necessary to complete the assessment may overestimate groundwater impacts. Adopted assumptions are detailed in Section 7.1, Section 8.1.5 and Section 9 of this report.

As the project progresses, it is possible that unexpected hydrogeological conditions may be encountered due to different, or previously unknown, subsurface conditions.

14. Mitigation and management

Environmental management and mitigation measures would form an integral part of construction activities and project operation. This section provides a high-level discussion of potential mitigation measures to reduce potential groundwater-related impacts during construction and operation of the project.

The management and mitigation measures outlined in Table 14-1 are recommended to manage and monitor potential groundwater related impacts during construction and operation of the project. These measures include the development and implementation of a range of management plans including an ASSMP, DMP and CEMP.

During construction, it is recommended that the mitigation measures be implemented through adaptive management strategies to mitigate groundwater impacts in response to the specific methodologies, schedules and potential unexpected conditions.

Table 14-1: Proposed groundwater management and mitigation measures

Potential project risk	Environmental management measure	Timing
Groundwater drawdown	Implement identified methods to minimise groundwater flow such as sheet piling, concrete encasement as per design to minimise groundwater flow.	During detailed design.
Groundwater quality and levels	A Construction Soils and Water Management Plan (CSWMP) would be developed as a sub plan of the CEMP and will outline measures to manage potential groundwater quality impacts associated with the construction works.	Prior to construction, and during construction
Groundwater seepage to trench bedding	Trench stoppers will be used to prevent migration of groundwater from the source.	During construction and operation
ASS	An ASSMP will be prepared in accordance with the Acid Sulphate Soil Manual (ASSMAC, 1998) prior to construction of the project. The ASSMP will outline how potential ASS within sediments and soils disturbed will be handled, treated and reused during construction.	Prior to construction and during construction
Spills and leaks	The CSWMP would outline site specific control measures and required procedures to ensure containment of accidental spills and leaks. This would include: ▪ All fuels, chemicals and liquids would be stored on level ground at least 20 metres away from waterways (including existing stormwater drainage system) and would be stored in a sealed bunded area within ancillary facilities. ▪ An emergency spill response procedure would be prepared to minimise the impact of accidental spills of fuels, chemicals and fluids during construction.	Prior to construction and during construction
Dewatering discharge	A Dewatering Management Protocol will be prepared as a sub plan of the CSWMP which would outline: ▪ The method for dewatering excavations, including requirements for monitoring of dewatering volumes and water quality. ▪ Required treatment and storage of dewatering and methods and locations for dewatering disposal.	Prior to construction and during construction as per the Dewatering Management Protocol

14.1 Groundwater level and quality monitoring

Groundwater level and quality monitoring is recommended to mitigate potential project risks during project construction.

A recommended groundwater monitoring program at the WRRF, along pipeline alignments and at Camellia pumping station is outlined in Section 14.1.1 and Section 14.1.2, respectively.

The frequency, location and water quality indicators to be included in the groundwater monitoring program should consider results from pre-construction monitoring. Details of the monitoring program are to be confirmed during detailed design.

As noted in Section 12, the risks associated with any potential operational groundwater impacts are considered low. No groundwater take is anticipated during operation of the project and, as such, drawdown associated impacts to GDEs, waterways or nearby users are not anticipated. Project operation is unlikely to cause perceptible change to regional groundwater systems.

For the purposes of this EIS, one round of groundwater level and quality monitoring completed within one year of construction being completed is considered sufficient to mitigate operational risks at the WRRF. Monitoring is not proposed during operation of the pipelines or the Camellia pumping station.

14.1.1 WRRF

The recommended groundwater level and quality monitoring to be undertaken at the WRRF during and post-construction is summarised in Table 14-2.

Table 14-2: Recommended groundwater monitoring at the WRRF

Timing	Monitoring task	Location	Frequency
During construction of WRRF	Manual groundwater level observation	On site groundwater wells	Every 6 months
	Groundwater quality sampling		
Dewatering Monitoring - During construction of WRRF, or where the WRRF is being used for management of dewatered groundwater discharge from pipeline excavations	Groundwater quality sampling	Dewatered groundwater discharge	As per DMP
Within one year of completion of the WRRF	Manual groundwater level observation	On site groundwater wells, where applicable. It is noted that some wells may no longer be accessible following completion of construction	Once
	Groundwater quality sampling		

14.1.2 Pipelines and Camellia pumping station

The recommended groundwater level and quality monitoring to be undertaken along the pipelines and at Camellia pumping station during construction is summarised in Table 14-3.

Table 14-3: Recommended groundwater monitoring along pipelines and at Camellia pumping station

Timing	Monitoring task	Location	Frequency
During construction of pipelines and Camellia pumping station	Manual groundwater level observation	Existing groundwater wells	Every 6 months
	Groundwater quality sampling		
Dewatering Monitoring - During construction of pipelines and upgrades at SP0067, or where SP0067 is being used for management of dewatered groundwater discharge from pipeline excavations	Groundwater quality sampling	Dewatered groundwater discharge	As per DMP

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Appendix A. Geotechnical bore logs

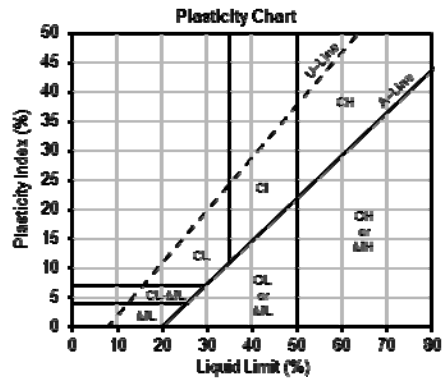
Soil Description

MATERIAL DESCRIPTION

Soil description is based on an assessment of disturbed samples, as recovered from boreholes and excavation, and from undisturbed materials as seen in excavation and exposures or in undisturbed samples.

CLASSIFICATION

Soils are described in general accordance with AS1726-2017 and the Unified Soil Classification (USC) as shown below.

Field Identification procedures (Excluding particles larger than 63 mm and basing fractions on estimated mass)								Code	Typical Names	Describing Soils	Laboratory Classification Criteria			
COARSE GRAINED SOILS More than 65% of material less than 63 mm is larger than 0.075 mm	GRAVELS More than 50% of coarse fraction is larger than 2.36 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength					GW	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name, symbol, indicate approximate % of sand and gravel, maximum size, angularity, surface condition, and strength of coarse grains: colour, amount plasticity of fine component. For undisturbed soils add information on moisture content, degree of compactness, stratification, cementation, and odour. Give local and other pertinent descriptive information. Example: SILTY SAND (SM), fine to coarse, light grey, about 20% strong angular gravel particles – 10mm max. size, rounded and sub-angular sand, about 12% non-plastic fines, moist, dense alluvial sand.	Use grain size curve in identifying the fractions as given under field identification	Determine percentages of gravel and sand from grain size curve Depending on percentage smaller than 0.075 mm size coarse grained soils are classified as follows: Less than 5% GW, GP, SW, SP More than 12% GM, GC, SM, SC 5% to 12% Borderline cases requiring use of dual symbols	Greater than 4 $c_u = \frac{D_{60}}{D_{10}}$	Between 1 & 3 $c_c = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength					GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels			Not meeting all gradation requirements for GW.		
		GRAVELS WITH FINE (Appreciable fines)	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength					GM	Silty gravels, gravel-sand-silt mixtures			Atterberg limits below 'A' line or PI less than 4	Above 'A' line with PI between 4 and 7 are borderline cases requiring use of dual symbols.	
			'Dirty' materials with excess of plastic fines, medium to high dry strength					GC	Clayey gravels, gravel-sand-clay mixtures			Atterberg limits above 'A' line with PI greater than 7		
	SANDS More than 50 % of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength					SW	Well graded sands, gravelly sands, little or no fines			Greater than 6 $c_u = \frac{D_{60}}{D_{10}}$	Between 1 & 3 $c_c = \frac{(D_{30})^2}{D_{10} x D_{60}}$	
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength					SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands			Not meeting all gradation requirements for SW		
		SANDS WITH FINES (Appreciable fines)	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength					SM	Silty sands, sand-silt mixtures			Atterberg limits below 'A' line or PI less than 4	Above 'A' line with PI between 4 and 7 are borderline cases requiring use of dual symbols	
			'Dirty' materials with excess of plastic fines, medium to high dry strength					SC	Clayey sands, sand-clay mixtures			Atterberg limits above 'A' line with PI greater than 7		
FINE GRAINED SOILS More than 35% of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS < 0.075 mm									Give typical name, symbol, and indicate degree and character of plasticity, colour, amount and size of coarse grains. For undisturbed soils add information on moisture content, consistency, structure, stratification, and odour. Give local or geologic name and other pertinent descriptive information. Example: CLAYEY SILT (ML), brown, low plasticity, trace sand, firm, dry, numerous vertical root holes.				
	SILTS AND CLAYS Low -Medium Plasticity, Liquid limit <50	DRY STRENGTH	DILATANCY	TOUGHNESS										
		None to low	Quick to slow	None				ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with low plasticity. Silts of low to medium Liquid Limit					
		Medium to high	None to very slow	Medium				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays					
		Low to medium	Slow	Low				OL*	Organic silts and organic silt-clays of low to medium plasticity					
	SILTS AND CLAYS High Plasticity, Liquid limit >50	Low to medium	Slow to none	Low to medium				MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, silts of high Liquid Limit					
		High to very high	None	High				CH	Inorganic clays of high plasticity					
		Medium to high	None to very slow	Low to medium				OH*	Organic clays of high plasticity					
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture							Pt*	Peat and other highly organic soils					

Laboratory:

MC	Moisture Content	MDD	Maximum Dry Density
LL	Liquid Limit	OMC	Optimum Moisture Content
PL	Plastic Limit	PSD	Particle Size Distribution
PI	Plasticity Index	UU	Undrained Unconsolidated
LS	Linear Shrinkage	CU	Consolidated Undrained
ρ_p	Particle Density	CD	Consolidated Drained
ρ_b	Bulk Density	$I_{s(50)}$	Point Load Index
ρ_d	Dry Density	UCS	Uniaxial Compressive Strength

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

* effervesces with H_2O_2

DESCRIPTION OF A SOIL

i. Colour
ii. Plasticity or particle characteristics of soil
iii. Secondary components name
iv. Estimated proportion
v. Secondary component plasticity or particle characteristics
vi. Other minor soil components
vii. Structure of soil, geological origin
viii. Consistency / density
ix. Moisture condition

Term		Grain Size	Shape and Texture	Field Guide
CLAY		< 2 µm	Shiny	Not visible under 10x
SILT		7 – 75 µm	Dull	Visible under 10x
SAND	Fine	0.075 – 0.2 mm	Angular / sub -angular / sub -rounded / rounded	Visible by eye
	Medium	0.2 – 0.6 mm		Visible at < 1 mm
	Course	0.6 – 2.36 mm		Visible at < 3 mm
GRAVEL	Fine	2.36 – 6 mm		Visible at < 5 mm
	Medium	6 – 20 mm		Road Gravel
	Course	20 – 63 mm		Rail ballast
COBBLES		63 – 200 mm		Beaching
BOULDERS		> 200 mm		

COLOUR

The colour of a soil should be described using simple terms, such as black, white, grey, red, brown, orange, yellow green or blue. These may be modified as necessary by 'pale', 'dark' or 'mottled'. Borderline colours may be described as a combination of these colours (e.g. orange brown). Where a soil consists of a primary colour with a secondary mottling it should be described as (primary colour) mottled (first colour) and (secondary colour). Where a soil consists of two colours presented in roughly equal proportions the colour description should be mottled (first colour) and (secondary).

PARTICLE CHARACTERISTICS – COARSE GRAINED SOILS

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

ANGULARITY – COARSE GRAINED SOILS



Rounded Sub-rounded Sub-angular Angular

PLASTICITY

Liquid limit (%)	Description
≤ 35	Low plasticity
>35 to ≤ 50	Medium plasticity
> 50	High plasticity

DESCRIPTIVE TERMS FOR SECONDARY AND MINOR COMPONENTS

Element	Coarse Grained Soils				Fine Grained Soils	
	% Fines	Term	% Access. Coarse	Term	% Coarse	Term
Minor	≤ 5	'trace clay or silt'	≤ 15	'trace sand or gravel'	≤ 15	Use 'trace'
	>5 to ≤12	'with clay or silt' as applicable	>15, ≤ 30	'with sand or gravel' as applicable	>15, ≤ 30	'with sand or gravel' as applicable
Secondary	> 12	Prefix 'clayey or silt' as applicable	>30	Prefix 'sandy' or 'gravelly' as applicable	> 30	Prefix 'sandy or gravelly' as applicable

CONSISTENCY TERMS – COHESIVE SOILS

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

CONSISTENCY TERMS – NON COHESIVE SOILS

Term	Density Index (%)	SPT (N) Blow Count	Field Guide to Density
Very Loose (VL)	< 15	0 – 4	Ravels
Loose (L)	15 – 35	4 – 10	Shovels easily
Medium Dense (MD)	35 – 65	10 – 30	Shovelling very difficult
Dense (D)	65 – 85	30 – 50	Pick required
Very Dense (VD)	> 85	50 -100	Pick difficult

MOISTURE

Term (Symbol)	Description
Dry	Looks and feels dry, cohesive soils hard, friable or powdery
Moist	Soil feels cool, darkened in colour, can be remoulded &/or adhere
Wet	Soil feels cool, darkened in colour, sticks, free water on remoulding
M < Wp	Moist, moisture content well below plastic limit
M = Wp	Moist, moisture content near plastic limit
M > Wp	Moist moisture content well above plastic limit

STRUCTURE

Term	Description	
Zoning	Soils may consist of separate zones different in colour, grain size or other properties. Thickness, orientation & any distinguishing features of the zone should be described i.e. gradational or distinct boundaries. The patterns of these zones may be described using layer (zone is continuous), lens (a discontinuous layer of different material, with lenticular shape) or pocket (irregular inclusion of different materials).	
Defects	Term	Definition
	Parting	A surface or crack (open/closed) with little or no tensile strength. Parallel or sub parallel to layering (e.g. bedding).
	Fissure	A surface or crack (open/closed) with little or no tensile strength not parallel or sub-parallel to layering; includes desiccation cracks.
	Sheared Seam	Zone in clayey soil roughly parallel near planar, curved or undulating boundaries containing closely, smooth or slickensided, curved intersecting fissures dividing mass into lenticular/wedge blocks.
	Sheared Surface	A near planar, curved or undulating smooth, polished or slickensided surface in clayey soil.
	Softened Zone	A zone in clayey soil, usually adjacent to a defect in which the soil has higher moisture content.
	Tube	Tubular cavity occurring as one of a large number of separate or interconnected tubes. Walls often coated with clay/strengthened by denser packing of grains. May contain organic matter. Origins include root holes, animal burrows, tunnel erosion.
	Tube cast	An infilled tube with uncemented or weakly cemented soil or have rock properties.
	Infilled Seam	Sheet/wall like body of soil with roughly planar to irregular near parallel boundaries cutting through mass. Open defect infilling.
Cementing	Soils or defects within soils may be cemented together by various agencies. The nature of the cementing agent should be identified if possible, strength, reaction to acid and the like. Weakly cemented – If the cementing agent allows the particle aggregation to be easily fractured by hand when the soil is saturated. Strongly cemented – If the cementing agent prevents fracturing by hand when the soil is saturated (use strength classification as per rock)	

ADDITIONAL OBSERVATIONS

Geological origin

Term	Description
Topsoil	Mantle of surface &/or near surface, often high levels of organics
Weathered in place soils	Extremely weathered soil - Structure and fabric of parent rock visible
	Residual soil - Structure and fabric of parent rock not visible
Transported soils	Aeolian soil - Deposited by wind and ash falls
	Alluvial soil - Deposited by streams and rivers
	Colluvial soil -Deposited on slopes (transported down slope by gravity)
	Lacustrine soil – Deposited in freshwater lakes
	Marine soil - Deposited in ocean, bays, beaches and estuaries
Fill materials	Soil Fill - Describe soil type, UCS symbol and add 'FILL'
	Rock Fill - Rock type, degree of weathering, and word 'FILL'
	Domestic Fill - Percent soil or rock, whether putrescible or not
	Industrial Fill - Percent soil, whether contaminated, particle size & type of waste product, i.e. – brick, concrete, metal

ORGANIC OR ARTIFICIAL MATERIALS

Preferred Terms	Secondary Description
Organic matter	Fibrous peat, charcoal, wood fragments, roots (greater than 2 mm diameter), root fibres (less than 2 mm diameter), Night soil
Waste fill	Domestic refuse, oil, bitumen, brickbats, concrete rubble, fibrous plaster, wood pieces, wood shavings, saw dust, iron filings, drums, steel bars, steel scrap, bottles, broken glass, leather, tyres, slag

Rock Description

ROCK TYPE

Composition of the rock material i.e. colour, grain size, structure, texture, fabric, mineral composition, hardness alteration, cementation etc. as applicable. Condition of the material i.e. estimated strength, weathering and moisture condition. Rock mass properties i.e. structure of rock, defects – type, orientation spacing, roughness, waviness and continuity and weathering (of the rock mass).

GRAIN SIZE

Particle size scales depends on rock type. For sedimentary rocks, the following descriptors can be used:

- Sand terms for sandstone
- Gravel terms for conglomerates and breccias
- No description of grain size is required for claystone, siltstone, shale and mudstone etc.

For metamorphic and igneous rocks, record the typical grain size in millimetres

COLOUR

The colour of a rock should be described using simple terms, such as black, white, grey, red, brown, orange, yellow, green or blue. These may be modified as necessary by 'pale', 'dark' or 'mottled'. Borderline colours may be described as a combination of these colours (e.g. grey green).

STRUCTURE

Terms typically used to describe the structure of a rock mass where possible include:

- Sedimentary rocks – bedded, laminated
- Metamorphic – foliated, banded, cleaved
- Igneous rocks – massive, flow banded.

The spacing or thickness of these structural features should be given as described in the table below:

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

TEXTURE

Type	Definition
Massive	Effectively Homogeneous and isotropic. Bulky or equidimensional and elongated or tabular grains uniformly distributed.
Distinct	Bedded, foliated, cleaved – effectively homogeneous with planar anisotropy. Elongated or tabular grains or pores in a layered arrangement. The arrangement of grains, referred to as the rock fabric, may show a preferred orientation.

STRENGTH

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

1. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considered weaker due to the effect of rock defects.
2. The field guide visual assessment of rock strength may be used for preliminary assessment or when point load testing is not available.
3. Anisotropy of rock material samples may affect the field assessment of strength

WEATHERING CLASSIFICATION

Degree of weathering		Definition
Residual soil (RS)		Soil developed from weathering of rock in-situ. The mass structure and substance fabric are no longer evident, but soil not significantly transported
Extremely weathered rock (XW)		Rock is weathered to such an extent that it has soil properties. It disintegrates or can be remoulded in water. It shows a rock fabric but is described as a soil.
Highly weathered rock (HW)	Distinctly weathered (DW)*	The whole of the rock material is discoloured, usually by iron staining or bleaching so that the original rock colour is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals.
Moderately weathered rock (MW)		The whole of the rock material is discoloured, usually by iron staining or bleaching so that the original rock colour is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered rock (SW)		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh rock (F)		Rock shows no sign of decomposition or individual minerals or colour changes.

*Distinctly Weathered indicates a distinct change in colour, hardness and/or friability and not distinguishable into HW or MW

DESCRIPTION OF A DISCONTINUITY

- Depth
- Dip
- Infill material
- Aperture observation
- Planarity
- Small scale roughness
- Aperture measurement (mm)
- Remark
- Roughness Class

INFILL MATERIAL

Code	Description
CA	Calcite
Clay	Clay
Fe	Iron oxide
Fe Clay	Iron oxide clay
KT	Chlorite
MS	Secondary mineral
MU	Unidentified mineral
Qz	Quartz
X	Carbonaceous

APERTURE OBSERVATION

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

PLANARITY

Code	Description
CU	Curved
DIS	Discontinuous
IR	Irregular
PR	Planar
ST	Stepped
UN	Undulating

SMALL SCALE ROUGHNESS

Code	Description
POL	Polished
RF	Rough
S	Smooth
SL	Slickensided
VR	Very rough

ROUGHNESS CLASS

Code	Description
I	Rough or irregular, stepped
II	Smooth, stepped
III	Slickensided, stepped
IV	Rough or irregular, undulating
IX	Slickensided, planar
V	Smooth, undulating
VI	Slickensided, undulating
VII	Rough or irregular, planar

TYPE OF DISCONTINUITY

Term	Code	Description	
Bedding	BP	Generally no micro fractures	Arrangement in layers, of mineral grains of similar sizes or composition, and/or arrangement of elongated to tabular minerals near parallel to one another, and/ or to the layers.
Foliation	FL	Discontinuous micro fractures may be present, near parallel to the layering	
Cleavage	CL		
Schistosity	SH		
Contact	CO	A contact is the surface along which one rock touches another.	
Joint	JT	A discontinuity or crack, planar, curved, irregular, across which the rock usually has little tensile strength. The joint may be open (filled with air or water) or filled by soil substance or by rock substance or rock substance which acts as a cement, joint surface may be rough, smooth or slickensided	
Sheared Zone	SZ	Zone, with roughly parallel planar boundaries of rock material intersected by closely spaced (generally <50 mm) joints and/ or microscopic fractures (cleavage) planes. The joints are at small angles to the zone boundaries. They are usually slightly curved and divide the mass into blocks of lenticular or wedge space.	
Sheared Surface	SS	A near planar, curved or undulating surface which is usually smooth, polished or slickensided	
Crushed seam/ zone	CS CZ	Zone with roughly parallel planar boundaries, composed of disoriented, usually angular fragments of the host rock substance. The fragments may be of clay, silt, sand or gravel size, or mixtures of any of these. Some minerals maybe altered or decomposed but this is not necessarily so.	
Decomposed zone	DZ	Zone of any shape, but commonly with roughly parallel boundaries in which the rock material is discoloured and usually weakened. The boundaries with fresh rock are usually gradational.	
Seam	SM	Thin clay or extremely weathered seam caused by complete weathering within the rock mass.	
Infill seam/ zone	IS	Seam or zone of any shape, but commonly with roughly parallel boundaries composed of soil substance. The infill is caused by migration of soil and into open joints. May show layering roughly parallel to the zone boundaries. Geological structures in the adjacent rock do not continue into the infill substance.	
Vein	VN	vein is a distinct sheet like body of crystallised minerals within a rock	
Dyke	DK	Dykes are sheet-like bodies of igneous rock that cut across sedimentary bedding or foliations in rocks. They may be single or multiple in nature.	
Sill	SI	A sill is an intrusion of magma that spreads underground between the layers of another kind of rock	
Void	VO	A completely empty space.	

Refer to Table 22 in AS1726-2017

DRILLING / EXCAVATION METHOD

Code	Description
AD/V	Auger drilling V-bit
AD/T	Auger drilling with TC-bit
AS	Auger screwing
AT	Air track
B	Bulldozer
BH	Backhoe bucket
DB	Washbore drag bit
CT	Cable Tool
DT	Diatube
CA	Casing advancer
E	Excavator
EH	Excavator with hammer
HA	Hand auger
NMLC	NMLC core barrel
HMLC	HMLC core barrel
NQ3	Wire line NQ core barrel
HQ3	Wire line HQ core barrel
PQ3	Wire line PQ core barrel
PT	Push tube
R	Ripper
RR	Rock roller
WB	Washbore
X	Existing excavation
N	Natural exposure

WATER/ DRILLING FLUID

Symbol	Description
	Water loss: partial
	Water loss: complete
	Water inflow
	Water outflow
	Water level: drilling
	Water level: standing

DRILLING PENETRATION

Ease of penetration in non-core drilling

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

SAMPLES AND FIELD TEST

Code	Description
B	Bulk disturbed sample
BLK	Block sample
DS	Small disturbed sample
ES	Soil sample for environmental testing
EW	Water sample for environmental testing
LB	Large bulk disturbed sample
P	Piston sample
SPT	Standard Penetration Test
VS	Vane shear test
HP	Hand penetrometer test
U	Undisturbed push in sample

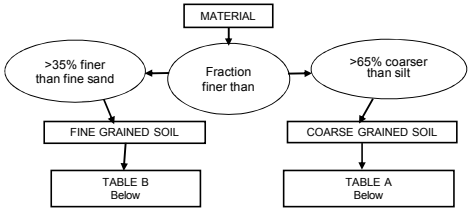
BACKFILL / WELL DETAIL

Symbol	Description
	Cement seal
	Grout backfill
	Blank pipe
	Slotted pipe
	Filter pack: sand filter
	Bentonite seal
	Backfill – excavated material

ORDER OF DESCRIPTION

Soils are described as follows:
A) MAIN SOIL TYPE & UNIFIED CLASSIFICATION SYMBOL (BLOCK LETTERS)
B) Plasticity if fine grained **or Particle Size Distribution and Grading** if coarse grained
C) Particle Shape
D) Colour.
E) Secondary and Minor component(s); name, estimated proportion, plasticity, particle size, colour.
F) Moisture condition.
G) Consistency or density.
H) Geological Origin (FILL, ALLUVIUM, COLLUVIUM, RESIDUAL etc.).
e.g. Silty SAND (SM); medium grained, poorly graded, rounded, yellow-brown, with a trace of fine grained sub-angular gravel, dry, loose. *Quaternary Alluvium*

A) Main Soil Type (See over for additional details)

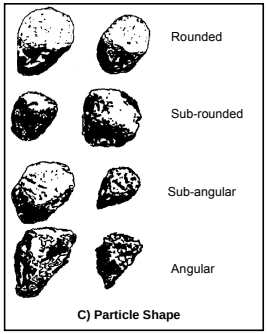


B) Plasticity (fine grained soils) OR Grading (coarse grained soils)

DESCRIPTIVE TERM	LIQUID LIMIT (%)
Of low plasticity	<35
Of medium plasticity	>35; <50
Of high plasticity	>50

DESCRIPTIVE TERM	DEFINITION
Well graded	good representation of all particle size from largest to the smallest
Poorly graded	one or more intermediate size poorly represented
Gap Graded	one or more intermediate sizes absent
Uniform	Essentially one size

C) Particle Shape



D) Colour

Described in the moist condition, using simple terms (eg black, white, grey, red, brown, yellow etc, modified as necessary by 'pale', 'dark' or 'mottled'. Borderline colours may be described as a combination of these colours. (eg dark grey, red-brown)

E) Proportion of Secondary & Minor Components

COARSE GRAINED SOILS		FINE GRAINED SOILS	
% fines	Modifier	% coarse	Modifier
<5	"with a trace of"	<15	"with a trace of"
>5 <15	"with some"	>15 <30	"with some"
>15	prefix soil with "silty, clayey, sandy, or gravelly"	>30	prefix soil with "sandy, gravelly silty, or clayey"

F) Moisture Content

CONDITION	Term	CRITERIA
Dry	D	Cohesive soils hard and friable, granular sands free running
Moist	M<Wp M=Wp M>Wp	Soils feel cool, darkened in colour. Cohesive soils can be moulded. Granular soils cohere
Wet	W	Soil feels cool, darkened in colour. Free water forms on hands when handling

G) Consistency or Density

GRAVEL/SAND (GW, GP, GM, GC)

DESCRIPTION	FIELD TEST
Loosely Packed	Can be removed from exposure by hand or easily removed by shovel
Tightly Packed	Requires pick for removal, either as lumps or as disaggregated material

SAND (SW, SP, SM, SC)

DENSITY	FIELD TEST	DCP Blows/100mm	SPT(N-value)	RELATIVE DENSITY (%)	CPT q_c (Mpa)
Very Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	< 1	<4	<15	0-2
Loose	Easily penetrated with 13mm reinforcing rod pushed by hand Can be excavated with a spade; 50mm wooden peg can be driven easily	1 - 2	4- 10	15 - 35	2 - 5
Medium Dense	Penetrated with 13mm reinforcing rod driven with 2kg hammer - hard shovelling	2 - 3	10 - 30	35 - 65	5 - 15
Dense	Penetrated 300mm with 13mm reinforcing rod driven with 2kg hammer, requires pick for excavation; 50mm wooden peg hard to drive	4 - 8	30 - 50	65 - 85	15 - 25
Very Dense	Penetrated only 25 - 50mm with 13mm reinforcing rod driven with 2kg hammer	> 8	>50	>85	>25

SILT AND CLAY (ML, CL, OL, MH, CH, PH, Pt)

CONSISTENCY	FIELD TEST	DCP (blows/ 100mm)	SPT (N)	UNDRAINED SHEAR STRENGTH (kPa)	UCS (pocket penetrom.) (kPa)	CPT q_c (kPa)
Very Soft	Easily penetrated 40mm by thumb. Exudes between thumb and fingers when squeezed	<1	<2	<12	<25	0 - 180
Soft	Easily penetrated 10mm by thumb. Can be moulded by light finger pressure	<1	2- 4	12 - 25	25 - 50	180 - 375
Firm	Impression made by thumb with moderate effort. Can be moulded by strong finger pressure	1 - 2	4 - 8	25 - 50	50 - 100	375 - 750
Stiff	Slight impression made by thumb, cannot be moulded by fingers	3 - 4	8 - 15	50 - 100	100 - 200	750 - 1500
Very Stiff	Very tough. Readily indented by thumbnail	5 - 10	15 - 30	100 - 200	200 - 400	1500 - 3000
Hard	Brittle. Indented with difficulty by thumbnail	>10	>30	>200	>400	>3000

TABLE A: COARSE GRAINED SOILS : more than half of the material less than 60mm is larger than 0.075mm

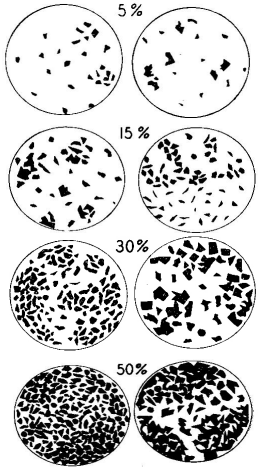
		GRADATIONS	NATURE OF FINES	DRY STRENGTH	SYMBOL	TYPICAL NAME
>50% coarser than coarse sand	*Gravels*	Good	Wide range in grain size	None	GW	Well graded gravels and sand - gravel mixtures, little or no fines
		Poor	Predominantly one size or range of sizes		GP	Poorly graded gravels and gravel - sand mixtures little or no fines
		Good to Fair	"Dirty" Materials (excess of Fines)	Fines are non-plastic	None to med	GM	Silty Gravels, gravel - sand - silt mixtures
				Fines are plastic	Med to high	GC	Clayey Gravels, gravel - sand - clay mixtures
>50% finer than fine gravel	*Sands*	Good	Wide range in grain size	None	SW	Well graded sands and gravelly sands, little or no fines
		Poor	Predominantly one size or range of sizes		SP	Poorly graded sands and gravelly sands, little or no fines
		Good to Fair	"Dirty" Materials (excess of Fines)	Fines are non-plastic	None to med	SM	Silty Sand, sand-silt mixtures
				Fines are plastic	Med to high	SC	Clayey Sand, sand-clay mixtures

TABLE B: FINE GRAINED SOILS : more than half of the material less than 60mm is smaller than 0.075mm

DRY STRENGTH	DILATANCY	TOUGHNESS	SYMBOL	TYPICAL NAME
None to Low	Quick to Slow	None	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
Medium to high	None to Very Slow	Medium	CL & CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays etc
Low to medium	Slow	Low	OL	Organic silts and organic silt clays of low plasticity
Low to medium	Slow to none	Low to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
High to very high	None	High	CH	Inorganic clays of high plasticity
Medium to high	None to very slow	Low to Medium	OH	Organic clays of medium to high plasticity
Readily identified by colour, odour, spongy feel and generally by fibrous texture			Pt	Peat muck and other highly organic soils

Organic and Artificial Materials

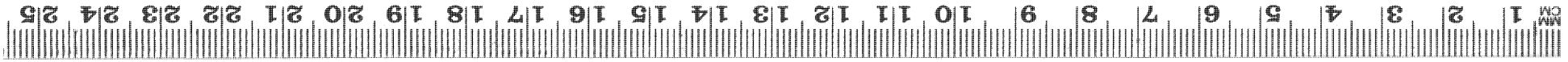
PREFERRED TERMS	TYPE
Fibrous Peat Charcoal Wood Fragments Roots (greater than 2mm dia) Root fibres (less than 2mm dia)	Organic Matter
Oil, Bitumen Domestic Refuse Brickbats Concrete Rubble Fibrous Plaster Wood pieces, shavings, sawdust Iron filings, drums, steel scrap Bottles, broken glass Leather	Waste Fill



Particle Size	0.002	0.06	0.2	0.6	2.0	6	20	60	200	Size (mm)
	Clay	Silt	Sand			Gravel			Cobbles	Boulders
			fine	medium	coarse	fine	medium	coarse		

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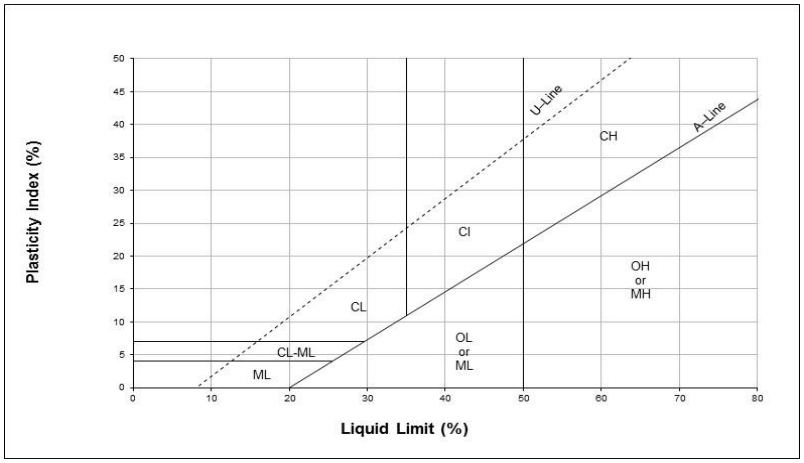
DESCRIPTION AND CLASSIFICATION OF SOILS (AS1726:2017)



Soil Origins

Term	Description
Topsoil	Mantle of surface &/or near surface, often high levels of organics
Weathered in place soils	Extremely weathered soil - Structure and fabric of parent rock visible
	Residual soil - Structure and fabric of parent rock not visible
Transported soils	Aeolian and Ash soils - Deposited by wind
	Alluvial soil - Deposited by streams, glaciers and rivers
	Colluvial soil -Deposited on slopes (transported down slope by gravity)
	Lacustrine soil – Deposited in freshwater lakes
	Marine soil - Deposited in ocean, bays, beaches and estuaries
Fill materials	Soil Fill - Describe soil type, UCS symbol and add 'FILL'
	Rock Fill - Rock type, degree of weathering, and word 'FILL'
	Domestic Fill - Percent soil or rock, whether putrescible or not
	Industrial Fill - Percent soil, whether contaminated, particle size & type of waste product, i.e. – brick, concrete, metal

Casagrande (Atterberg Limits) Chart



Derivation of Soil Name

Soils are generally made up of more than one component. The soil name depends on the proportion of each component.

The soil name is based on the presence of more than 50% of either fine grained (silt, clay) or coarse grained (sand, gravel) components in the soil. When more than one component exists the smaller amount is placed first.

Example 1: 60% clay
35% sand
5% gravel

is Sandy CLAY, with a trace of Gravel

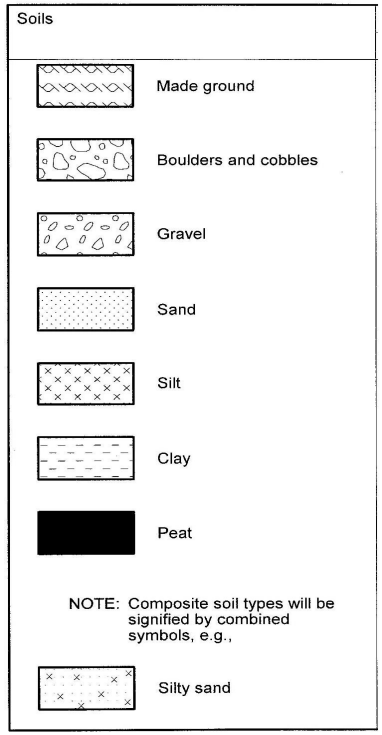
Example 2: 40% gravel
14% sand } >50% coarse grained :
46% silt

is Silty GRAVEL with some sand

The soil name can therefore be split into three fractions:
1. Secondary, 2 .Major, and 3. Minor

e.g. Silty GRAVEL with some sand

Graphic Symbols



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DESCRIPTION AND CLASSIFICATION OF SOILS (AS 1726:2017)

ORDER OF DESCRIPTION

Rock Material is described as follows:
A) MAIN ROCK TYPE (BLOCK LETTERS)
B) Strength
C) Weathering
D) Colour e.g. black, white, grey, red, brown, orange, yellow, green, or blue - using pale, dark or mottled.
E) Fabric (spacing and development)
F) Particle Size (if coarse grained)
G) Inclusions or minor components
H) Degree of Fracturing (drill core) or Defect spacing (outcrop)
Geological Name (optional)
eg. GRANODIORITE, very high strength, slightly weathered, light pink-grey, massive, coarse sand sized. Jointing widely spaced. *Mowamba Granodiorite*

A) Main Rock Type

SEE OVER PAGE

B) Strength

Rock Strength is defined by the Point Load Strength Index (Is50) and refers to the strength of the rock substance in the direction normal to the fabric

STRENGTH	TERM	Is(50) (MPa)	UCS (MPa)	FIELD GUIDE
Very Low	VL	0.03 - 0.1	0.6 - 2	Material crumbles under firm blow with sharp end of pick; can be peeled by a knife. Pieces up to 30mm thick can be broken by finger pressure.
Low	L	0.1 - 0.3	2 - 6	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long and 50mm diameter may be broken by hand.
Medium	M	0.3 - 1.0	6 - 20	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty
High	H	1 - 3	20 - 60	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken in one blow by a geological hammer
Very High	VH	3 - 10	60 - 200	Hand specimen breaks with geological hammer after more than one blow; rock rings under hammer
Extremely High	EH	10	>200	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer

C) Weathering

GRADE	TERM	DEFINITION
Extremely Weathered	EW	Rock is weathered to such an extent that it has soil properties. It disintegrates or can be remoulded in water. It shows a rock fabric but is described as a soil.
Highly Weathered	HW	The whole rock material is discoloured, usually by iron staining or bleaching so that the original rock colour is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals.
Moderately Weathered	MW	The whole rock material is discoloured, usually by iron staining or bleaching so that the original rock colour is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition or individual minerals or colour changes.

E) Fabric

Typical rock fabrics include but are not limited to:
'- bedding, cross bedding (sedimentary)
'- schistosity or foliation (metamorphic)
- flow banding (igneous)

FABRIC SPACING

TERM		SEPARATION OF STRATIFICATION PLANES
Sedimentary	Igneous/Metamorphic	
Thinly laminated	Thinly foliated	< 6mm
Laminated	Foliated	6mm to 20mm
Very thinly bedded	Very thinly layered	20 to 60mm
Medium bedded	Medium layered	0.2m to 0.6m
Thickly bedded	Thickly layered	0.6m to 2m
Very thickly bedded	Very thickly layered	>2m

FABRIC DEVELOPMENT

Massive	No obvious fabric - rock appears homogenous
Poorly developed	Fabric is barely obvious as faint mineralogical layering or grain size banding.
Well developed	Fabric is apparent as distinct layers or lines marked by mineralogical or grain size layering.
Very well developed	Fabric is often marked by a distinct colour banding as well

F) Particle Size

0.2	0.6	2.0	6	20	60	200	Size (mm)
fine	medium	coarse	fine	medium	coarse		
Sand			Gravel			Cobbles	Boulders

Sedimentary rocks:

Sandstone - Use sand terms
Conglomerate - Use gravel terms
Shale, Siltstone
Claystone - No description of grain size is necessary

Metamorphic and Igneous Rocks:

Either record the grain size in millimetres **or** use appropriate sedimentary term, for example, "fine sand sized crystals", medium gravel sized crystals"

G) Inclusions or Minor Components

Any isolated minor components within the rock material may be described using the appropriate terms. Some examples are given in the table below.

Sedimentary Rocks	Igneous Rocks
Concretions	Vesicles
Ironstone Band	Xenoliths
'Tea leaf' structure	Phenocrysts

H) Degree of Fracturing or Defect Spacing

Degree of Fracturing (borehole core)

TERM	DESCRIPTION
Fragmented	The core is composed primarily of fragments of length less than 20mm, and mostly of width less than the core diameter
Highly Fractured	Core lengths are generally less than 20mm - 40mm with occasional fragments
Fractured	Core lengths are mainly 30 - 100mm with occasional shorter and longer sections
Slightly Fractured	Core lengths are generally 300 - 1000mm with occasional longer sections and occasional sections between 100 to 300mm
Unbroken	The core does not contain any fractures

Defect Spacing (Outcrop)

TERM	SPACING (mm)
Extremely closely spaced	<20
Very closely spaced	20 - 60mm
Closely spaced	60 - 200m
Moderately spaced	200 - 600mm
Widely spaced	600mm - 2m

Rock Mass Defects

Order of Description: Type; inclination, shape, roughness, infill type, infill thickness

1. Defect Type

Defect Type and Code	Description	Diagram	Map symbol	Graphic log
Bedding Parting (BP)	A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering (e.g. bedding) or a planar anisotropy in the rock substance (e.g., cleavage). May be open or closed.			
Foliation (FL) Cleavage (CL) Schistosity (SH)	Discontinuous micro fractures may be present, near parallel to the layering. Arrangement in layers, of mineral grains of similar sizes or composition, and/or arrangement of elongated to tabular minerals near parallel to one another, and/ or to the layers.			
Joint (JT)	A surface or crack across which the rock has little or no tensile strength but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.			
Sheared Zone (SZ)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints (generally <50 mm), sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.			
Sheared Surface (SS)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.			
Crushed Seam (CS) Crushed Zone (CZ)	Seam or wider zone with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam/zone often have the rock fragments within a soil matrix.			
Infilled Seam (IS)	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint. Infilled seams less than 1 mm thick may be described as veneer or coating on joint surface.			
Decomposed Zone (DZ) Decomposed Seam (DS) Clay Seam (SM)	Zone of more weathered rock or soil, often with gradational boundaries. Formed by weathering of the rock substance in place. Clay seam or extremely weathered seam within the rock			
Vein (VN)	Vein is a distinct sheet like body of crystallized minerals within a rock			
Dyke (DK)	Dykes are sheet-like bodies of igneous rock that cut across sedimentary bedding or foliations in rocks. They may be single or multiple in nature.			

2. Defect Inclination
Measured as dip/dip direction in exposure measured in degrees from core normal in boreholes (90° is vertical)

3. Defect Shape

Code	Description
PR	Planar, defect does not vary in orientation
CU	Curved, defect has a gradual change in orientation
UN	Undulose/Undulating, defect has a wavy surface
ST	Stepped, defect has one or more well defined steps
IR	Irregular, defect has many sharp changes of orientation
DIS	Discontinuous

4. Defect Roughness

Code	Term	Description
S	Smooth	Smooth to touch. Few or no surface irregularities
POL	Polished	Shiny smooth surface
SL	Slickensided	Grooved or striated surface, usually polished
RF	Rough	Many small surface irregularities (amplitude generally < 1 mm) feels like fine to coarse sand paper
VR	Very rough	Many large surface irregularities (amplitude generally > 1 mm). Feels like coarse to very coarse sand paper

5. Defect Infill

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

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DESCRIPTION AND CLASSIFICATION OF ROCK (AS 1726:2017)

A) Main Rock Type

Igneous Rocks

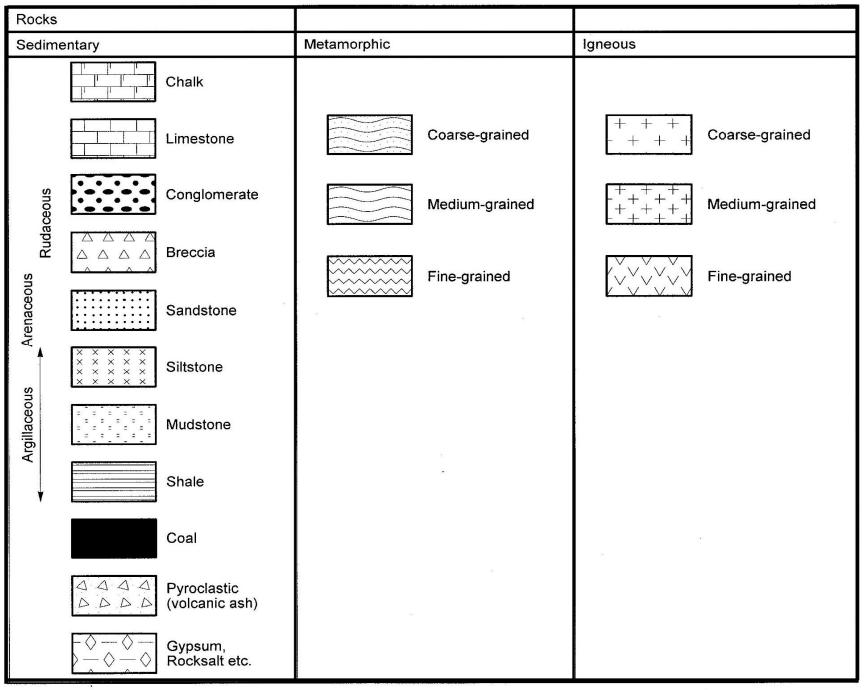
Pyroclastic	Igneous				Composition		
At least 50% of grains are of igneous rock	Quartz, feldspars, micas dark minerals		Feldspar, dark minerals	Dark minerals			
	Acid	Intermediate	Basic	Ultrabasic			
Rounded grains AGGLOMERATE	PEGMATITE				Very Coarse Grained	60	Predominant Grain Size (mm)
Angular grains VOLCANIC BRECCIA	GRANITE	DIORITE	GABBRO	Pyroxenite Peridotite Serpentinite	Coarse Grained	2	
TUFF			DOLERITE		Medium Grained	0.06	
Fine grained TUFF	RHYOLITE	ANDESITE	BASALT		Fine Grained	0.002	
Very Fine Grained TUFF					Very Fine Grained		
	VOLCANIC GLASS (OBSIDIAN)				Glassy Amorphous		

Sedimentary Rocks

Detrital Sedimentary					Chemical/ Organic			
Grains of rock, quartz, feldspar and clay minerals			At least 50% of the grains are of carbonate		Salts, carbonates silica, carbonaceous	Composition		
Rudaceous	Grains are typically rock fragments		LIMESTONE (undifferentiated)		*Saline Rocks* HALITE ANHYDRITE GYPSUM	Very Coarse Grained	60	Predominant Grain Size (mm)
	Rounded grains: CONGLOMERATE			CALCI--RUDITE	*Calcareous Rocks* LIMESTONE DOLOMITE	Coarse Grained	2	
	Angular grains: BRECCIA							
Arenaceous	Grains are typically mineral fragments					Medium Grained	0.06	
	SANDSTONE			CALC--ARENITE	*Siliceous Rocks* CHERT FLINT			
Argillaceous	MUDSTONE SHALE (fissile mudstone)	SILTSTONE: 50% fine grained particles		CALCI--SILTITE	*Carbonaceous Rocks* LIGNITE COAL	Fine Grained	0.002	
		CLAYSTONE: 50% very fine grained particles		CALCI--LUTITE		Very Fine Grained		

Metamorphic Rocks

Foliated		Massive	Composition		
Quartz, feldspars, micas dark minerals		Quartz, feldspars, micas dark minerals, carbonates			
MIGMATITE	TECTONIC BRECCIA	HORNFELS MARBLE GRANULITE QUARTZITE AMPHIBOLITE	Very Coarse Grained	60	Predominant Grain Size (mm)
GNEISS			Coarse Grained	2	
SCHIST	MYLONITE		Medium Grained	0.06	
PHYLLITE SLATE			Fine Grained	0.002	
			Very Fine Grained		



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DESCRIPTION AND CLASSIFICATION OF ROCKS (AS 1726 : 2017)

Table A- 1 List of Project Geotechnical Investigations - WRRF

Location Location	Borehole Type Date	Easting Depth (m) (m BGS)	Easting (m)	Northing (m)	Surface RL (m AHD)	Reason for Termination
WRRF-BH-101	11/06/2024	24.37	317761.4	6255230	5.05	Target depth
WRRF-BH-102	17/06/2024	23.25	318157.0	6255194	5.04	Target depth
WRRF-BH-103	13/06/2024	21.30	317694.7	6255066	4.03	Target depth
WRRF-BH-104	18/06/2024	22.29	317927.8	6255087	5.00	Target depth
WRRF-BH-105	28/06/2024	21.29	317737.8	6254805	4.10	Target depth
WRRF-BH-106	1/07/2024	25.97	317892.3	6254846	5.04	Target Depth
WRRF-BH-107	25/06/2024	22.33	318045.9	6254889	4.82	Target depth
WRRF-GW-101	18/06/2024	5.50	317805.7	6255271.2	5.06	Target depth
WRRF-GW-107	19/06/2024	17.23	317894.5	6255268.8	5.05	Target depth
WRRF-GW-108	21/06/2024	5.50	317985.3	6255249	4.98	Target depth
WRRF-GW-108A	20/06/2024	0.50	317985.2	6255249	4.99	Obstruction
WRRF-GW-108B	20/06/2024	2.00	317982.6	6255248.8	4.97	Obstruction
WRRF-GW-109	24/06/2024	5.00	318076.2	6255249.7	4.98	Target depth
WRRF-GW-110	17/06/2024	7.50	317704.8	6255157.4	4.12	Target depth
WRRF-GW-111	26/06/2024	6.20	318161.6	6255086.5	4.98	Target depth
WRRF-GW-112	3/07/2024	5.00	317750.4	6254898	4.42	Target depth
WRRF-GW-113	5/07/2024	9.42	317973.3	6254867.7	4.67	Target depth
WRRF-GW-114	25/06/2024	4.45	318004.3	6254862.6	4.74	Target depth
WRRF-GW-115	26/06/2024	6.00	318114.9	6254835.1	4.88	Target depth
WRRF-GW-116	28/06/2024	6.10	317893.0	6254745.2	5.32	Target depth
WRRF-GW-117	21/06/2024	5.80	317884.3	6255163	5.02	Target depth
WRRF-GW-118	25/06/2024	6.00	318025.7	6254995.7	5.31	Target depth
WRRF-SV-102	18/06/2024	3.45	318158.9	6255204.8	5.00	Target depth

Notes: BGS = below ground surface; AHD = Australian Height Datum; Position Coordinates to MGA datum.

Engineering Log - Borehole

WRRF-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 5
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317761.4 m	**Elevation:**	5.05 m	**Started:**	11/06/2024
Plant:	Comacchio 305	**Northing:**	6255230.0 m	**Datum:**	AHD	**Finished:**	12/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/T					5	0		FILL: Silty GRAVEL: low plasticity silt, dark grey, fine grained, angular to sub-angular gravel,; with fine to coarse grained sand	D		FILL
				D				FILL: CLAY: high plasticity, orange brown mottled grey; trace fine grained sand; trace sub-angular gravel			
				SPT N=33 5,10,23		0.5			M <Wp		0.60 : HP = 450 kPa
					4	1.0					0.80 : HP = 600 kPa
				D				CLAY: high plasticity, grey mottled orange and red; trace white rootlets/ fibrous organic material			ALLUVIUM
						1.5				St	
				D				*1.8m: colour changing to brownish red; trace fine grained, sub-angular to rounded gravel*			
				SPT N=15 5,7,8	3	2.0			M =Wp		2.10 : HP = 230 kPa
											2.30 : HP = 300 kPa
				U		2.5					2.76 : HP = 290 kPa
			11/06/2024		2	3.0					
				D				*3.3m: colour changing to red-brown mottled yellow/grey*		VSt	
				D		3.5					3.60 : HP = 470 kPa
				SPT N=19 4,8,11							3.70 : HP = 200 kPa 3.80 : HP = 280 kPa
AD/V	140 mm				1	4.0					
						4.5					
				SPT N=8 2,3,5	0	5.0		*5.1m: colour changing to dark grey; with rootlets*			5.10 : HP = 170 kPa 5.20 : HP = 120 kPa 5.30 : HP = 230 kPa
						5.5			M >Wp	St	
			13/06/2024		-1	6.0					
				D				*6.4m: colour changing to grey mottled red*			
				SPT N=8 2,3,5		6.5					6.60 : HP = 230 kPa 6.70 : HP = 220 kPa 6.80 : HP = 170 kPa
					-2	7.0				St-VSt	
						7.5		*7.6m: colour changing to grey mottled orange/yellow; trace pockets of sandy clay*			

METHOD & SUPPORT
HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION
No resistance ranging to refusal

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317761.4 m	**Elevation:**	5.05 m	**Started:**	11/06/2024
Plant:	Comacchio 305	**Northing:**	6255230.0 m	**Datum:**	AHD	**Finished:**	12/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		18/06/2024 12/06/2024	SPT N=9 3,3,6	-3	8.5		CLAY: high plasticity, grey mottled orange and red; trace white rootlets/ fibrous organic material	M >Wp	St-VSt	ALLUVIUM 8.10 : HP = 180 kPa 8.20 : HP = 190 kPa 8.30 : HP = 210 kPa
					-4	9.0					
				SPT N=11 3,4,7		9.5		*9.5m: colour changing to grey*			9.60 : HP = 150 kPa 9.70 : HP = 150 kPa 9.80 : HP = 140 kPa
					-5	10.0				St	
						10.5		Silty CLAY: medium plasticity, dark grey and green	M =Wp	F	
				U	-6	11.0					11.39 : HP = 90 kPa 11.40 : HP = 95 kPa 11.50 : HP = 80 kPa 11.60 : HP = 80 kPa 11.70 : HP = 60 kPa
				SPT N=2 0,0,2		11.5					
					-7	12.0		CLAY: high plasticity, grey			
				D		12.5					
				U							12.84 : HP = 400 kPa 12.85 : HP = 200 kPa 12.86 : HP = 350 kPa
				SPT N=R 5,20,6/30mm	-8	13.0				H	12.87 : HP = 510 kPa 12.89 : HP > 600 kPa
								Continued as cored hole from 13.24m			
						13.5					
					-9	14.0					
						14.5					
					-10	15.0					
						15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
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C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

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SAMPLES & FIELD TESTS

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U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
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HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Cored Borehole

WRRF-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317761.4 m	**Elevation:**	5.05 m	**Started:**	11/06/2024
Plant:	Comacchio 305	**Northing:**	6255230.0 m	**Datum:**	AHD	**Finished:**	12/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
		-3	8.5		Starting coring from 13.24 m						
		-4	9.0								
			9.5								
		-5	10.0								
			10.5								
		-6	11.0								
			11.5								
		-7	12.0								
			12.5								
		-8	13.0								
HQ3	40		13.5		EXTREMELY WEATHERED SILTSTONE RECOVERED AS CLAY: high plasticity, orange brown; trace bands of highly weathered siltstone, relic rock fabric	XW			34	100		HB SM, 5mm SM, 10mm SM, 100mm BP SM, 20mm SM, 20mm BP JT, 60°, UN, S, VNR, clay BP SM, 10°, PR, S, CN, 40mm SM, 20mm SM, 20mm SM, 100mm SM, 20mm HB, caused by defect at 15.14m BP JT, 70°, PR, S, Filled, clay (infill) JT, 40°, PR, RF, CN BP BP
			14.0		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey banded brown and grey, sandstone is fine grained, distinctly laminated at 0-5°	HW						
		-9	14.5			MW		d=0.03 a=0.16				
		-10	15.0		*15m: colour is dark grey and grey*							
	10		15.5			SW-FR		d=0.38 a=1.36				

Defects are BP, 0-10, PR, CN, S-RF ; SM, 0-10, PR, Clay (or similar), 10-20mm unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▶ = Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317761.4 m	**Elevation:**	5.05 m	**Started:**	11/06/2024
Plant:	Comacchio 305	**Northing:**	6255230.0 m	**Datum:**	AHD	**Finished:**	12/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	10	-11	16.5			SW-FR		d=0.29 a=1.22	59	100		BP BP BP	
		-12	17.0		SILTSTONE: dark grey, distinctly laminated at 0-5°; trace grey fine grained sandstone laminations								
			17.5					d=0.46 a=2.01				JT, 40°, PR, S, CN	
		-13	18.0									BP	
								d=0.66 a=2.22					
			18.5									JT, 40°, PR, S, CN	
		-14	19.0									JT, 10°, PR, S, VNR	
			19.5					d=0.08 a=0.99	83	100		VNR, patchy pyrite VNR, patchy pyrite VNR, patchy pyrite VNR, patchy pyrite	
	10	-15	20.0			FR		d=0.42 a=0.70				CS, 10°, PR, CT, 10mm, fractured rock recovered as gravel VNR, patchy pyrite VNR, patchy pyrite VNR, patchy pyrite JT, 40°, PR, S, CN	
			20.5									CS, 10°, PR, S, CT, 10mm, fractured rock recovered as gravel VNR, patchy pyrite JT, 88°, PR, RF, CN	
		-16	21.0									BP BP	
			21.5									BP JT, 60°, PR, RF, CN BP	
		-17	22.0					d=0.07 a=0.95				BP BP BP BP BP	
			22.5					d=0.09 a=0.87	89	100		JT, 60°, PR, RF, CN BP	
	10	-18	23.0									JT, 80°, PR, RF, CN BP BP	
			23.5					d=0.09 a=1.08				DB BP	

Defects are BP, 0-10, PR, CN, S-RF ; SM, 0-10, PR, Clay , 10-20mm unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
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ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317761.4 m	**Elevation:**	5.05 m	**Started:**	11/06/2024
Plant:	Comacchio 305	**Northing:**	6255230.0 m	**Datum:**	AHD	**Finished:**	12/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	**Description of Strata** ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	10	-19	24.5		SILTSTONE: dark grey, distinctly laminated at 0-5°; trace grey fine grained sandstone laminations	FR	○ □	d=0.04 a=1.24				JT, 75°, PR, RF, VNR closely spaced defects drilling induced along a sub-vertical joint	
					Exploratory hole terminated at 24.37 m Target depth								
		-20	25.0										
			25.5										
		-21	26.0										
			26.5										
		-22	27.0										
			27.5										
		-23	28.0										
			28.5										
		-24	29.0										
			29.5										
		-25	30.0										
			30.5										
		-26	31.0										
			31.5										

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▶ = Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
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CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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WRRF-BH-101 Depth Range: 13.24 - 21.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-101
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 1/2

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WRRF-BH-101 Depth Range: 21.00 - 24.37m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-101
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 2/2

This figure was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318157.0 m	**Elevation:**	5.04 m	**Started:**	17/06/2024
Plant:	Comacchio 305	**Northing:**	6255194.2 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		04/07/2024	D		0.5		FILL: Silty GRAVEL: low plasticity silt, dark grey, fine grained, angular to sub-angular gravel; with fine to coarse grained sand	M		FILL 0.15 : HP = 350 kPa 0.20 : HP = 240 kPa
				SPT N=10 4,4,6							0.70 : HP = 370 kPa
				D	4	1.0		CLAY: high plasticity, brown mottled red yellow	M <Wp		ALLUVIUM
				D		1.5		*1.6m: colour changing to grey mottled yellow; with medium grained sub angular to angular ironstone gravel*		St/ VSt	
				SPT N=14 5,7,7	3	2.0					2.10 : HP = 240 kPa 2.20 : HP = 320 kPa 2.30 : HP = 160 kPa
						2.5					
					2	3.0		*3.0m: colour changing to grey mottled red yellow*	M =Wp		
				SPT N=15 4,7,8		3.5					3.60 : HP = 310 kPa 3.70 : HP = 250 kPa 3.80 : HP = 320 kPa
					1	4.0					
						4.5				VSt	
				SPT N=13 4,6,7	0	5.0					5.10 : HP = 310 kPa 5.20 : HP = 250 kPa 5.30 : HP = 320 kPa
						5.5					
				D	-1	6.0		CLAY: medium plasticity, grey mottled red			
			18/06/2024	U		6.5			M >Wp		
				SPT N=R 4,8,10/100mm	-2	7.0		*7.0m: colour increases in red; with fine grained, sub-angular ironstone gravel*			6.70 : HP = 180 kPa 6.80 : HP = 210 kPa 6.90 : HP = 210 kPa
						7.5		CLAY: high plasticity, black		St/ VSt	

METHOD & SUPPORT
HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION
No resistance ranging to refusal

GROUNDWATER
▼ = Water level (static)
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HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318157.0 m	**Elevation:**	5.04 m	**Started:**	17/06/2024
Plant:	Comacchio 305	**Northing:**	6255194.2 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm					8.0		CLAY: high plasticity, black *8.0m: colour changing to grey mottled black red*			
				SPT N=8 3,3,5		8.5				St/ VSt	8.50 : HP = 150 kPa 8.60 : HP = 190 kPa 8.70 : HP = 210 kPa
					-4	9.0		*9.0m: colour changing to grey mottled red*			
				SPT N=3 1,1,2		9.5					9.60 : HP = 80 kPa 9.70 : HP = 90 kPa 9.80 : HP = 170 kPa
					-5	10.0					
						10.5		*10.0m: colour changing to dark grey mottled black*	M >Wp		
				SPT N=5 1,1,4	-6	11.0				F/St	11.10 : HP = 90 kPa 11.20 : HP = 110 kPa 11.30 : HP = 160 kPa
						11.5					
					-7	12.0					
				SPT N=13 2,5,8		12.5					12.60 : HP = 450 kPa 12.70 : HP = 150 kPa 12.80 : HP = 150 kPa
						13.0		CLAY: high plasticity, brown orange *12.95m: relic rock fabric; trace bands (1-2 mm) of highly weathered siltstone brown-orange in colour*	M <Wp	H	EXTREMELY WEATHERED MATERIAL
				SPT N=R 11, 13/70mm	-8	13.5		CLAY: medium plasticity, grey mottled brown			13.40 : HP > 600 kPa
								Continued as cored hole from 13.52m			
					-9	14.0					
						14.5					
					-10	15.0					
						15.5					

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Engineering Log - Cored Borehole

WRRF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318157.0 m	**Elevation:**	5.04 m	**Started:**	17/06/2024
Plant:	Comacchio 305	**Northing:**	6255194.2 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE				ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
			8.5		Starting coring from 13.52 m							
		-4	9.0									
			9.5									
		-5	10.0									
			10.5									
		-6	11.0									
			11.5									
		-7	12.0									
			12.5									
		-8	13.0									
			13.5		EXTREMELY WEATHERED SILTSTONE RECOVERED AS CLAY: medium plasticity, grey brown								
HQ3	10	-9	14.0		INTERLAMINATED SILTSTONE and SANDSTONE: dark grey banded brown and grey, sandstone is fine grained, distinctly laminated at 0-5°	HW		d=0.00 a=0.1	26	100		CS, 10°, PR, S, CN JT, 15°, PR, RF, CN JT, 15°, UN, RF, CN BP BP SM BP JT SM, 5°, PR, XW BP BP BP	Defects are BP, 0-5°, PR, CN, S-RF unless noted otherwise
		-10	14.5										
			15.0										
	10		15.5		SILTSTONE: dark grey, distinctly laminated grey; trace fine grained sandstone laminations	MW FR		d=0.43 a=0.85				SM, 5°, PR, XW SM, 5°, PR, XW SM, 5°, PR, XW SM, 5°, PR, XW SM, 5°, PR, XW JT JT, 10°, UN, RF, CN	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318157.0 m	**Elevation:**	5.04 m	**Started:**	17/06/2024
Plant:	Comacchio 305	**Northing:**	6255194.2 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	10	-12	16.5		SILTSTONE: dark grey, distinctly laminated grey, trace fine grained sandstone laminations		○ □	d=0.22 a=0.61	52	100		BP JT, 60°, CU, CN BP BP JT, 60°, UN, RF, CN BP BP JT, 0°, ST, RF, CN JT, 75°, PR, S, CN BP JT, 45°, PR, RF, CN BP	Defects are BP, 0-5°, PR, CN, S-RF unless noted otherwise
			17.0										
			17.5				○ □	d=0.51 a=1.48				BP BP BP BP BP BP JT, 15°, CU, RF, CN	
		-13	18.0				□ ○	d=1.56 a=1.37				BP BP BP BP, 5°, PR, S, VNR	
			18.5									BP BP BP BP BP BP BP BP BP	
		-14	19.0				○ □	d=0.56 a=0.64				JT, 30°, PR, S, CN JT, 40°, PR, S, CN BP	
	10		19.5			FR			59	100		BP BP BP BP BP BP JT BP	
		-15	20.0									JT, 65°, PR, S, CN BP	
			20.5				○ □	d=0.38 a=0.43				BP BP BP JT, 45°, PR, RF, CN BP	
		-16	21.0									BP BP JT, 45°, PR, S, CN JT, 75°, UN, RF, CN	
			21.5										
			22.0				○ □	d=0.89 a=0.96					
	0	-17							76	100			
			22.5				□ ○	d=0.99 a=1.39					
		-18	23.0									JT, 30°, PR, S, CN JT, 70°, PR, RF, CN	
			23.5		Exploratory hole terminated at 23.25 m Target depth								

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

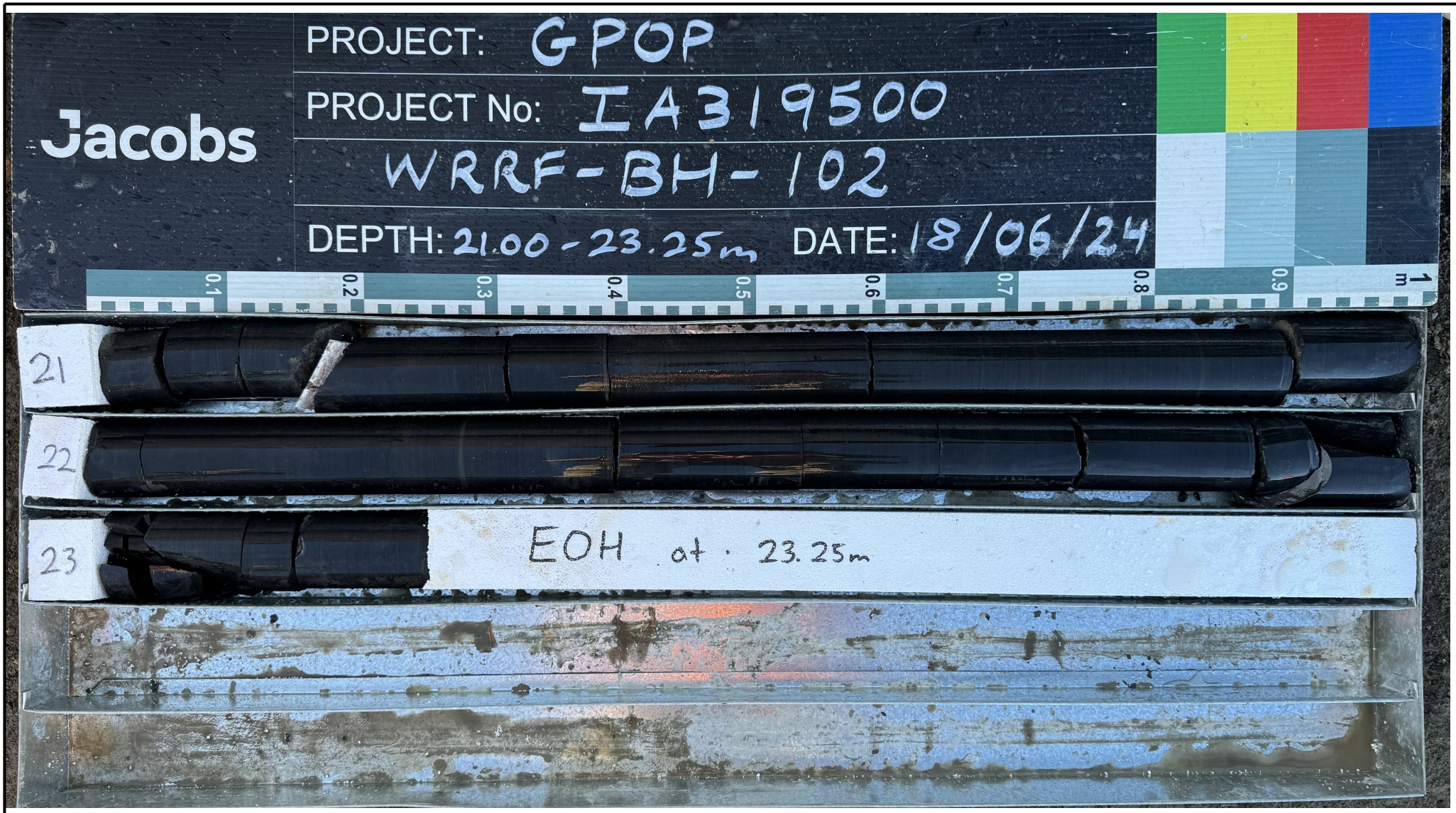
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WRRF-BH-102 Depth Range: 13.52 - 21.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-102
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 1/2

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WRRF-BH-102 Depth Range: 21.00 - 23.25m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-102
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 2/2

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Engineering Log - Borehole

WRRF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317694.7 m	**Elevation:**	4.03 m	**Started:**	13/06/2024
Plant:	Comacchio 305	**Northing:**	6255065.7 m	**Datum:**	AHD	**Finished:**	14/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		04/07/2024	D		0.5		CLAY: high plasticity, brown mottled red grey	M =Wp	F	ALLUVIUM
				SPT N=10 3,4,6	3	1.0		*0.5m: becoming grey mottled orange red; trace fine grained, sub-angular ironstone gravel*			0.60 : HP = 320 kPa 0.70 : HP = 230 kPa 0.80 : HP = 150 kPa
						1.5				St-VSt	
				U	2	2.0			M <Wp		
				SPT N=20 5,8,12		2.5					2.30 : HP = 270 kPa 2.40 : HP = 270 kPa 2.50 : HP = 360 kPa
					1	3.0				VSt	
			13/06/2024	D		3.5		CLAY: medium plasticity, grey mottled red			3.60 : HP = 250 kPa 3.70 : HP = 100 kPa 3.80 : HP = 160 kPa
				SPT N=13 3,4,9	0	4.0			M =Wp	St	
				D		4.5					
				SPT N=13 4,6,7	-1	5.0		CLAY: high plasticity, grey blotched red; trace fine grained, yellow sand; trace sub-angular ironstone gravel; trace white rootlets			5.10 : HP = 210 kPa 5.20 : HP = 250 kPa 5.30 : HP = 440 kPa
						5.5				VSt	
				D	-2	6.0		*6.2m: no rootlets observed, reducing sand and gravel content*			6.30 : HP = 140 kPa 6.40 : HP = 210 kPa
				SPT N=9 2,4,5		6.5			M >Wp		6.60 : HP = 190 kPa 6.70 : HP = 250 kPa 6.80 : HP = 210 kPa
					-3	7.0				St	
						7.5		*7.5m: colour changing to grey, mottled yellow and red*			

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317694.7 m	**Elevation:**	4.03 m	**Started:**	13/06/2024
Plant:	Comacchio 305	**Northing:**	6255065.7 m	**Datum:**	AHD	**Finished:**	14/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		20/06/2024	SPT N=8 1,3,5				CLAY: high plasticity, grey blotched red; trace fine grained, yellow sand; trace sub-angular ironstone gravel; trace white rootlets			8.10 : HP = 230 kPa 8.20 : HP = 210 kPa 8.30 : HP = 150 kPa
						8.5		*8.0m: colour changing to dark grey mottled yellow* CLAY: medium plasticity, brown mottled red; trace yellow sand; trace stained sub-angular ironstone gravel			
				D	-5	9.0		*9.0m: colour changing to light grey and yellow, reducing sand content*	M >Wp	St-VSt	
				SPT N=15 8,7,8		9.5		CLAY: medium plasticity, grey mottled yellow brown; with medium grained, sub-angular dark grey gravel; with fine to medium grained sand			RESIDUAL SOIL
					-6	10.0		CLAY: high plasticity, grey banded orange red brown, relic rock fabric			
			25/06/2024			10.5			M <Wp	VSt-H	
				SPT N=R 13, 18/110mm	-7	11.0					
						11.5		Continued as cored hole from 11.26m			
					-8	12.0					
						12.5					
					-9	13.0					
						13.5					
					-10	14.0					
						14.5					
					-11	15.0					
						15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Cored Borehole

WRRF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317694.7 m	**Elevation:**	4.03 m	**Started:**	13/06/2024
Plant:	Comacchio 305	**Northing:**	6255065.7 m	**Datum:**	AHD	**Finished:**	14/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
					Starting coring from 11.26 m						
HQ3	5	-8	11.5		Extremely weathered siltstone recovered as CLAY: high plasticity, dark grey mottled dark brown red	XW			28	100	SM
			12.0		INTERLAMINATED SILTSTONE (65%) AND SANDSTONE (35%) : dark grey banded brown and grey sandstone is fine grained, distinctly laminated at 0-5°						SM SM BP BP SM, PR, S, 30mm, Clay SM JT, 10°, PR, S, CN
		-9	12.5			MW		d=0.00 a=0.07			SM BP BP BP SM, 10mm BP CS, 0°, PR, S, clayey gravel 20mm JT, 20°, UN, S, CN BP, 10°, PR, RF, CT, Clay
			13.0								BP
	40	-10	13.5			SW		d=0.04 a=0.13	66	100	BP BP, 15°, UN, S, VNR JT, 20°, PR, S, CN JT, 70°, PR, S, CN BP
			14.0		INTERLAMINATED SILTSTONE (80%) AND SANDSTONE (20%) : dark grey and grey sandstone is fine grained, distinctly laminated at 0-5°			d=0.01 a=0.30			JT, 40°, PR, S, VNR BP
			14.5								
		-11	15.0			FR					JT, 40°, PR, S, CN BP JT, 45°, PR, S, CN JT, 40°, PR, S, CN
	40		15.5					d=0.06 a=0.27			BP BP BP

Defects are BP, 0-10, PR, CN, S-RF ; SM, 0-10, PR, Clay, 10 -20mm unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
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FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317694.7 m	**Elevation:**	4.03 m	**Started:**	13/06/2024
Plant:	Comacchio 305	**Northing:**	6255065.7 m	**Datum:**	AHD	**Finished:**	14/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
HQ3	40	-13	16.5		INTERLAMINATED SILTSTONE (80%) AND SANDSTONE (20%) : dark grey and grey sandstone is fine grained, distinctly laminated at 0-5°			d=0.16 a=0.44	58	100		BP BP JT, 70°, UN, RF, CN BP BP BP JT, 10°, PR, S, CN BP BP CS, fractured rock recovered as gravel, 40mm wide JT, 10°, UN, S, CN JT, 11°, UN, RF, CN BP BP BP JT, 35°, PR, S, CN BP BP BP, 10°, UN, S, CN BP BP BP
		-14	17.0 17.5 18.0					d=0.58 a=1.01				
		-15	18.5 19.0		SILTSTONE: dark grey, distinctly laminated at 0-5°, trace grey fine grained sandstone laminations	FR		d=1.09 a=0.88				BP BP BP



WRRF-BH-103 Depth Range: 11.26 - 19.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-103
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 1/2

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WRRF-BH-103 Depth Range: 19.00 - 21.30m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-103
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:**	**Scale:** NTS	**Drawing Number:** 2/2

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Engineering Log - Borehole

WRRF-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317927.8 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255087.4 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		20/06/2024 04/07/2024	D SPT N=16 3,5,11 D D U SPT N=9 3,3,6 D SPT N=9 2,3,6 SPT N=11 3,4,7 D SPT N=12 3,5,7 D	4 3 2 1 0 -1 -2	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: CLAY: medium plasticity, brown; trace fine to medium grained, sub-angular gravel; trace coarse grained sand *0.4m: becoming brown mottled grey and red* CLAY: high plasticity, mottled grey and orange; trace rootlets *2.6m: becoming red-brown mottled grey and orange; trace fine grained sand; trace sub-angular ironstone gravel* CLAY: high plasticity, grey mottled orange *6.0m: becoming grey mottled, red-brown; trace fine grained, sub-angular to sub-rounded ironstone gravel* CLAY: medium plasticity, grey mottled green and red	M <Wp M =Wp M >Wp	St St-VSt F-St	FILL 0.50 : HP > 600 kPa 0.60 : HP > 600 kPa 0.70 : HP > 600 kPa ALLUVIUM 2.10 : HP = 170 kPa 2.20 : HP = 180 kPa 2.50 : HP = 240 kPa 2.60 : HP = 240 kPa 2.70 : HP = 190 kPa 5.10 : HP = 240 kPa 5.20 : HP = 250 kPa 5.30 : HP = 200 kPa 6.60 : HP = 210 kPa 6.70 : HP = 200 kPa 6.80 : HP = 180 kPa

METHOD & SUPPORT
HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION
No resistance ranging to refusal

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317927.8 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255087.4 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm			SPT N=6 1,2,4		8.5		CLAY: medium plasticity, grey mottled green and red			8.10 : HP = 170 kPa 8.20 : HP = 190 kPa 8.30 : HP = 150 kPa
				U	-4	9.0				F-St	
						9.5					9.60 : HP = 360 kPa 9.70 : HP = 290 kPa 9.80 : HP = 250 kPa
				SPT N=14 3,6,8	-5	10.0					
				D		10.5			M >Wp		
					-6	11.0				St-VSt	
				D		11.5		*11.6m: increasing yellow/green colour*			
					-7	12.0					
				SPT N=R 16, 20/50mm		12.5		CLAY: high plasticity, grey banded brown red, relic rock fabric			12.65 : HP > 600 kPa
								Continued as cored hole from 12.70m			
					-8	13.0					
						13.5					
					-9	14.0					
						14.5					
					-10	15.0					
						15.5					

METHOD & SUPPORT
HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION
No resistance ranging to refusal

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Cored Borehole

WRRF-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317927.8 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255087.4 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE				ROCK MASS DEFECTS				
Method	Flush Return	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
					Starting coring from 12.70 m							
HQ3	10	-8	13.0		Extremely weathered siltstone recovered as CLAY: high plasticity, banded grey mottled red yellow; trace fine grained gravel	XW						
					INTERLAMINATED SILTSTONE (65%) AND SANDSTONE (35%): black banded grey yellow, sandstone is fine grained, distinctly laminated at 0-5°	HW		d=0.01 a=0.05	53	100		SM BP, 10°, PR, RF, SN CS, 0°, PR, clayey gravel, 40mm BP BP BP BP	
		-9	14.0			MW		d=0.02 a=0.12				JT, 15°, PR, RF, SN CS, 0°, PR, clayey gravel, 20mm BP, 5°, PR, RF, SN JT CZ, 0°, PR, fractured rock recovered as gravel 21mm SM BP BP BP BP BP BP BP BP BP	Defects are BP, 0-10, PR, CN, S-RF : SM, 0-10, PR, Clay, 10-20mm and JT, 10-45, PR CN, S-RF unless stated otherwise
		-10	15.0			SW		d=0.09 a=1.30					
	10		15.5			FR							

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317927.8 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255087.4 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
HQ3	10	-12	16.5		INTERLAMINATED SILTSTONE (65%) AND SANDSTONE (35%): black banded grey yellow, sandstone is fine grained, distinctly laminated at 0-5°	FR		d=0.16 a=1.17	85	100		JT JT BP BP BP BP BP JT, 50°, PR, RF, CN CS, 0°, PR, Clayey gravel, 20mm BP BP BP BP BP BP BP BP BP BP
		-13	17.5 18.0					d=0.02 a=0.40 d=0.87 a=1.45				
	10	-14	18.5 19.0					d=0.79 a=2.06	94	100		BP BP BP BP BP
		-15	19.5 20.0		INTERLAMINATED SILTSTONE (80%) AND SANDSTONE (20%): dark grey and pale grey, sandstone is fine grained, distinctly laminated at 0-5°			d=0.21 a=0.90 d=0.17 a=1.90				BP BP BP BP BP BP BP BP BP BP BP BP BP
	10	-16	20.5 21.0					d=0.25 a=0.49	87	100		BP BP BP BP BP BP
		-17	21.5 22.0					d=0.18 a=1.60				JT
					Exploratory hole terminated at 22.29 m Target depth							
		-18	22.5 23.0									
			23.5									

General: Defects are BP, 0-10, PR, CN, S-RF ; SM, 0-10, PR, Clay (or similar), 10-20mm and JT, 10-45, PR CN, S-RF unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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WRRF-BH-104 Depth Range: 12.73 - 20.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-104
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	GC	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 1/2

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WRRF-BH-104 Depth Range: 20.00 - 22.29m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-104
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	GC	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 2/2

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Engineering Log - Borehole

WRRF-BH-105

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317737.8 m	**Elevation:**	4.10 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254804.8 m	**Datum:**	AHD	**Finished:**	02/07/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/T	140 mm		08/07/2024 05/07/2024 28/06/2024 04/07/2024 28/06/2024	D D SPT N=9 3,4,5 D D SPT N=16 4,6,10 D SPT N=8 2,3,5 U D SPT N=11 4,4,7 D SPT N=8 1,3,5 U D	4 3 2 1 0 -1 -2 -3	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		Sandy CLAY: High plasticity, brown, trace fine to coarse grained, sub angular to sub rounded, black bitumen gravel and trace fine to coarse grained, sub angular to sub rounded, grey gravel, trace rootlets. Sand is fine to coarse grained, sub rounded to rounded, dark grey CLAY: High plasticity, brown trace fine to coarse grained, sub angular to angular bitumen, trace rootlets CLAY: High plasticity, grey mottled red yellow trace rootlets CLAY: Medium plasticity, grey mottled red yellow CLAY: High plasticity, grey mottled red yellow *1.9m: trace fine to coarse grained, sub angular to angular ironstone gravel, trace fine to coarse grained, sub angular to angular grey gravel* *4.9m: trace fine to coarse grained, sub angular to angular grey gravel* *6.2m: colour is dark grey* *6.5m: colour is grey mottled green* Sandy CLAY: Medium plasticity, grey mottled yellow. Sand is fine-coarse grained, sub rounded- rounded, yellow CLAY: High plasticity, grey mottled red and yellow with fine grained sand and coarse grained ironstone gravel	M =Wp M <Wp M =Wp M >Wp	St VSt F-St St	FILL ALLUVIUM 0.70 : PP= 250, 300, 260 kPa 2.20 : PP= >600, 500, >600 kPa 5.20 : PP= 170, 230, 40 kPa 6.70 : PP= 180, 200, 190 kPa 7.20 : PP= 240, 260, 190 kPa ALLUVIUM

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Engineering Log - Borehole

WRRF-BH-105

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317737.8 m	**Elevation:**	4.10 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254804.8 m	**Datum:**	AHD	**Finished:**	02/07/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION							MATERIAL SUBSTANCE				
Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/T	140 mm		28/06/2024	SPT N=12 4,6,6	-4	8.5		CLAY: High plasticity, grey mottled red and yellow with fine grained sand and coarse grained ironstone gravel	M >Wp	St	ALLUVIUM 8.20 : PP= 180, 300, 210 kPa
				D	-5	9.0					
				D							
				SPT N=42 9,17,25		9.5		CLAY: Medium plasticity, grey *9.5m: with fine to coarse grained, sub angular to sub rounded ironstone gravel, relic rock fabric*	M =Wp	H	9.70 : PP= >600, >600, >600 kPa
					-6	10.0		Continued as cored hole from 9.95m			
						10.5					
					-7	11.0					
						11.5					
					-8	12.0					
						12.5					
					-9	13.0					
						13.5					
					-10	14.0					
						14.5					
					-11	15.0					
						15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Cored Borehole

WRRF-BH-105

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317737.8 m	**Elevation:**	4.10 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254804.8 m	**Datum:**	AHD	**Finished:**	02/07/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-4	8.5		Starting coring from 9.95 m								
		-5	9.0										
			9.5										
HQ3		-6	10.0		NO CORE: 290 mm (9.95m - 10.24m)								
			10.5		Sandy CLAY: High Plasticity, grey with bands of brown/red, sand is fine to medium grained with medium grained sub-angular gravel	XW							
	50	-7	11.0						27	31			
			11.5		SILTSTONE: grey, with fine grained sandstone laminations at 10°			d=0.17 a=0.15				BP	
			12.0			HW						BP BP BP BP BP	
		-8	12.5					d=0.00 a=0.06				SM, 5°, PR, S, CT, 5mm SM, 5°, PR, S, CT, 5mm BP	
		-9	13.0									JT, 20°, PR, S, CT	
			13.5					d=0.00 a=0.33				SM, 5°, PR, S, CT, 5mm	
	10	-10	14.0			MW			94	100		JT, 10°, IR, S, CN SM, 5°, PR, S, CT, 5mm JT, 10°, IR, S, CN	
			14.5					d=0.03 a=0.31				BP BP SM, 5°, PR, S, CT, 10mm JT, 20°, PR, S, CT BP	
		-11	15.0									JT, 10°, IR, S, VN	
			15.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey and pale grey, sandstone is fine grained, distinctly laminated at 10°	SW		d=0.46 a=0.48				CS, 10°, PR, RF, 10mm, fine to medium grained angular gravel with clay CS, 10°, PR, RF, 5mm, fine to medium grained angular gravel	Defects are BP, 10°, PR, Clay CT, S unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-105

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317737.8 m	**Elevation:**	4.10 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254804.8 m	**Datum:**	AHD	**Finished:**	02/07/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
HQ3	10	-12 -13 -14 -15 -16 -17 -18 -19	16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5		SILTSTONE: Dark grey, laminated at 10°	SW FR		d=0.41 a=0.40 d=0.33 a=1.43 d=1.35 a=1.37 d=0.72 a=2.59 d=0.51 a=2.00 d=0.60 a=2.45	82 98	100 100		with clay CS, 10°, PR, RF, 5mm, fine to medium grained angular gravel with clay BP BP BP BP BP BP BP JT, 90°, IR, S, CN BP BP JT, 30°, IR, RF, CN, 10mm BP BP BP BP, CT BP, CT BP, CT BP, CT BP BP BP BP BP BP BP JT, 45°, IR, RF, CN BP BP BP BP BP, CT BP, CT BP
					Exploratory hole terminated at 21.29 m Target depth							

General: Defects are BP, 0° - 5°, PR, CN, S unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
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ROCK STRENGTH (Is50 MPa)

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0.1-0.3	Low (L)
0.3-1.0	Medium (M)
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3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

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CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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WRRF-BH-105 Depth Range: 09.95 - 17.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-105
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 1/2

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WRRF-BH-105 Depth Range: 17.00 - 21.29m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-105
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 2/2

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Engineering Log - Borehole

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			08/07/2024 01/07/2024	SPT N=1 2,1,0	4	0.5 1.0		FILL: Sandy CLAY: low plasticity, brown; fine to coarse grained sand; with fine to medium grained, sub-rounded to sub-angular, ironstone gravel *0.8m: grey, dark grey and orange-brown mottling*			FILL 0.69 : HP = 110 kPa 0.70 : HP = 90 kPa 0.71 : HP = 90 kPa 0.80 : 150mm SPT hammer weight penetration 1.00 : Hydrocarbon odour
				SPT N=11 5,5,6	3	1.5 2.0 2.5		CLAY: high plasticity, brown mottled grey; trace fine grained, sub-rounded to sub-angular, ironstone gravel; trace fine to coarse grained sand *2.4m: grey mottled brown*	M =Wp	St-VSt	ALLUVIUM 2.19 : HP = 450 kPa 2.20 : HP = 320 kPa 2.21 : HP = 510 kPa 2.39 : HP = 150 kPa 2.40 : HP = 300 kPa 2.41 : HP = 230 kPa
				SPT N=11 4,4,7	2	3.0 3.5		CLAY: high plasticity, grey mottled brown			3.59 : HP = 280 kPa 3.60 : HP = 220 kPa 3.61 : HP = 300 kPa 3.89 : HP = 300 kPa 3.90 : HP = 400 kPa 3.91 : HP = 300 kPa
				SPT N=16 5,6,10	1 0	4.0 4.5 5.0		*5.5: grey mottled orange-brown and red-brown*	M >Wp	VSt	5.09 : HP = 330 kPa 5.10 : HP = 270 kPa 5.11 : HP = 370 kPa 5.39 : HP = 250 kPa 5.40 : HP = 290 kPa 5.41 : HP = 350 kPa 5.50 : HP = 210 kPa 5.51 : HP = 250 kPa 5.52 : HP = 230 kPa
				SPT N=20 5,9,11	-1 -2	5.5 6.0 6.5 7.0		CLAY: high plasticity, orange-brown; trace medium grained, sub-angular to sub-rounded, ironstone gravel			6.48 : HP = 320 kPa 6.49 : HP = 350 kPa 6.50 : HP = 410 kPa 6.69 : HP = 450 kPa 6.70 : HP = 270 kPa 6.71 : HP = 400 kPa
						7.5					

METHOD & SUPPORT

HA	Hand Auger
AS	Auger
AD/V	Auger - V-bit
AD/T	Auger - TC-bit
WB	Washbore
RR	Rock Roller
SNC	Sonic Drilling
AH	Air Hammer
C	Casing
PT	Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample	N SPT blows per 300mm
B Bulk Sample	HW SPT penetration by hammer weight
SPT SPT Sample	RW SPT penetration by rod weight
U Undisturbed Sample	HP Hand Penetrometer
E Enviro Sample	HV Hand Vane Shear
W Water Sample	(P: Peak Su R: Residual Su)

MOISTURE

D = Dry	
M = Moist	
W = Wet	
Wp = Plastic Limit	
Wl = Liquid Limit	

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V				SPT N=R 7,12,14/50mm				CLAY: high plasticity, orange-brown; trace medium grained, sub-angular to sub-rounded, ironstone gravel	M >Wp	VSt-H	ALLUVIUM 8.11 : HP 330 kPa 8.12 : HP 350 kPa 8.13 : HP 540 kPa
						8.5		Continued as cored hole from 8.35m			8.35 : SPT hammer bouncing
					-4	9.0					
						9.5					
					-5	10.0					
						10.5					
					-6	11.0					
						11.5					
					-7	12.0					
						12.5					
					-8	13.0					
						13.5					
					-9	14.0					
						14.5					
					-10	15.0					
						15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Cored Borehole

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
					Starting coring from 8.35 m						
HQ3	0	-4	8.5 9.0		CLAY (RESIDUAL SOIL): high plasticity, orange-brown mottled grey; with fine to medium grained, sub-rounded to sub-angular ironstone gravel *9.12-9.15m: sandstone cobble* *9.15-9.35m: fine to medium grained, sub-rounded to sub-angular, clayey gravel band*				0	100		
			9.5		NO CORE (100mm): 9.35-9.43m							
	0	-5	10.0 10.5		CLAY (RESIDUAL SOIL): high plasticity, orange-brown mottled grey; with fine to medium grained, sub-rounded to sub-angular ironstone gravel *10.43-10.45m: trace of fine to medium grained, sub-angular to sub-rounded gravel*	XW			0	95		
	0	-6	11.0		Sandy GRAVEL: fine to medium grained, sub-rounded, red, grey and orange, highly weathered gravel; fine to medium grained sand							
	0		11.5		CLAY: high plasticity, grey mottled orange brown *11.37-11.41m: 40mm sandstone band*				29	100		
		-7	12.0		SILTSTONE: dark grey with iron staining, indistinctly laminated at 0° to 5°	HW		d=0.12 a=0.07				BP, 0°, PR, S, CN, 40mm, Zone of very closely spaced BP's BP, 0°, PR, S, CT, Clay BP, 0°, PR, S, CT, Clay BP, 0°, PR, S, CT, Clay
			12.5		CLAY: high plasticity, dark grey with iron staining, extremely weathered siltstone *12.45m: ironstone gravel band*	XW		d=0.01 a=0.02				
	0	-8	13.0		*12.72-12.76m: ironstone gravel band* Interlaminated SILTSTONE (65%) and SANDSTONE (35%): iron stained dark grey, distinctly laminated at 0° to 5°	MW		d=0.08 a=0.22	37	100		BP, 0°, PR, S, CT, Clay BP, 0°, PR, S, CT, Sand SM, 0°, XW, 200mm SM, 0°, XW, 50mm SM, 0°, XW, 60mm
		-9	13.5 14.0									BP, 0°, PR, S, CT, Clay JT, 30°, PR, RF, CN BP, 0°, PR, S, CT, Clay SM, 0°, Clay, 10mm
	0		14.5			SW		d=0.00 a=0.01	82	100		CZ, 0°, Sandy Gravel, 50mm JT, 40°, PR, S, SN CZ, 0°, Sandy Gravel, 50mm JT, 45°, PR, S, CN
		-10	15.0									BP
	0		15.5					d=0.05 a=0.29				BP BP

General: Defects are typically BP, 0°, PR, S, CN unless noted otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
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MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-12	16.5		Interlaminated SILTSTONE (65%) and SANDSTONE (35%): iron stained dark grey, distinctly laminated at 0° to 5°	SW		d=0.02 a=0.28	96	100		BP BP BP BP, 0°, 20mm	Defects are typically BP, 0°, PR, S, CN unless noted otherwise
	0	-13	17.0					d=0.09 a=0.32	99	100		BP JT, 10°, PR, S, CN, 10mm HB BP, 0°, PR, S, VNR, Clay HB HB	
	0	-14	18.0		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): pale grey and dark grey, sandstone is fine grained, distinctly laminated at 0° to 5°			d=0.08 a=0.38	90	100		BP BP BP BP HB JT, 10°, PR, S, CN HB HB	
	0	-15	19.5					d=0.97 a=1.00				BP BP	
	0	-16	20.5			FR		d=0.51 a=2.96	99	100		BP	
	0	-17	21.5					d=0.29 a=1.65	100	100			
	0	-18	22.5					d=0.56 a=0.60					
	0		23.0					d=0.96 a=1.09	100	100		BP	
			23.5		SILTSTONE: dark grey, trace of fine grained, grey, sandstone laminae, indistinctly laminated at 0° to 5°								

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
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DEFECT ABBREVIATIONS

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CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 5

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE				ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-20	24.5		SILTSTONE: dark grey, trace of fine grained, grey, sandstone laminae, indistinctly laminated at 0° to 5°	FR	○ □	d=0.23 a=2.31	100	100		BP	Defects are typically BP, 0°, PR, S, CN unless noted otherwise
	0		25.0										
			25.5				□ ○	d=1.01 a=0.72					
		-21	26.0		Exploratory hole terminated at 25.97 m Target depth								
			26.5										
		-22	27.0										
			27.5										
		-23	28.0										
			28.5										
		-24	29.0										
			29.5										
		-25	30.0										
			30.5										
		-26	31.0										
			31.5										

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.



WRRF-BH-106 Depth Range: 8.35 - 16.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-106
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 1/4

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WRRF-BH-106 Depth Range: 16.00 - 20.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-106
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 2/4

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WRRF-BH-106 Depth Range: 20.00 - 24.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-106
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 3/4

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WRRF-BH-106 Depth Range: 24.00 - 25.97m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-106
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 4/4

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Engineering Log - Borehole

WRRF-BH-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318045.8 m	**Elevation:**	4.82 m	**Started:**	25/06/2024
Plant:	Comacchio Geo 307	**Northing:**	6254889.1 m	**Datum:**	AHD	**Finished:**	27/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		25/06/2024 26/06/2024	D	4	0.0		FILL: Sandy GRAVEL: fine to coarse grained, sub-angular-angular, dark grey. Sand is fine to coarse grained, trace silt	M		FILL
				D		0.5		FILL: CLAY: medium plasticity, grey-brown, trace fine grained sand, trace rootlets	M <Wp		0.50 : HP = 50 kPa 0.60 : HP = 160 kPa 0.70 : HP = 300 kPa
				SPT N=10 2,4,6		1.0		CLAY: medium plasticity, grey mottled brown and red		St	ALLUVIUM
				D	3	2.0		CLAY: high plasticity, grey trace rootlets			2.00 : HP = 350 kPa 2.10 : HP = 320 kPa 2.20 : HP = 310 kPa
				SPT N=16 3,6,10		2.5		*2.5m: colour is changing to grey mottled brown and red*			
				D	2	3.0					
				SPT N=16 5,8,8	1	3.5		*3.75m: trace fine-medium grained ironstone gravel*			3.50 : HP = 70 kPa 3.60 : HP = 270 kPa 3.70 : HP = 370 kPa
				D		4.0			M >Wp		
				D	0	4.5				St-VSt	
				SPT N=9 1,3,6		5.0		*5.2m: colour is changing to grey*			5.00 : HP = 410 kPa 5.10 : HP = 300 kPa 5.20 : HP = 210 kPa
				D	-1	5.5					
				SPT N=12 4,5,7	-2	6.0					6.50 : HP = 320 kPa 6.60 : HP = 390 kPa 6.70 : HP = 210 kPa
				D		6.5					
					-3	7.0		Silty CLAY: high plasticity, grey mottled red, trace fine grained sand			8.00 : HP = 40 kPa

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit WI = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-BH-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318045.8 m	**Elevation:**	4.82 m	**Started:**	25/06/2024
Plant:	Comacchio Geo 307	**Northing:**	6254889.1 m	**Datum:**	AHD	**Finished:**	27/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm			SPT N=19 6,7,12		8.5		Silty CLAY: high plasticity, grey mottled red, trace fine grained sand			8.10 : HP = 40 kPa 8.20 : HP = 50 kPa
					-4			CLAY: high plasticity, banded grey and red yellow with fine-coarse grained ironstone gravel		St-VSt	
				D		9.0					
						9.5		Gravelly CLAY: high plasticity, red banded grey and yellow, gravel is fine grained sub angular to sub rounded ironstone.			RESIDUAL SOIL 9.50 : HP > 600 kPa 9.60 : HP = 510 kPa 9.70 : HP > 600 kPa
				SPT N=35 12,17,18	-5	10.0			M >Wp		
				D		10.5		CLAY: high plasticity, banded grey and red yellow with fine to coarse grained, sub angular to sub rounded ironstone gravel		H	
					-6	11.0					11.00 : HP > 600 kPa 11.10 : HP > 600 kPa 11.20 : HP > 600 kPa
				SPT N=R 12,30,0/0mm				*11.2m: relic rock fabric*			
						11.5		CLAY: high plasticity, grey mottled brown with highly weathered siltstone gravel			EXTREMELY WEATHERED MATERIAL
				D	-7	12.0		*12.04m: colour is grey mottled red brown with fine-coarse grained, sub angular sub rounded, ironstone gravel*			
								Continued as cored hole from 12.04m			
						12.5					
					-8	13.0					
						13.5					
					-9	14.0					
						14.5					
					-10	15.0					
						15.5					
					-11						

METHOD & SUPPORT
HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION
No resistance ranging to refusal

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Cored Borehole

WRRF-BH-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318045.8 m	**Elevation:**	4.82 m	**Started:**	25/06/2024
Plant:	Comacchio Geo 307/Comacchio Geo 308	**Northing:**	6254889.1 m	**Datum:**	AHD	**Finished:**	27/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE				ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
					Starting coring from 12.04 m							
HQ3	10	-4	8.5									
			9.0									
			9.5									
		-5	10.0									
			10.5									
		-6	11.0									
			11.5									
		-7	12.0		Interlaminated SILTSTONE (80%) and SANDSTONE (20%), dark grey banded brown and yellow. Sandstone is fine grained, distinctly laminated at 0-5°.	XW			45	100		BP BP BP BP BP BP
			12.5			HW						
		-8	13.0			XW		d=0.38 a=0.54				BP, 5°, PR, S, SN
			13.5			MW						JT, 25°, PR, S BP BP SM, 0°, IR, RF BP
	10	-9	14.0						79	100		BP BP BP BP JT, 25°, PR, S JT, 25°, PR, S JT, 25°, PR, S BP BP
		-10	14.5			SW		d=0.51 a=0.34				JT, 25°, PR, RF, CN JT, 25°, PR
			15.0					d=0.03 a=0.37				BP, 5°, PR, RF, VN HB BP
	10	-11	15.5									

Defects are BP, 0°-10°, PR, CN, S-RF unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Engineering Log - Cored Borehole

WRRF-BH-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318045.8 m	**Elevation:**	4.82 m	**Started:**	25/06/2024
Plant:	Comacchio Geo 307/Comacchio Geo 308	**Northing:**	6254889.1 m	**Datum:**	AHD	**Finished:**	27/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			ROCK MASS DEFECTS				
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral	Point Load Strength Index Is(50) (MPa)	RQD (%)	TCR (%)	Defect Spacing (mm)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
HQ3	10	-12	16.5 17.0		Interlaminated SILTSTONE (80%) and SANDSTONE (20%), dark grey banded brown and yellow. Sandstone is fine grained, distinctly laminated at 0-5°.	SW		d=0.01 a=0.29	94	100		BP, 5°, UN, S, CN JT, 25°, PR, S BP
		-13	17.5 18.0					d=0.04 a=0.68				JT, 25°, PR, S BP BP BP BP
	10	-14	18.5 19.0									BP
		-15	19.5 20.0			FR		d=0.90 a=1.50	99	100		BP BP JT, 25°, PR, S
		-16	20.5 21.0					d=1.36 a=1.52				BP BP CZ, 25°, IR, zone of closely spaced joints recovered as gravel
	10	-17	21.5 22.0					d=0.91 a=2.27	78	100		BP BP BP
		-18	22.5 23.0		Exploratory hole terminated at 22.33 m Target depth							
		-19	23.5									

General: Defects are BP, 0°-10°, PR, CN, S-RF unless stated otherwise

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

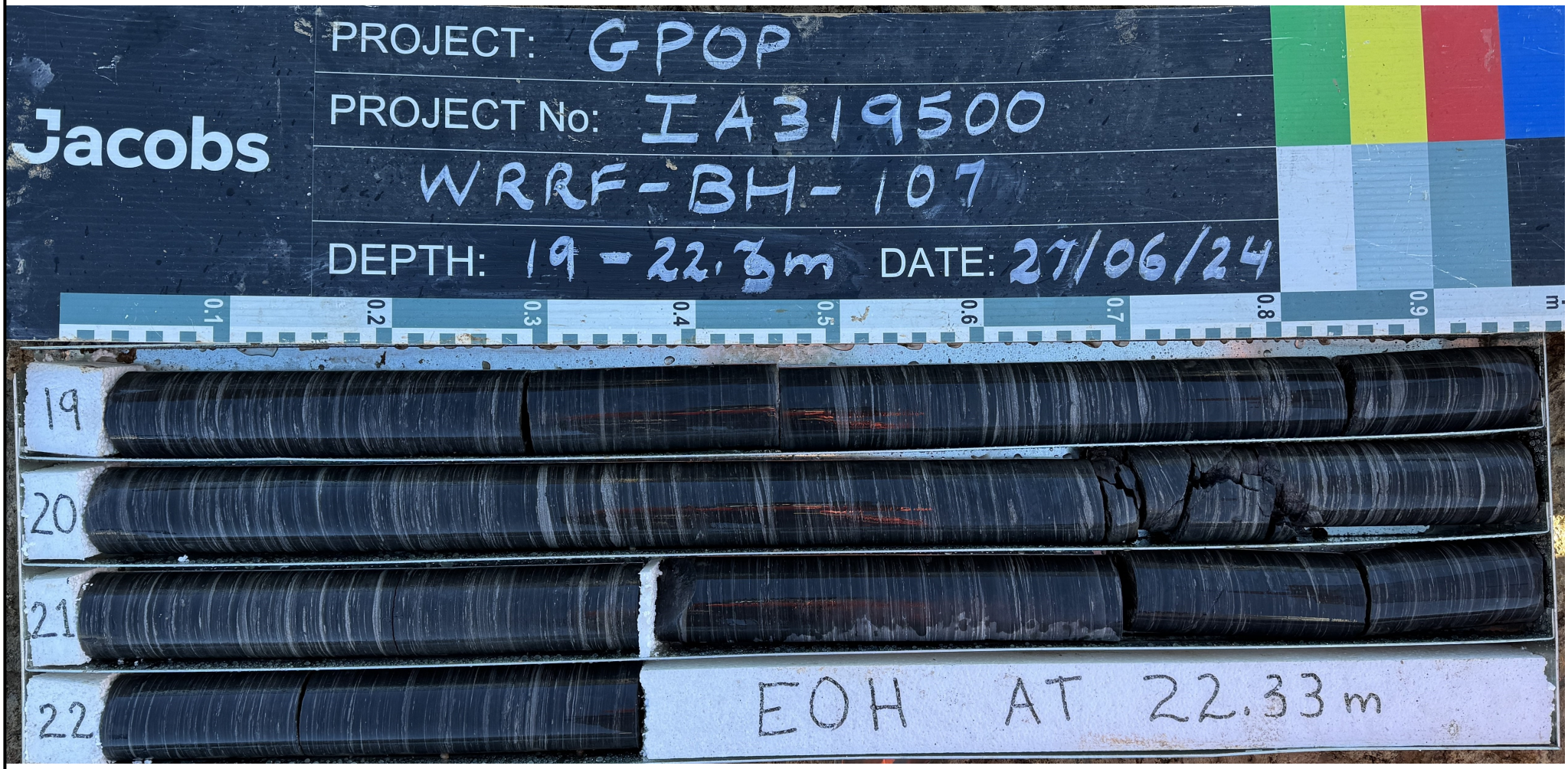
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WRRF-BH-107 Depth Range: 12.04 - 19.00m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-107
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 1/2

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WRRF-BH-107 Depth Range: 19.00 - 22.30m

Jacobs	**Client:**	Sydney Water		**Title:**	WRRF-BH-107
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 2/2

This figure was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317805.7 m	**Elevation:**	5.06 m	**Started:**	18/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255271.2 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		09/07/2024 19/06/2024	D SPT N=17 4,8,9 D SPT N=12 4,5,7 D SPT N=9 3,4,5 D SPT N=10 2,4,6	5 4 3 2 1 0 -1 -2	0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: CLAY: medium plasticity, brown mottled dark grey; with fine to coarse grained sand; with fine to medium grained, sub-rounded to sub-angular, siltstone and sandstone gravel *0.3m: trace of gravel* FILL: CLAY: medium to high plasticity, orange-brown mottled grey; trace fine to coarse grained sand *0.8m: yellow-white and dark orange-brown mottling* CLAY: high plasticity, brown mottled grey *2.4m: grey mottled orange-brown* *2.9m: grey mottled grey-brown* *4m: dark grey and brown mottling* *4.7m: trace of fine to coarse grained sand* *4.8m: trace of fine to medium grained, sub-rounded to sub-angular, siltstone gravel* Exploratory hole terminated at 5.50 m Target depth	M <Wp M =Wp M >Wp	VSt St-VSt	FILL 0.59 : HP = 520 kPa 0.60 : HP = 320 kPa 0.61 : HP = 500 kPa 0.79 : HP = 220 kPa 0.80 : HP = 240 kPa 0.81 : HP = 340 kPa 0.89 : HP = 480 kPa 0.90 : HP = 360 kPa 0.91 : HP = 380 kPa ALLUVIUM 1.99 : HP = 320 kPa 2.00 : HP = 370 kPa 2.01 : HP = 290 kPa 2.29 : HP = 250 kPa 2.30 : HP = 260 kPa 2.31 : HP = 220 kPa 3.69 : HP = 190 kPa 3.70 : HP = 110 kPa 3.71 : HP = 170 kPa 3.72 : HP = 140 kPa 3.73 : HP = 150 kPa 3.74 : HP = 170 kPa 5.09 : HP = 140 kPa 5.10 : HP = 220 kPa 5.11 : HP = 190 kPa

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
WI = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317894.5 m	**Elevation:**	5.05 m	**Started:**	19/06/2024
Plant:	Comacchio 305	**Northing:**	6255268.8 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		16/06/2024		5	0.5		FILL: Sandy CLAY: medium plasticity, brown, fine to coarse grained sand with asphalt fragments	M <Wp		FILL
				D							
				SPT N=9 5,4,5	4	1.0		CLAY: high plasticity, grey mottled red orange			ALLUVIUM 0.90 : HP = 250 kPa 1.00 : HP = 300 kPa 1.10 : HP = 320 kPa
						1.5				St-VSt	
				D	3	2.0					
						2.5		*2.4m: with fine grained sand; trace medium grained gravel and rootlets*	M =Wp		2.50 : HP = 500 kPa 2.60 : HP = 370 kPa 2.70 : HP = 220 kPa
				SPT N=15 4,6,9	2	3.0					
						3.5		*3.3m: colour is red mottled grey yellow*			
				D						VSt-H	
				SPT N=16 6,7,9	1	4.0					4.00 : HP > 600 kPa 4.10 : HP = 450 kPa 4.20 : HP = 150 kPa
						4.5					
				D	0	5.0					
						5.5				St-VSt	5.50 : HP = 270 kPa 5.60 : HP = 160 kPa 5.70 : HP = 190 kPa
				SPT N=10 4,4,6	-1	6.0			M >Wp		
						6.5					
				D				*6.8m: colour is dark grey*			
					-2	7.0		*7.0m: colour is dark grey mottled brown*			7.00 : HP = 300 kPa 7.10 : HP = 240 kPa 7.20 : HP = 210 kPa
				SPT N=9 3,4,5		7.5					

METHOD & SUPPORT
HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION
No resistance ranging to refusal

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317894.5 m	**Elevation:**	5.05 m	**Started:**	19/06/2024
Plant:	Comacchio 305	**Northing:**	6255268.8 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm			D	-3	8.5		CLAY: high plasticity, grey mottled red orange *8.1m: colour is grey mottled red; trace fine to coarse grained sand*		St-VSt	ALLUVIUM 8.50 : HP = 140 kPa 8.60 : HP = 170 kPa 8.70 : HP = 150 kPa
				SPT N=6 2,3,3	-4	9.0				St	
						9.5		*9.8m: colour is grey mottled brown; trace fine grained sand*			
				SPT N=3 0,0,3	-5	10.0					10.10 : HP = 90 kPa 10.20 : HP = 150 kPa 10.30 : HP = 130 kPa
						10.5		*10.8m: colour is dark grey*		F-St	
				D	-6	11.0					
				SPT N=11 5,5,6		11.5		*11.4m: colour is dark grey mottled green*	M >Wp		11.40 : HP = 230 kPa 11.50 : HP = 260 kPa 11.60 : HP = 340 kPa
					-7	12.0					
						12.5					12.90 : HP = 190 kPa 13.00 : HP = 370 kPa 13.10 : HP = 160 kPa
				SPT N=12 4,6,6	-8	13.0				St-VSt	
						13.5					
				SPT N=11 3,5,6	-9	14.0		CLAY: medium plasticity, grey, mottled brown and dark grey; trace fine grained sand; relic rock fabric			RESIDUAL SOIL 14.30 : HP = 320 kPa 14.40 : HP = 210 kPa 14.50 : HP = 230 kPa
					-10	14.5					
						15.0		*15.25m: some black mottling becoming high plasticity*			
						15.5					16.00 : HP = 450 kPa

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317894.5 m	**Elevation:**	5.05 m	**Started:**	19/06/2024
Plant:	Comacchio 305	**Northing:**	6255268.8 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm			SPT N=13 4,6,7	-11	16.5		CLAY: medium plasticity, grey, mottled brown and dark grey; trace fine grained sand; relic rock fabric	M >Wp	St-VSt	RESIDUAL SOIL 16.10 : HP = 470 kPa 16.20 : HP = 160 kPa
				SPT N=R 3/30mm	-12	17.0		*17.0m: becoming dark brown*		H	
						17.5		SILTSTONE: extremely weathered, very low strength, indistinctly laminated recovered as gravelly CLAY: low plasticity, fine grained sub-rounded to sub angular siltstone gravel, dark brown Exploratory hole terminated at 17.23 m Target depth			EXTREMELY WEATHERED MATERIAL
					-13	18.0					
						18.5					
					-14	19.0					
						19.5					
					-15	20.0					
						20.5					
					-16	21.0					
						21.5					
					-17	22.0					
						22.5					
					-18	23.0					
						23.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-108

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317985.3 m	**Elevation:**	4.98 m	**Started:**	21/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255249.0 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		04/07/2024 21/06/2024	D SPT N=21 6,11,10 D SPT N=12 5,6,6 D SPT N=13 7,7,6 D SPT N=12 4,5,7	4 3 2 1 0 -1 -2	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: CLAY: medium plasticity, brown mottled orange-brown and grey, with fine to medium grained sub-angular siltstone gravel; with fine to coarse grained sand	M <Wp		FILL 0.89 : HP > 600 kPa 0.90 : HP > 600 kPa 0.91 : HP > 600 kPa
								0.6-1.1m: trace sand and gravel content *0.7m: some grey-white mottling*			
								CLAY: medium to high plasticity, brown mottled grey and orange-brown	M =Wp	St-VSt	ALLUVIUM 2.09 : HP = 170 kPa 2.10 : HP = 200 kPa 2.11 : HP = 200 kPa
								2.2m: grey mottled orange-brown and brown			2.29 : HP = 250 kPa 2.30 : HP = 150 kPa 2.31 : HP = 170 kPa 2.39 : HP = 350 kPa 2.40 : HP = 160 kPa 2.41 : HP = 230 kPa
								2.7-3m: brown, trace of sand			
								3m: grey mottled brown			3.09 : HP = 190 kPa 3.10 : HP = 100 kPa 3.11 : HP = 120 kPa 3.29 : HP = 320 kPa 3.30 : HP = 140 kPa 3.31 : HP = 120 kPa
								3.6m: trace of sub-angular to sub-rounded sandstone gravel *3.7m: trace of fine to coarse grained sand*		St	
								3.9-4.2m: trace of fine to medium grained, sub-angular to sub-rounded sandstone gravel	M >Wp		
								4.8m onwards: high plasticity			5.09 : HP = 220 kPa 5.10 : HP = 260 kPa 5.11 : HP = 190 kPa 5.29 : HP = 340 kPa 5.30 : HP = 230 kPa 5.31 : HP = 350 kPa 5.39 : HP = 200 kPa 5.40 : HP = 250 kPa 5.41 : HP = 260 kPa
								Exploratory hole terminated at 5.50 m Target depth			

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-108A

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317985.2 m	**Elevation:**	4.99 m	**Started:**	20/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255249.0 m	**Datum:**	AHD	**Finished:**	20/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			Not Observed			0.0		FILL: Gravelly CLAY: low to medium plasticity, brown; fine to medium grained, sub-angular ironstone gravel	M <Wp		FILL 0.10 : PACM encountered (presumed asbestos containing material)
						0.1		FILL: Gravelly CLAY: low plasticity, grey mottled orange brown; fine to medium grained, sub-angular ironstone gravel			
						0.5		Exploratory hole terminated at 0.50 m Obstruction			0.50 : Borehole terminated due to presence of PACM
					4	1.0					
						1.5					
					3	2.0					
						2.5					
					2	3.0					
						3.5					
					1	4.0					
						4.5					
					0	5.0					
						5.5					
					-1	6.0					
						6.5					
					-2	7.0					
						7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-108B

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317982.6 m	**Elevation:**	4.97 m	**Started:**	20/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255248.8 m	**Datum:**	AHD	**Finished:**	20/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			Not Observed	SPT N=13 4,9,4	4	0.5		FILL: Gravelly CLAY: low to medium plasticity, brown; fine to medium grained, sub-angular ironstone gravel	M <Wp		FILL 0.60 : Possible cobble encountered
						1.0		*1.1m: black sludge, very strong hydrocarbon odour*			0.89 : HP > 600 kPa 0.90 : HP > 600 kPa 0.91 : HP > 600 kPa 1.10 : Hydrocarbon odour, PID>1000
						1.5			M >Wp		
					3	2.0		Exploratory hole terminated at 2.00 m Obstruction			
						2.5					
					2	3.0					
						3.5					
					1	4.0					
						4.5					
					0	5.0					
						5.5					
					-1	6.0					
						6.5					
					-2	7.0					
						7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-109

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318076.2 m	**Elevation:**	4.97 m	**Started:**	24/06/2024
Plant:	Comacchio 305	**Northing:**	6255249.7 m	**Datum:**	AHD	**Finished:**	24/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		09/07/2024 01/07/2024 24/06/2024	D D SPT N=20 18,12,8 D D SPT N=16 4,7,9 D SPT N=34 5,15,19 D	4 3 2 1 0 -1 -2	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: Silty CLAY: low plasticity, brown, trace fine to coarse grained gravel and plastic fragments	M <Wp		FILL 0.50 : HP = 410 kPa 0.60 : HP = 520 kPa
								CLAY: medium plasticity, brown, mottled red			ALLUVIUM
								CLAY: high plasticity, grey mottled yellow brown	M =Wp	VSt-H	2.10 : HP = 520 kPa 2.20 : HP = 240 kPa 2.30 : HP = 410 kPa
								3.2m: colour changing to grey mottled red yellow			3.50 : HP > 600 kPa 3.60 : HP > 600 kPa
								GRAVEL: fine to coarse grained, sub-angular to angular, red, with clay, high plasticity, grey mottled yellow, gravel is ironstone			
								CLAY: high plasticity, grey mottled red yellow	M<Wp		
								Exploratory hole terminated at 5.00 m Target depth			

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
WI = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-110

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317704.8 m	**Elevation:**	4.12 m	**Started:**	17/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255157.4 m	**Datum:**	AHD	**Finished:**	17/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		08/07/2024	D	4	0		FILL: CLAY: low plasticity, brown; with fine to coarse grained sand; with fine grained, sub-angular, siltstone gravel			FILL
								FILL: CLAY: medium plasticity, brown mottled orange-brown			0.24 : HP = 410 kPa 0.25 : HP = 460 kPa 0.26 : HP = 320 kPa 0.34 : HP = 510 kPa 0.35 : HP = 400 kPa 0.36 : HP = 390 kPa
				SPT N=12 3,5,7		0.5		*0.7m: colour is grey mottled brown*			
					3	1.0		*1.1m: trace of fine to medium grained, sub-angular to sub-rounded, sandstone and siltstone gravel content* *1.2m: colour is red-brown mottled grey and orange-brown*	M =Wp		
				D		1.5		*1.7m: trace of fine to coarse grained sand content*			
								1.9m: colour is brown mottled grey, orange-brown and dark brown			
				SPT N=15 4,7,8	2	2.0					2.24 : HP = 420 kPa 2.25 : HP = 370 kPa 2.26 : HP = 320 kPa 2.34 : HP = 540 kPa 2.35 : HP = 210 kPa 2.36 : HP = 550 kPa
						2.5		*2.5m: colour is brown*	M >Wp		
								2.7m: low plasticity			
				D	1	3.0		*3.2m: colour is brown mottled grey and orange-brown*	M =Wp		
						3.5					3.60 : HP = 480 kPa 3.61 : HP = 410 kPa 3.62 : HP = 510 kPa 3.69 : HP = 440 kPa 3.70 : HP = 600 kPa 3.71 : HP > 600 kPa
				SPT N=14 5,6,8		4.0					
					0			CLAY: medium to high plasticity, grey mottled brown; trace fine grained sand			ALLUVIUM
				D		4.5					
			17/06/2024			5.0		*5.1m: colour is brown mottled grey, fine to medium grained, trace of sub-angular, sandstone gravel* *5.3m: high plasticity, colour is dark grey mottled red-brown*		St	5.29 : HP = 210 kPa 5.30 : HP = 200 kPa 5.31 : HP = 190 kPa
				SPT N=9 3,4,5	-1	5.5					
				D		6.0			M >Wp		
					-2	6.5				VSt	6.59 : HP = 350 kPa 6.60 : HP = 350 kPa 6.61 : HP = 270 kPa
				SPT N=11 3,5,6							6.79 : HP = 400 kPa 6.80 : HP = 320 kPa 6.81 : HP = 420 kPa
					-3	7.0				VSt-H	
						7.5		Exploratory hole terminated at 7.50 m Target depth			

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-111

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318161.6 m	**Elevation:**	4.98 m	**Started:**	26/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255086.5 m	**Datum:**	AHD	**Finished:**	26/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V				D				FILL: Gravelly CLAY: low to medium plasticity, brown; fine to coarse grained, sub-angular to angular gravel; trace fine to coarse grained sand			FILL
						0.5		FILL: CLAY: medium plasticity, brown; with fine grained sub-angular to sub-rounded gravel; trace fine to coarse grained sand			0.60 : HP = 250 kPa 0.61 : HP = 320 kPa
				SPT N=9 2,4,5					M =Wp		
					4	1.0		CLAY: medium plasticity, orange mottled red; trace fine to coarse grained sand; trace fine grained, sub-angular gravel			ALLUVIUM
				D						St	
						1.5		CLAY: high plasticity, grey mottled orange and red; trace fine grained sand			
				D						St/ VSt	
			04/07/2024	SPT N=10 3,5,5	3	2.0					2.10 : HP = 150 kPa 2.11 : HP = 200 kPa
						2.5		*2.3-2.9m: with fine grained, sub-angular ironstone gravel, red mottled grey and orange*			2.40 : HP = 400 kPa
					2	3.0					
						3.5			M <Wp	VSt	3.59 : HP = 250 kPa 3.60 : HP = 300 kPa 3.61 : HP = 200 kPa
				SPT N=14 3,6,8							
					1	4.0					
						4.5					
				D							
			26/06/2024	SPT N=27 6,13,14	0	5.0					5.19 : HP = 370 kPa 5.20 : HP = 360 kPa 5.21 : HP = 420 kPa
						5.5				VSt/H	
				D				*5.8m: grey mottled red-brown*	M =Wp		
					-1	6.0					
								Exploratory hole terminated at 6.20 m Target depth			
					-2	6.5					
						7.0					
						7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-112

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317750.4 m	**Elevation:**	4.42 m	**Started:**	03/07/2024
Plant:	Comacchio Geo 305	**Northing:**	6254898.0 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	MR **Checked By:** PH	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		08/07/2024	SPT N=7 2,3,4 D	4	0.5		FILL: Sandy CLAY: High plasticity, brown, medium to coarse grained sand			FILL
								FILL: Sandy CLAY: High plasticity, brown mottled grey and red, medium to coarse grained sand, with medium to fine grained gravel			0.60 : HP = 170 kPa 0.70 : HP = 140 kPa 0.80 : HP = 130 kPa
					3	1.0		FILL: Sandy CLAY: high plasticity, dark grey mottled yellow, medium to coarse grained sand, trace fine grained sub angular gravel			
				D		1.5				F	
				SPT N=6 2,2,4	2	2.0					2.10 : HP = 80 kPa 2.20 : HP = 70 kPa 2.30 : HP = 90 kPa
						2.5			M =Wp		
						3.0					3.20 : 3.2-4.7m: Hydrocarbon odour
				D	1	3.5		FILL: CLAY: High plasticity, dark grey *3.2m: colour is dark grey*			3.40 : 3.2-3.3m: Very soft soil on auger
				SPT N=9 3,4,5		4.0					3.60 : HP = 250 kPa 3.70 : HP = 240 kPa 3.80 : HP = 210 kPa
					0	4.5				St	
				D		5.0		Sandy CLAY: High plasticity, brown mottled grey and red, medium to coarse grained sand			ALLUVIUM 4.70 : HP = 150 kPa 4.80 : HP = 140 kPa
								Exploratory hole terminated at 5.00 m Target depth			4.90 : HP = 120 kPa
					-1	5.5					
						6.0					
					-2	6.5					
						7.0					
					-3	7.5					

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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WRRF-GWW-112 Depth Range: 0.50 - 0.95 m



WRRF-GWW-112 Depth Range: 2.00 - 2.45 m

Jacobs	**Client:**	Sydney Water	**Title:** WRRF-GWW-112
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)	
	Drawn: MR	**Checked:**	**Scale:** NTS **Drawing Number:** 1/2

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WRRF-GWW-112 Depth Range: 3.50 - 3.95 m

Jacobs	**Client:**	Sydney Water	**Title:**	WRRF-GWW-112	
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn: MR	**Checked:**	**Scale:** NTS	**Drawing Number:**	2/2

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Engineering Log - Borehole

WRRF-GW-113

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 2
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317973.3 m	**Elevation:**	4.67 m	**Started:**	05/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254867.7 m	**Datum:**	AHD	**Finished:**	05/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			08/07/2024	SPT N=11 4,5,6	4	0.5		FILL: Gravelly CLAY: low plasticity, brown; fine to medium grained, fill gravel; with fine to coarse grained sand	M >Wp		FILL
								FILL: CLAY: medium to high plasticity, orange-brown; trace fine to coarse grained sand			0.48 : HP = 330 kPa 0.49 : HP = 340 kPa 0.50 : HP = 360 kPa
						1.0		FILL: CLAY: high plasticity, grey mottled brown; trace fine to medium grained sand			0.89 : HP = 280 kPa 0.90 : HP = 430 kPa 0.91 : HP = 470 kPa 0.95 : Light fuel odour
				D		1.5			M <Wp		
					3						
						2.0					2.09 : HP = 500 kPa 2.10 : HP = 450 kPa 2.11 : HP = 450 kPa
				SPT N=14 4,7,7				CLAY: high plasticity, grey			ALLUVIUM
						2.5		*2.3m: increasing moisture content*			2.39 : HP = 330 kPa 2.40 : HP = 350 kPa 2.41 : HP = 220 kPa
					2			*2.8m: brown mottling*		St	
				D		3.0					
						3.5					3.59 : HP = 90 kPa 3.60 : HP = 80 kPa 3.61 : HP = 100 kPa
				SPT N=11 5,5,6	1			CLAY: high plasticity, grey mottled orange-brown; trace sub-angular, fine grained, ironstone gravel			3.89 : HP = 350 kPa 3.90 : HP = 390 kPa 3.91 : HP = 360 kPa
						4.5		*4.4m: red-brown mottling*	M =Wp	VSt-H	
					0	5.0		CLAY: high plasticity, dark grey mottled brown, grey, orange and red-brown; trace fine to medium grained sand			5.09 : HP > 600 kPa 5.10 : HP > 600 kPa 5.11 : HP > 600 kPa
				SPT N=30 9,13,17							5.39 : HP > 600 kPa 5.40 : HP > 600 kPa 5.41 : HP > 600 kPa
					-1	5.5				H	
			05/07/2024	D		6.0					
						6.5					6.69 : HP = 330 kPa 6.70 : HP = 450 kPa 6.71 : HP = 430 kPa
				SPT N=31 9,14,17	-2	7.0			M >Wp	VSt-H	
					-3	7.5		*7.5m: increasing sand content*			

METHOD & SUPPORT
HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION
No resistance ranging to refusal

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
WI = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-113

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 2

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317973.3 m	**Elevation:**	4.67 m	**Started:**	05/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254867.7 m	**Datum:**	AHD	**Finished:**	05/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V				SPT N=29 9,13,16	-4	8.5		CLAY: high plasticity, dark grey mottled brown, grey, orange and red-brown; trace fine to medium grained sand			8.09 : HP = 450 kPa 8.10 : HP = 320 kPa 8.11 : HP = 400 kPa
						9.0		Sandy CLAY: medium to high plasticity, grey mottled brown and orange-brown; trace fine to medium grained sand; trace fine to medium grained, sub-rounded, sandstone gravel	M >Wp	VSt-H	RESIDUAL SOIL 8.39 : HP = 350 kPa 8.40 : HP = 450 kPa 8.41 : HP = 290 kPa
				SPT N=R 16, 0/0mm		9.5		SANDSTONE: red-brown, coarse grained, highly weathered, very low strength			WEATHERED ROCK
					-5	10.0		...recovered as Gravelly CLAY: low plasticity, red-brown; fine to medium grained, sub-rounded to sub-angular, fine to medium grained, sandstone gravel; with fine to coarse grained sand Exploratory hole terminated at 9.42 m Target depth			9.42 : SPT hammer bouncing, V-bit refusal
					-6	10.5					
						11.0					
					-7	11.5					
						12.0					
					-8	12.5					
						13.0					
					-9	13.5					
						14.0					
					-10	14.5					
						15.0					
					-11	15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
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RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-114

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318006.3 m	**Elevation:**	4.74 m	**Started:**	25/06/2024
Plant:	Comacchio 305	**Northing:**	6254868.2 m	**Datum:**	AHD	**Finished:**	25/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		04/07/2024 25/06/2024	D	4	0.5		FILL: CLAY: medium plasticity, brown green			FILL
				D				CLAY: medium plasticity, brown green mottled red		St-VSt	
				SPT N=12 4,5,7		1.0					1.40 : HP = 360 kPa 1.45 : HP = 260 kPa 1.50 : HP = 460 kPa
					3	1.5					
						2.0		CLAY: low plasticity, grey mottled brown red	M =Wp		
				D		2.5					
				SPT N=18 4,9,9	2			*2.8m: trace ironstone gravel /siltstone gravel* *2.85m: colour changing to grey mottled red*			2.85 : HP > 600 kPa 2.90 : HP = 310 kPa 2.95 : HP = 240 kPa
						3.0				VSt-H	
				D	1	3.5					
				SPT N=13 3,5,8		4.0		CLAY: high plasticity, grey			4.35 : HP = 370 kPa 4.40 : HP = 310 kPa 4.45 : HP = 420 kPa
					0	4.5		Exploratory hole terminated at 4.45 m Target depth			
						5.0					
					-1	5.5					
						6.0					
					-2	6.5					
						7.0					
					-3	7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
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SAMPLES & FIELD TESTS

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HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
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DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-115

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318114.9 m	**Elevation:**	4.88 m	**Started:**	26/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6254835.1 m	**Datum:**	AHD	**Finished:**	26/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			04/07/2024	SPT N=R 4,7,9/140mm	4	0.5		FILL: CLAY: medium plasticity, brown; with sub-rounded to sub-angular, fine to medium grained, ironstone and sandstone gravel	M <Wp		FILL
						1.0		FILL: CLAY: high plasticity, white-grey mottled orange; trace fine to medium grained, sub-rounded to sub-angular, siltstone and sandstone gravel			0.59 : HP = 340 kPa 0.60 : HP > 600 kPa 0.61 : HP > 600 kPa
											0.79 : HP = 400 kPa 0.80 : HP = 390 kPa 0.81 : HP = 450 kPa 0.94 : SPT hammer bouncing, possibly on gravel or cobbles
						1.5			M =Wp		1.30 : Auger grinding, possible cobble on sidewall
				D	3	2.0		*1.7m: becoming brown mottled orange-brown, grey-brown and grey*			
				SPT N=12 4,5,7							2.00 : Rig tilted, SPT rods tilted when inserted into hole 2.19 : HP = 240 kPa 2.20 : HP = 200 kPa 2.21 : HP = 160 kPa 2.30 : Auger grinding
						2.5		*2.5m: PVC fragment found*			
				D	2	3.0		CLAY: high plasticity, grey mottled brown			ALLUVIUM
											3.19 : HP = 290 kPa 3.20 : HP = 300 kPa 3.21 : HP = 320 kPa
				SPT N=13 4,5,8		3.5		*3.7m: trace rootlets*		St-VSt	3.79 : HP = 300 kPa 3.80 : HP = 310 kPa 3.81 : HP = 430 kPa
					1	4.0		CLAY: high plasticity, grey mottled brown, orange-brown; trace fine grained, sub-angular, ironstone gravel			
				D		4.5		*4.2m: trace fine grained, sub-angular ironstone gravel*	M >Wp		
					0	5.0					5.09 : HP = 430 kPa 5.10 : HP = 350 kPa 5.11 : HP = 500 kPa
				SPT N=28 7,12,16				*5.2m: brown mottled dark brown, grey, orange-brown and dark grey*		VSt-H	5.29 : HP = 480 kPa 5.30 : HP > 600 kPa 5.31 : HP > 600 kPa
					-1	6.0		Exploratory hole terminated at 6.00 m Target depth			
					-2	7.0					
					-3	7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Borehole

WRRF-GW-116

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317893.0 m	**Elevation:**	5.32 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6254745.2 m	**Datum:**	AHD	**Finished:**	28/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			08/07/2024	SPT N=11 2,4,7	5	0.5		FILL: Sandy CLAY: low to medium plasticity, brown; fine to coarse grained sand; with fine to medium grained, sub-rounded to sub-angular ironstone gravel			FILL 0.65 : HP = 130 kPa 0.66 : HP = 120 kPa 0.67 : HP = 90 kPa 0.68 : HP = 90 kPa 0.69 : HP = 120 kPa 0.70 : HP = 150 kPa
						1.0		*0.8m: pale brown, with orange-brown mottling*			
				D	4	1.5		*1.3m: decreasing gravel content*	M =Wp		
				SPT N=3 1,1,2		2.0					
					3	2.5					2.80 : Hydrocarbon odour from hole
				D		3.0		CLAY: high plasticity, grey mottled brown and orange-brown			ALLUVIUM 3.19 : HP = 330 kPa 3.20 : HP = 340 kPa 3.21 : HP = 340 kPa 3.39 : HP = 500 kPa 3.40 : HP = 530 kPa 3.41 : HP = 580 kPa
				SPT N=19 4,10,9	2	3.5		*3.8m: trace fine grained, sub-angular ironstone gravel*			
						4.0				VSt	
					1	4.5		*4.2m: grey*	M <Wp		4.90 : No perceptible hydrocarbon odour from hole after this depth
				SPT N=19 4,7,12	0	5.0					5.19 : HP = 410 kPa 5.20 : HP = 350 kPa 5.21 : HP = 390 kPa
						5.5				VSt-H	5.39 : HP = 450 kPa 5.40 : HP = 510 kPa 5.41 : HP = 480 kPa
				D		6.0		*5.9m: grey mottled brown and orange-brown*			
					-1	6.5		Exploratory hole terminated at 6.10 m Target depth			
						7.0					
					-2	7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-117

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317884.3 m	**Elevation:**	5.02 m	**Started:**	21/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255163.0 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		09/07/2024 21/06/2024	SPT N=17 9,8,9 SPT N=11 3,5,6 SPT N=11 3,5,6 SPT N=12 3,5,7	4 3 2 1 0 -1 -2	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: Gravelly CLAY: low plasticity, brown; fine to medium grained, sub-angular, sandstone and siltstone gravel FILL: CLAY: low plasticity brown; with fine to coarse grained sand *0.7m: medium grained sub-rounded to sub-angular sandstone and siltstone gravel encountered* *0.8m: colour is grey mottled brown*	M <Wp		FILL 0.69 : HP > 600 kPa 0.70 : HP > 600 kPa 0.71 : HP > 600 kPa
								CLAY: high plasticity, brown mottled grey and orange-brown *2.7m: colour is red and brown* *2.8m: trace fine to medium grained sand* *3.4m: colour is grey* *4.8m: some red-brown mottling*	M =Wp M >Wp	VSt St VSt	ALLUVIUM 2.19 : HP = 220 kPa 2.20 : HP = 270 kPa 2.21 : HP = 210 kPa 3.59 : HP = 150 kPa 3.60 : HP = 190 kPa 3.61 : HP = 120 kPa 3.79 : HP = 220 kPa 3.80 : HP = 210 kPa 3.81 : HP = 220 kPa 5.09 : HP = 210 kPa 5.10 : HP = 180 kPa 5.11 : HP = 200 kPa 5.39 : HP = 210 kPa 5.40 : HP = 220 kPa 5.41 : HP = 200 kPa
								Exploratory hole terminated at 5.80 m Target depth			

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
WI = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Borehole

WRRF-GW-118

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318025.7 m	**Elevation:**	5.31 m	**Started:**	25/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254995.7 m	**Datum:**	AHD	**Finished:**	25/06/2024
Logged By:	MZ **Checked By:**	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V	140 mm		04/07/2024	D	5	0.5		Sandy CLAY: High plasticity, brown, trace fine grained, sub angular to sub rounded, grey gravel. Sand is fine to coarse grained, sub rounded to rounded, dark grey			FILL
				D							
				SPT N=5 2,2,3	4	1.0			M <Wp		1.00 : HP > 600 kPa 1.10 : HP > 600 kPa 1.20 : HP > 600 kPa
						1.5		*1.2m: colour is brown mottled red and sand is fine grained*			
				D	3	2.0		CLAY: High plasticity, grey mottled red and yellow			ALLUVIUM
				SPT N=18 4,8,10		2.5		*2.4m: with fine grained, sub rounded to sub angular, grey sand trace medium grained, sub angular to sub rounded gravel trace rootlets* *2.5m: trace fine to coarse grained, sub angular to angular ironstone gravel*		VSt	2.50 : HP > 600 kPa 2.60 : HP = 320 kPa 2.70 : HP = 210 kPa
					2	3.0		*3.3m: becoming red mottled grey yellow*			
				D		3.5		CLAY: Low plasticity, grey mottled brown			
				SPT N=11 4,4,7	1	4.0		*4.2m: becoming grey mottled red yellow*	M =Wp		4.00 : HP = 200 kPa 4.10 : HP = 280 kPa 4.20 : HP = 260 kPa
						4.5				St/ VSt	
				D	0	5.0					
				SPT N=10 3,5,5		5.5					5.50 : HP = 250 kPa 5.60 : HP = 290 kPa 5.70 : HP = 350 kPa
					-1	6.0		Exploratory hole terminated at 6.00 m Target depth			
						6.5					
					-2	7.0					
						7.5					

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Engineering Log - Borehole

WRRF-SV-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318158.9 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255204.8 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Casing	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			Not Observed	SPT N=11 3,4,7	4	0.5		FILL: gravelly CLAY: medium plasticity, brown, fine grained angular gravel; with fine to coarse grained sand			FILL 0.60 : HP = 100 kPa 0.70 : HP = 240 kPa
				D		1.0		CLAY: medium to high plasticity, red brown mottled orange and grey; trace fine grained sand; trace fine grained, sub-rounded to sub-angular ironstone gravel *1.5m: colour changing mottled red brown, orange, grey*	M <Wp	St/ VSt	ALLUVIUM 1.15 : HP = 200 kPa 1.18 : HP = 200 kPa
				SPT N=17 4,8,9	3	1.5 2.0				VSt	2.10 : HP = 300 kPa 2.20 : HP = 340 kPa 2.30 : HP = 340 kPa
				SPT N=13 5,5,8	2	2.5 3.0		CLAY: high plasticity, grey mottled red and orange		VSt/H	3.10 : HP = 410 kPa 3.20 : HP = 580 kPa 3.30 : HP = 310 kPa
					1	3.5 4.0		Exploratory hole terminated at 3.45 m Target depth			
					0	4.5 5.0					
					-1	5.5 6.0					
					-2	6.5 7.0					
						7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Piezometer Installation Details

WRRF-GW-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

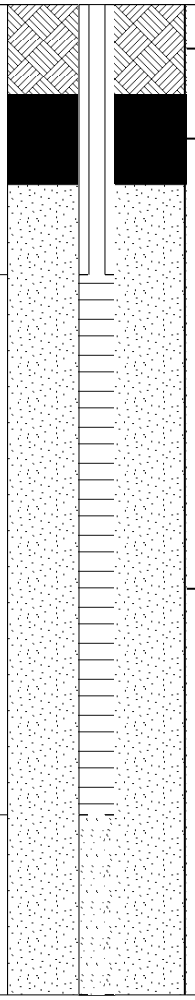
Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317805.7 m	**Elevation:**	5.06 m	**Started:**	18/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255271.2 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	19/06/2024	5	0		FILL: CLAY: medium plasticity, brown mottled dark grey; with fine to coarse grained sand; with fine to medium grained, sub-rounded to sub-angular, siltstone and sandstone gravel	1.3
			0.5		*0.3m: trace of gravel*	1
					FILL: CLAY: medium to high plasticity, orange-brown mottled grey; trace fine to coarse grained sand	
					0.8m: yellow-white and dark orange-brown mottling	
		4	1.0		CLAY: high plasticity, brown mottled grey	
			1.5			
		3	2.0			1.3
			2.5		*2.4m: grey mottled orange-brown*	
		2	3.0		*2.9m: grey mottled grey-brown*	
			3.5			1
		1	4.0		*4m: dark grey and brown mottling*	
			4.5			
		0	5.0		*4.7m: trace of fine to coarse grained sand* *4.8m: trace of fine to medium grained, sub-rounded to sub-angular, siltstone gravel*	
			5.5		Exploratory hole terminated at 5.50 m Target depth	
		-1	6.0			
			6.5			
		-2	7.0			
			7.5			

ID : Type: Stick Up & RL : Tip Depth & Tip RL :

Standpipe 0.63 m 4.43 m 5.50 m -0.44 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

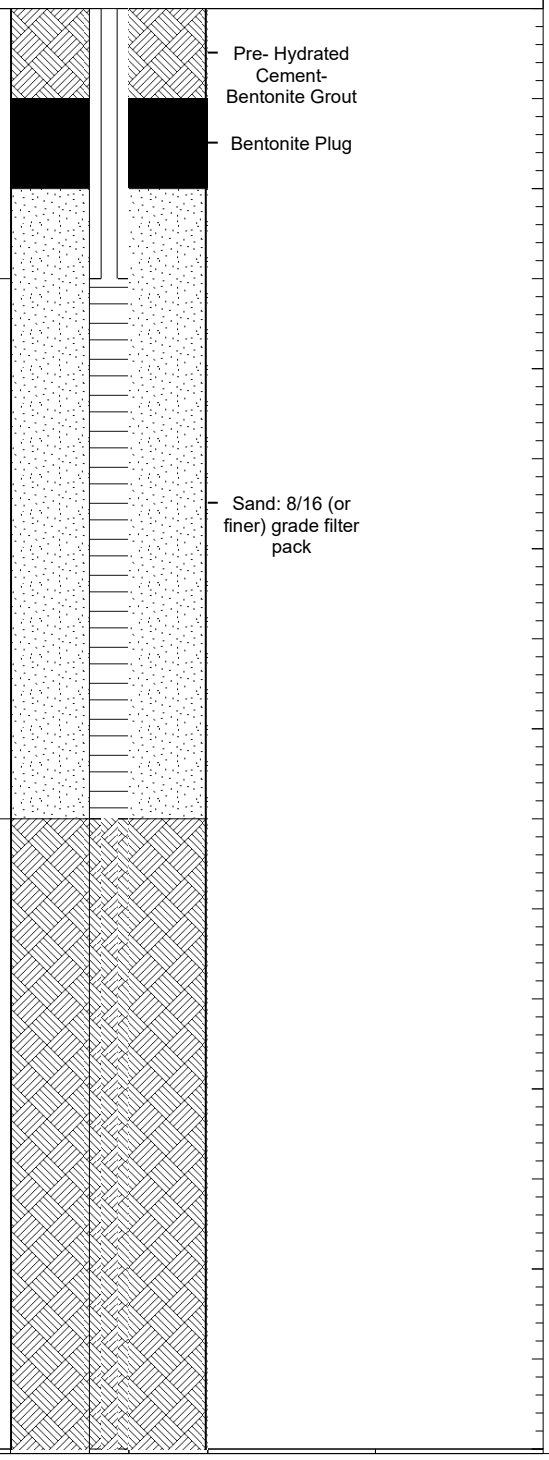
Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318157.0 m	**Elevation:**	5.04 m	**Started:**	17/06/2024
Plant:	Comacchio 305	**Northing:**	6255194.2 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
AD/V	18/06/2024	4	0.5		FILL: Silty GRAVEL: low plasticity silt, dark grey, fine grained, angular to subangular gravel; with fine to coarse grained sand
			1.0		CLAY: high plasticity, brown mottled red yellow
			1.5		*1.6m: colour changing to grey mottled yellow; with medium grained sub angular to angular ironstone gravel*
		3	2.0		
			2.5		
		2	3.0		*3.0m: colour changing to grey mottled red yellow*
			3.5		
		1	4.0		
			4.5		
		0	5.0		
			5.5		
		-1	6.0		CLAY: medium plasticity, grey mottled red
			6.5		
		-2	7.0		*7.0m: colour increases in red; with fine grained, subangular ironstone gravel*
			7.5		CLAY: high plasticity, black

ID : Type: Stick Up & RL : Tip Depth & Tip RL :

Standpipe 0.76 m 4.28 m 23.25 m -18.21 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318157.0 m	**Elevation:**	5.04 m	**Started:**	17/06/2024
Plant:	Comacchio 305	**Northing:**	6255194.2 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE	INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	**Description of Strata** ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID : Type:	Stick Up & RL : / Tip Depth & Tip RL :
						Standpipe	0.76 m / 4.28 m 23.25 m / -18.21 m
AD/V			8.5		CLAY: high plasticity, black *8.0m: colour changing to grey mottled black red*		
		-4	9.0		*9.0m: colour changing to grey mottled red*		
			9.5				
		-5	10.0				
			10.5		*10.0m: colour changing to dark grey mottled black*		
		-6	11.0				
			11.5				
		-7	12.0				
			12.5				
		-8	13.0		CLAY: high plasticity, brown orange *12.95m: relic rock fabric; trace bands (1-2 mm) of highly weathered siltstone brown-orange in colour*		
			13.5		CLAY: medium plasticity, grey mottled brown		
HQ3		-9	14.0		EXTREMELY WEATHERED SILTSTONE RECOVERED AS CLAY: medium plasticity, grey brown		Pre- Hydrated Cement-Bentonite Grout
			14.5		INTERLAMINATED SILTSTONE and SANDSTONE: dark grey banded brown and grey, sandstone is fine grained, disticnctly laminated at 0-5°		
		-10	15.0				
			15.5		SILTSTONE: dark grey, distinctly laminated grey; trace fine grained sandstone laminations		

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318157.0 m	**Elevation:**	5.04 m	**Started:**	17/06/2024
Plant:	Comacchio 305	**Northing:**	6255194.2 m	**Datum:**	AHD	**Finished:**	18/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	**Description of Strata** ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip R
							Standpipe	0.76 m 4.28 m	23.25 m -18.21 m
HQ3		-12	16.5		SILTSTONE: dark grey, distinctly laminated grey, trace fine grained sandstone laminations				
			17.0						
			17.5						
		-13	18.0						
			18.5						
		-14	19.0						
			19.5						
		-15	20.0						
			20.5						
		-16	21.0						
			21.5						
		-17	22.0						
			22.5						
		-18	23.0			23.25 m			
			23.5		Exploratory hole terminated at 23.25 m Target depth				

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

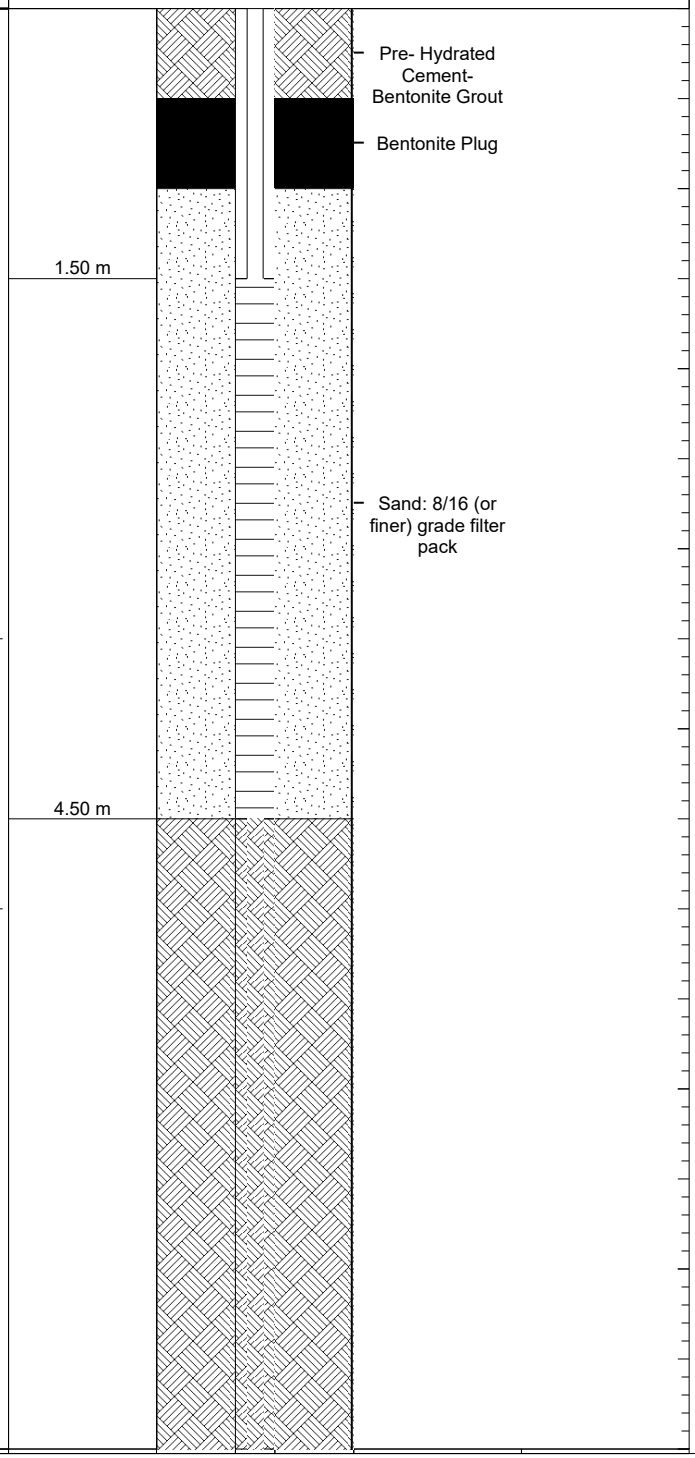
Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317694.7 m	**Elevation:**	4.03 m	**Started:**	13/06/2024
Plant:	Comacchio 305	**Northing:**	6255065.7 m	**Datum:**	AHD	**Finished:**	14/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
AD/V	13/06/2024	3	1.0		CLAY: high plasticity, brown mottled red grey
			0.5		*0.5m: becoming grey mottled orange red; trace fine grained, sub-angular ironstone gravel*
		2	2.0		
		1	3.0		
			3.5		CLAY: medium plasticity, grey mottled red,
		0	4.0		
			4.5		
		-1	5.0		CLAY: high plastiity, grey blotched red; trace fine grained, yellow sand; trace sub-angular ironstone gravel; trace white rootlets
			5.5		
		-2	6.0		*6.2m: no rootlets observed, reducing sand and gravel content*
			6.5		
		-3	7.0		
			7.5		*7.5m: colour changing to grey, mottled yellow and red*

ID : | Type: Standpipe | Stick Up & RL : 0.82 m 3.21 m | Tip Depth & Tip RL : 21.30 m -17.27 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317694.7 m	**Elevation:**	4.03 m	**Started:**	13/06/2024
Plant:	Comacchio 305	**Northing:**	6255065.7 m	**Datum:**	AHD	**Finished:**	14/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
AD/V			8.5		CLAY: high plastiity, grey blotched red; trace fine grained, yellow sand; trace sub-angular ironstone gravel; trace white rootlets
					8.0m: colour changint to dark grey mottled yellow
					CLAY: medium plasticity, brown mottled red; trace yellow sand; trace stained sub-angular ironstone gravel
		-5	9.0		*9.0m: colour changing to light grey and yellow, reducing sand content*
			9.5		CLAY: medium plasticity, grey mottled yellow brown; with medium grained, sub-angular dark grey gravel; with fine to medium graned sand
		-6	10.0		CLAY: high plasticity, grey banded orange red brown, relic rock fabric
			10.5		
		-7	11.0		
			11.5		Extremely weathered siltstone recovered as CLAY: high plasticity, dark grey mottled dark brown red
HQ3		-8	12.0		INTERLAMINATED SILTSTONE (65%) AND SANDSTONE (35%) : dark grey banded brown and grey sandstone is fine grained, distinctly laminated at 0-5°
			12.5		
		-9	13.0		
			13.5		
		-10	14.0		
			14.5		INTERLAMINATED SILTSTONE (80%) AND SANDSTONE (20%) : dark grey and grey sandstone is fine grained, distinctly laminated at 0-5°
		-11	15.0		
			15.5		

ID :

Type: Standpipe

Stick Up & RL : 0.82 m, 3.21 m

Tip Depth & Tip RL : 21.30 m, -17.27 m

Pre- Hydrated Cement-Bentonite Grout

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

WRRF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317694.7 m	**Elevation:**	4.03 m	**Started:**	13/06/2024
Plant:	Comacchio 305	**Northing:**	6255065.7 m	**Datum:**	AHD	**Finished:**	14/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE	INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	**Description of Strata** ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID : Type:	Stick Up & RL : / Tip Depth & Tip RL
						Standpipe	0.82 m / 3.21 m 21.30 m / -17.27 m
HQ3			16.5		INTERLAMINATED SILTSTONE (80%) AND SANDSTONE (20%) : dark grey and grey sandstone is fine grained, distinctly laminated at 0-5°		
		-13	17.0				
			17.5				
		-14	18.0				
			18.5		SILTSTONE: dark grey, distinctly laminated at 0- 5°, trace grey fine grained sandstone laminations		
		-15	19.0				
			19.5				
		-16	20.0				
			20.5				
		-17	21.0			21.30 m	
			21.5		Exploratory hole terminated at 21.30 m Target depth		
		-18	22.0				
			22.5				
		-19	23.0				
			23.5				

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

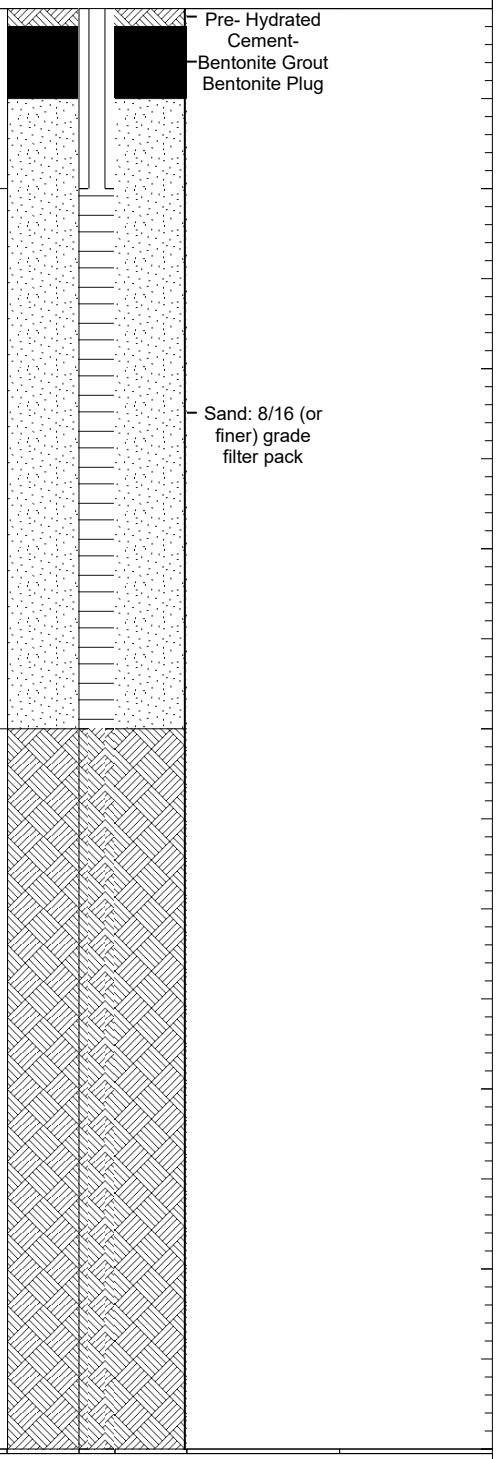
WRRF-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317927.8 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255087.4 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING			MATERIAL SUBSTANCE			INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m) / Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
							Standpipe	0.74 m 4.26 m	22.29 m -17.29 m
AD/V		5.0 / 0.0		FILL: CLAY: medium plasticity, brown; trace fine to medium grained, sub-angular gravel; trace coarse grained sand	2				
				0.4m: becoming brown mottled grey and red	1.7				
		4.0 / 1.0				1.00 m			
		3.5 / 1.5		CLAY: high plasticity, mottled grey and orange; trace rootlets					
		3.0 / 2.0			0.9				
		2.5 / 2.5		*2.5m: hydrocarbon odour* *2.6m: becoming red-brown mottled grey and orange; trace fine grained sand; trace sub-angular ironstone gravel*					
		2.0 / 3.0			1.2				
		1.5 / 3.5							
		1.0 / 4.0				4.00 m			
		0.5 / 4.5							
		0.0 / 5.0		CLAY: high plasticity, grey mottled orange	0.5				
		-0.5 / 5.5							
		-1.0 / 6.0		*6.0m: becoming grey mottled, red-brown; trace fine grained, sub-angular to sub-rounded ironstone gravel*					
		-1.5 / 6.5							
		-2.0 / 7.0							
		-2.5 / 7.5							
				CLAY: medium plasticity, grey mottled green and red					



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317927.8 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255087.4 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING			MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m) / Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID : Type:	Stick Up & RL : / Tip Depth & Tip RL :
						Standpipe	0.74 m / 22.29 m 4.26 m / -17.29 m
AD/V		8.5		CLAY: medium plasticity, grey mottled green and red			
		-4 9.0					
		9.5					
		-5 10.0					
		10.5					
		-6 11.0					
		11.5		*11.6m: increasing yellow/green colour*			
		-7 12.0					
		12.5		CLAY: high plasticity, grey banded brown red, relic rock fabric			
				EXTREMELY WEATHERED SILTSTONE RECOVERED AS CLAY: high plasticity, banded grey mottled red yellow; trace fine grained gravel			
		-8 13.0					
HQ3		13.5		INTERLAMINATED SILTSTONE (65%) AND SANDSTONE (35%): black banded grey yellow, sandstone is fine grained, distinctly laminated at 0-5			Pre- Hydrated Cement-Bentonite Grout
		-9 14.0					
		14.5					
		-10 15.0					
		15.5					

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Jacobs — Piezometer Installation Details

WRRF-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317927.8 m	**Elevation:**	5.00 m	**Started:**	18/06/2024
Plant:	Comacchio 305	**Northing:**	6255087.4 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
								Standpipe	0.74 m 4.26 m	22.29 m -17.29 m
HQ3		-12	17.0		INTERLAMINATED SILTSTONE (65%) AND SANDSTONE (35%): black banded grey yellow, sandstone is fine grained, distinctly laminated at 0-5					
		-13	18.0							
		-14	19.0							
		-15	20.0		INTERLAMINATED SILTSTONE (80%) AND SANDSTONE (20%): dark grey and pale grey, sandstone is fine grained, distinctly laminated at 0-5					
		-16	21.0							
		-17	22.0				22.29 m			
					Exploratory hole terminated at 22.29 m Target depth					
		-18	23.0							

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

WRRF-BH-105

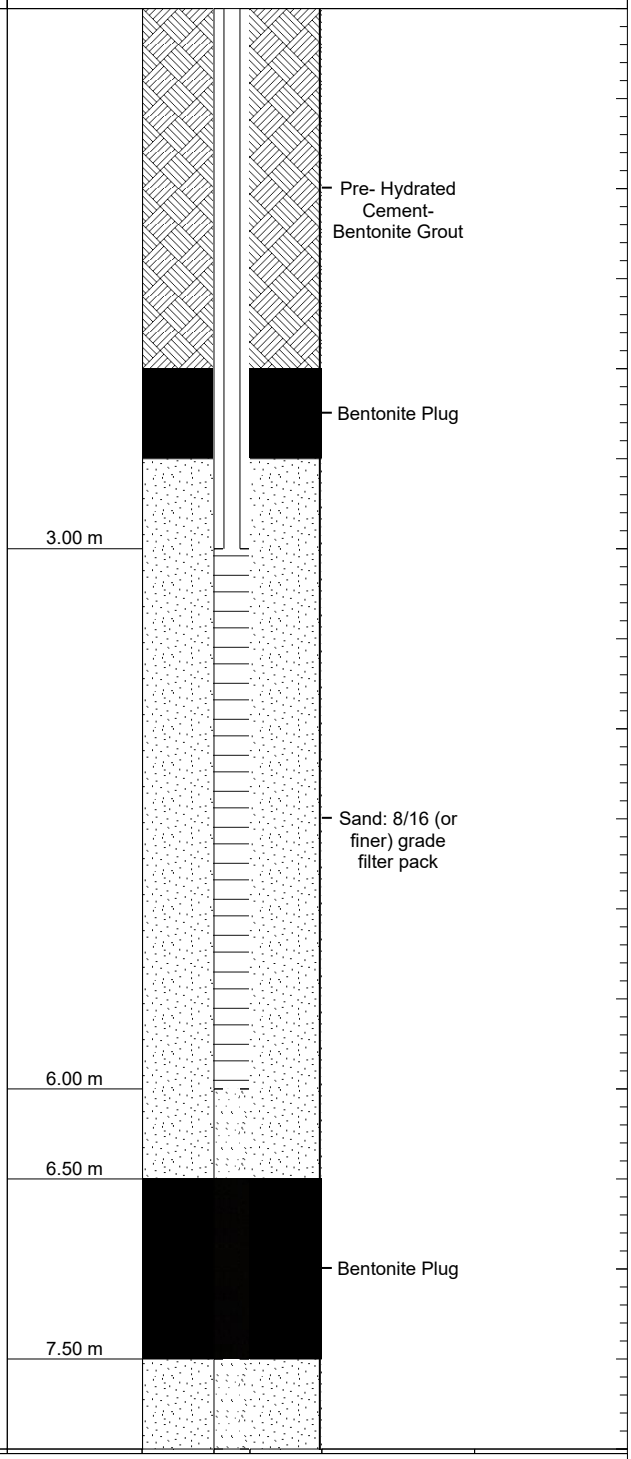
Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317737.8 m	**Elevation:**	4.10 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254804.8 m	**Datum:**	AHD	**Finished:**	02/07/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/T	28/06/2024	4	0		Sandy CLAY: High plasticity, brown, trace fine to coarse grained, sub angular to sub rounded, black bitumen gravel and trace fine to coarse grained, sub angular to sub rounded, grey gravel, trace rootlets.	11
			0.5		Sand is fine to coarse grained, sub rounded to rounded, dark grey, bitumen	2
					CLAY: High plasticity, brown trace fine to coarse grained, sub angular to angular bitumen, trace rootlets, bitumen	
		3	1.0		CLAY: High plasticity, grey mottled red yellow trace rootlets	2.4
			1.5		CLAY: Medium plasticity, grey mottled red yellow	
					CLAY: High plasticity, grey mottled red yellow	1.7
		2	2.0		*1.9m: trace fine to coarse grained, sub angular to angular ironstone gravel, trace fine to coarse grained, sub angular to angular grey gravel*	
			2.5			
		1	3.0			2
			3.5			
		0	4.0			
			4.5			2
		-1	5.0		*4.9m: trace fine to coarse grained, sub angular to angular grey gravel*	
			5.5			
		-2	6.0			2.5
			6.5		*6.2m: colour is dark grey* *6.5m: colour is grey mottled green*	
		-3	7.0			
			7.5		Sandy CLAY: Medium plasticity, grey mottled yellow. Sand is fine-coarse grained, sub rounded- rounded, yellow	
					CLAY: High plasticity, grey mottled red and yellow with fine grained sand and coarse grained ironstone gravel	3.3



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-105

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317737.8 m	**Elevation:**	4.10 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254804.8 m	**Datum:**	AHD	**Finished:**	02/07/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING			MATERIAL SUBSTANCE			INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m) / Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL : / Tip Depth & Tip RL :
							Standpipe	0.80 m 3.31 m / 21.29 m -17.19 m
AD/T		-4 / 8.5		CLAY: High plasticity, grey mottled red and yellow with fine grained sand and coarse grained ironstone gravel				Sand: 8/16 (or finer) grade filter pack
		-5 / 9.0						
		9.5		CLAY: Medium plasticity, grey *9.5m: with fine to coarse grained, sub angular to sub rounded ironstone gravel, relic rock fabric*				
		10.0		NO CORE: 290 mm (9.95m - 10.24m)		9.95 m		
		-6 / 10.5		Sandy CLAY: High Plasticity, grey with bands of brown/ red, sand is fine to medium grained with medium grained subangular gravel				Bentonite Plug
		11.0				11.00 m		
HQ3		-7 / 11.5		SILTSTONE: grey, with fine grained sandstone laminations at 10°				
		12.0						
		-8 / 12.5						
		13.0						
		-9 / 13.5						
		14.0						
		-10 / 14.5						
		15.0						
		-11 / 15.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey and pale grey, sandstone is fine grained, distinctly laminated at 10°				

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-105

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317737.8 m	**Elevation:**	4.10 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254804.8 m	**Datum:**	AHD	**Finished:**	02/07/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
								Standpipe	0.80 m 3.31 m	21.29 m -17.19 m
HQ3		-12	16.5		SILTSTONE: Dark grey, laminated at 10				Sand: 8/16 (or finer) grade filter pack	
		-13	17.0							
			17.5							
		-14	18.0							
			18.5							
		-15	19.0							
			19.5							
		-16	20.0							
			20.5							
		-17	21.0				21.29 m			
			21.5		Exploratory hole terminated at 21.29 m Target depth					
		-18	22.0							
			22.5							
		-19	23.0							
			23.5							

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
							Standpipe	0.83 m 4.21 m	25.97 m -20.93 m

FILL: Sandy CLAY: low plasticity, brown; fine to coarse grained sand; with fine to medium grained, sub-rounded to sub-angular, ironstone gravel

0.8m: grey, dark grey and orange-brown mottling

1.0m: hydrocarbon odours

CLAY: high plastcity, brown mottled grey; trace fine grained, sub-rounded to sub-angular, ironstone gravel; trace fine to coarse grained sand

2.4m: grey mottled brown

CLAY: high plasticity, grey mottled brown

5.5: grey mottled orange-brown and red-brown

CLAY: high plasticity, orange-brown; trace medium grained, sub-angular to sub-rounded, ironstone gravel

AD/V

01/07/2024

2.00 m

5.00 m

5.50 m

6.50 m

Pre- Hydrated Cement-Bentonite Grout

Bentonite Plug

Sand: 8/16 (or finer) grade filter pack

Bentonite Plug

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

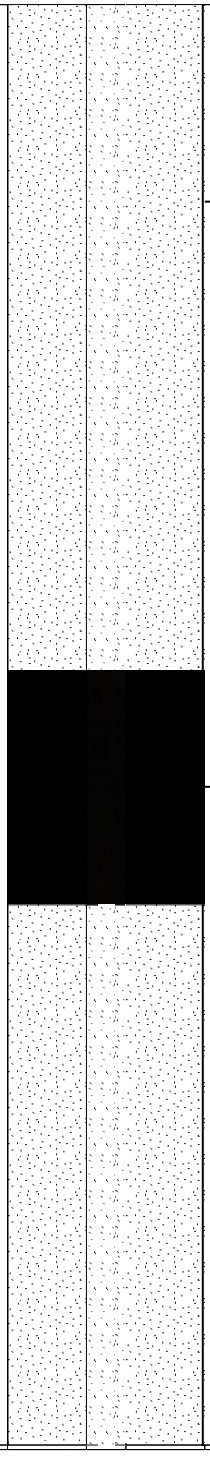
Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
AD/V					CLAY: high plasticity, orange-brown; trace medium grained, sub-angular to sub-rounded, ironstone gravel
			8.5		CLAY (ALLUVIUM): high plasticity, orange-brown mottled grey; with fine to medium grained, sub-rounded to sub-angular ironstone gravel
		-4	9.0		*9.12-9.15m: sandstone band* *9.15-9.35m: fine to medium grained, sub-rounded to sub-angular, clayey gravel band*
			9.5		NO CORE (100mm): 9.35-9.43m
					CLAY (ALLUVIUM): high plasticity, orange-brown mottled grey; with fine to medium grained, sub-rounded to sub-angular ironstone gravel
		-5	10.0		
			10.5		*10.43-10.45m: trace of fine to medium grained, sub-angular to subrounded gravel*
					Sandy GRAVEL: fine to medium grained, subrounded, red, grey and orange, highly weathered gravel; fine to medium grained sand
		-6	11.0		
					CLAY: high plasticity, grey mottled orange brown *11.37-11.41m: 40mm sandstone band*
			11.5		
HQ3					SILTSTONE: dark grey with iron staining, indistinctly laminated at 0° to 5°
		-7	12.0		
					CLAY: high plasticity, dark grey with iron staining, extremely weathered siltstone *12.45m: ironstone gravel band*
			12.5		*12.72-12.76m: ironstone gravel band*
					Interlaminated SILTSTONE (65%) and SANDSTONE (35%): ironstained dark grey, distinctly laminated at 0° to 5°
		-8	13.0		
			13.5		
		-9	14.0		
			14.5		
		-10	15.0		
			15.5		

INSTALLATION DETAILS

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.83 m 4.21 m	25.97 m -20.93 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	**Description of Strata** ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID :	Type:	Stick Up & RL : / Tip Depth & Tip RL :
							Standpipe	0.83 m 4.21 m 25.97 m -20.93 m
HQ3		-12	16.5 17.0		Interlaminated SILTSTONE (65%) and SANDSTONE (35%): ironstained dark grey, distinctly laminated at 0° to 5°			
		-13	17.5 18.0		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): pale grey and dark grey, sandstone is fine grained, distinctly laminated at 0° to 5°			
		-14	18.5 19.0					
		-15	19.5 20.0					Sand: 8/16 (or finer) grade filter pack
		-16	20.5 21.0					
		-17	21.5 22.0					
		-18	22.5 23.0					
			23.5		SILTSTONE: dark grey, trace of fine grained, grey, sandstone laminae, indistinctly laminated at 0° to 5°			

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

WRRF-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317892.3 m	**Elevation:**	5.04 m	**Started:**	01/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254846.5 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	**Description of Strata** ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
HQ3		-20	24.5 25.0 25.5		SILTSTONE: dark grey, trace of fine grained, grey, sandstone laminae, indistinctly laminated at 0° to 5°	25.97 m	Standpipe	0.83 m 4.21 m	25.97 m -20.93 m
		-21	26.0		Exploratory hole terminated at 25.97 m Target depth				
		-22	26.5 27.0						
		-23	27.5 28.0						
		-24	28.5 29.0						
		-25	29.5 30.0						
		-26	30.5 31.0						
			31.5						

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

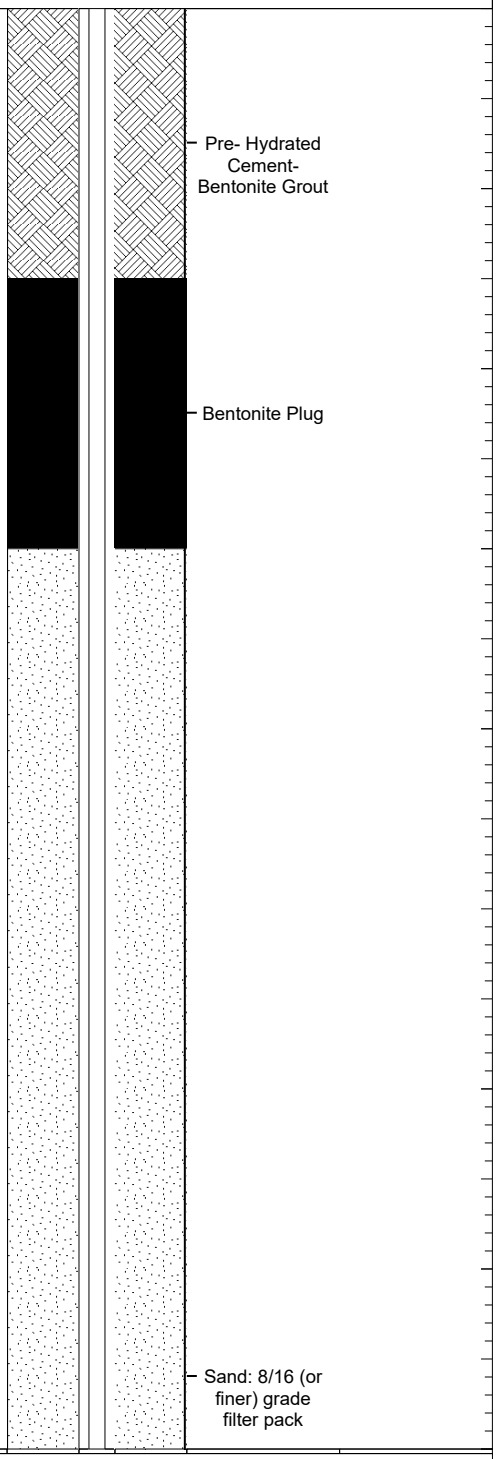
Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317894.5 m	**Elevation:**	5.05 m	**Started:**	19/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6255268.8 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	19/06/2024	5	0.5		FILL: Sandy CLAY: medium plasticity, brown, fine to coarse grained sand with asphalt fragments	
		4	1.0		CLAY: high plasticity, grey mottled red orange	1.8
			1.5			
		3	2.0			
			2.5		*2.4m: with fine grained sand; trace medium grained gravel and rootlets*	4
		2	3.0			
			3.5		*3.3m: colour is red mottled grey yellow*	
		1	4.0			2.5
			4.5			
		0	5.0			
			5.5			4.2
		-1	6.0			
			6.5			
			7.0		*6.8m: colour is dark grey* *7.0m: colour is dark grey mottled brown*	3.2
		-2	7.5			

ID : Type: Standpipe | Stick Up & RL : 0.80 m, 4.25 m | Tip Depth & Tip RL : 17.23 m, -12.18 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

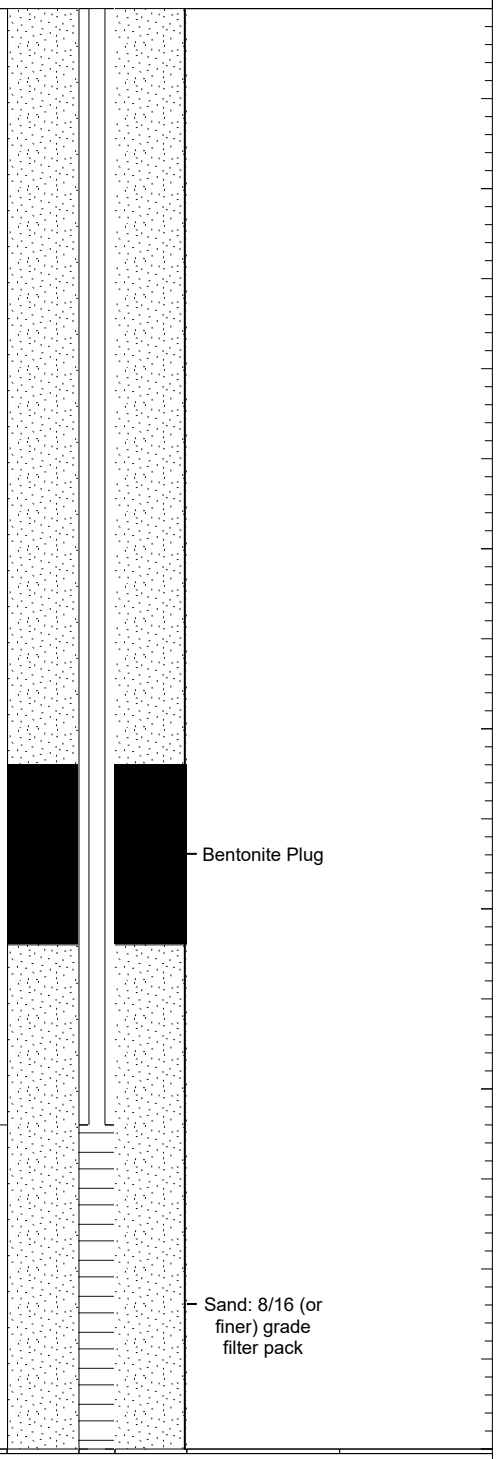
Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317894.5 m	**Elevation:**	5.05 m	**Started:**	19/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6255268.8 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V		-3	8.5		CLAY: high plasticity, grey mottled red orange *8.1m: colour is grey mottled red; trace fine to coarse grained sand*	
		-4	9.0			
			9.5		*9.8m: colour is grey mottled brown; trace fine grained sand*	
		-5	10.0			
			10.5		*10.8m: colour is dark grey*	
		-6	11.0			
			11.5		*11.4m: colour is dark grey mottled green*	
		-7	12.0			
			12.5			
		-8	13.0			
			13.5			
		-9	14.0			
			14.5		CLAY: medium plasticity, grey, mottled brown and dark grey; trace fine grained sand; relic rock fabric	
		-10	15.0			
			15.5		*15.25m: some black mottling becoming high plasticity*	

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.80 m 4.25 m	17.23 m -12.18 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317894.5 m	**Elevation:**	5.05 m	**Started:**	19/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6255268.8 m	**Datum:**	AHD	**Finished:**	19/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
AD/V		-11	16.5		CLAY: medium plasticity, grey, mottled brown and dark grey; trace fine grained sand; relic rock fabric			Standpipe	0.80 m 4.25 m	17.23 m -12.18 m
		-12	17.0		*17.0m: colour is dark brown*		17.20 m			
			17.5		SILTSTONE: extremely weathered, very low strength, indistinctly laminated recovered as gravelly CLAY: low plasticity, fine grained sub-rounded to sub angular siltstone gravel, dark brown					
					Exploratory hole terminated at 17.23 m Target depth					
		-13	18.0							
			18.5							
		-14	19.0							
			19.5							
		-15	20.0							
			20.5							
		-16	21.0							
			21.5							
		-17	22.0							
			22.5							
		-18	23.0							
			23.5							

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-108

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

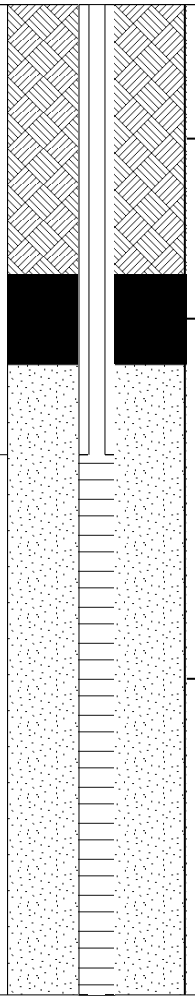
Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317985.3 m	**Elevation:**	4.98 m	**Started:**	21/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255249.0 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	21/06/2024	4	0.5		FILL: CLAY: medium plasticity, brown mottled orange-brown and grey, with fine to medium grained sub-angular siltstone gravel; with fine to coarse grained sand	0.5
			1.0		*0.6-1.1m: trace sand and gravel content* *0.7m: some grey-white mottling*	0.6
			1.5		CLAY: medium to high plasticity, brown mottled grey and orange-brown	8.4
		3	2.0		*2.2m: grey mottled orange-brown and brown*	2.1
			2.5		*2.7-3m: brown, trace of sand*	
		2	3.0		*3m: grey mottled brown*	4.8
			3.5		*3.6m: trace of sub-angular to sub-rounded sandstone gravel* *3.7m: trace of fine to coarse grained sand* *3.9-4.2m: trace of fine to medium grained, sub-angular to sub-rounded sandstone gravel*	1.3
		1	4.0			
			4.5		*4.8m onwards: high plasticity*	
		0	5.0			2.2
			5.5		Exploratory hole terminated at 5.50 m Target depth	
		-1	6.0			
			6.5			
		-2	7.0			
			7.5			

INSTALLATION DETAILS

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.74 m 4.24 m	5.50 m -0.52 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-109

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

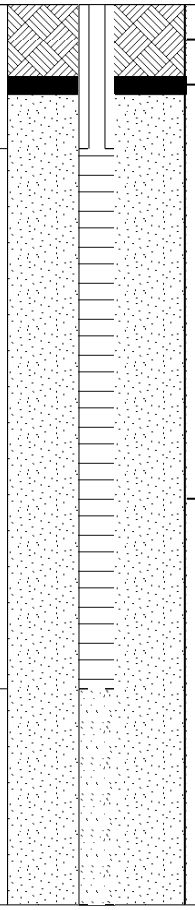
Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318076.2 m	**Elevation:**	4.97 m	**Started:**	24/06/2024
Plant:	Comacchio 305	**Northing:**	6255249.7 m	**Datum:**	AHD	**Finished:**	24/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	24/06/2024	4	1.0		FILL: Silty CLAY: low plasticity, brown, trace fine to coarse grained gravel and plastic fragments	2
			0.5			34.5
			1.0		CLAY: medium plasticity, brown, mottled red	
			1.5			
		3	2.0		CLAY: high plasticity, grey mottled yellow brown	3.8
			2.5			
		2	3.0		*3.2m: colour changing to grey mottled red yellow*	
			3.5			
					GRAVEL: fine to coarse grained, sub-angular to angular, red, with clay, high plasticity, grey mottled yellow, gravel is ironstone	3.4
		1	4.0		CLAY: high plasticity, grey mottled red yellow	
			4.5			
		0	5.0		Exploratory hole terminated at 5.00 m Target depth	4.3
			5.5			
		-1	6.0			
			6.5			
		-2	7.0			
			7.5			

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.79 m 4.19 m	5.00 m -0.02 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-110

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

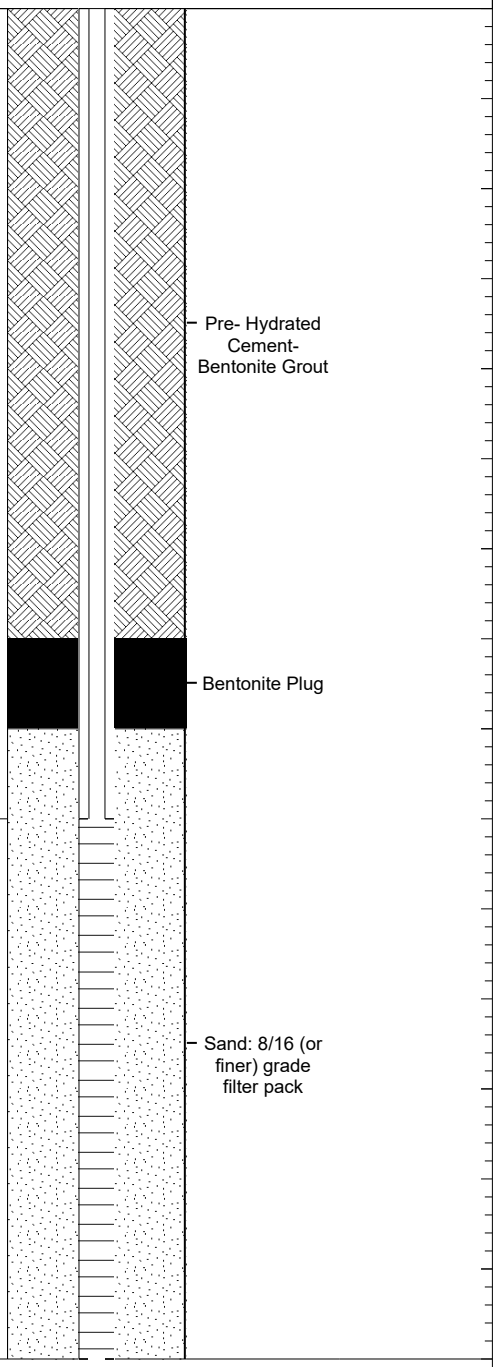
Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317704.8 m	**Elevation:**	4.12 m	**Started:**	17/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255157.4 m	**Datum:**	AHD	**Finished:**	17/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	17/06/2024	4	0		FILL: CLAY: low plasticity, brown; with fine to coarse grained sand; with fine grained, sub-angular, siltstone gravel	2.1
			0.5		FILL: CLAY: medium plasticity, brown mottled orange-brown	0.9
					0.7m: colour is grey mottled brown	
		3	1.0		*1.1m: trace of fine to medium grained, sub-angular to sub-rounded, sandstone and siltstone gravel content*	
			1.5		*1.2m: colour is red-brown mottled grey and orange-brown*	
					1.7m: trace of fine to coarse grained sand content	
		2	2.0		*1.9m: colour is brown mottled grey, orange-brown and dark brown*	1.8
			2.5		*2.5m: colour is brown*	
					2.7m: low plasticity	
		1	3.0		*3.2m: colour is brown mottled grey and orange-brown*	
			3.5			1.9
			4.0			
		0			CLAY: medium to high plasticity, grey mottled brown; trace fine grained sand	
			4.5			
		-1	5.0		*5.1m: colour is brown mottled grey, fine to medium grained, trace of sub-angular, sandstone gravel*	2.5
			5.5		*5.3m: high plasticity, colour is dark grey mottled red-brown*	
		-2	6.0			
			6.5			0.8
		-3	7.0			
			7.5		Exploratory hole terminated at 7.50 m Target depth	

ID : Type: Stick Up & RL : Tip Depth & Tip RL :

Standpipe 0.67 m 3.45 m 7.50 m -3.38 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-GW-111

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

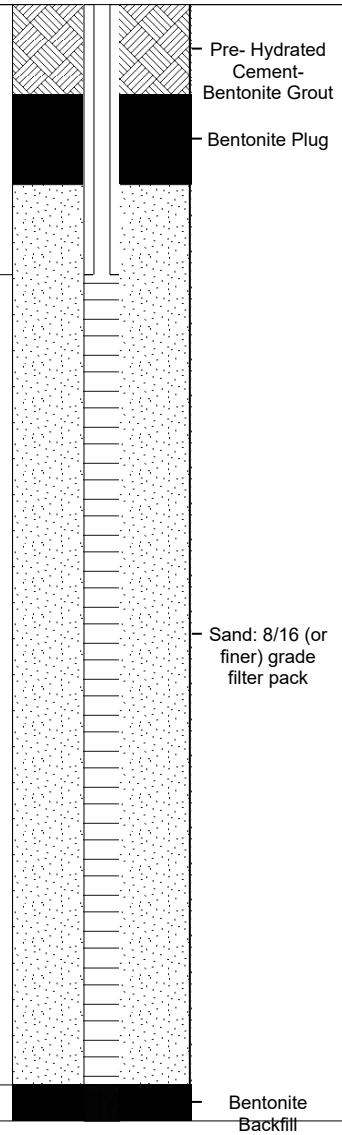
Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318161.6 m	**Elevation:**	4.98 m	**Started:**	26/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255086.5 m	**Datum:**	AHD	**Finished:**	26/06/2024
Logged By:	GC **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	26/06/2024	4	0.5		FILL: Gravelly CLAY: low to medium plastcity, brown; fine to coarse grained, sub-angular to angular gravel; trace fine to coarse grained sand	1.5
					FILL: CLAY: medium plasticity, brown; with fine grained sub-angular to sub-rounded gravel; trace fine to coarse grained sand	1.1
			1.0		CLAY: medium plasticity, orange mottled red; trace fine to coarse grained sand; trace fine grained, sub-angular gravel	
			1.5			
		3	2.0		CLAY: high plasticity, grey mottled orange and red; trace fine grained sand	0.6
			2.5		*2.3-2.9m: with fine grained, sub-angular ironstone gravel, red mottled grey and orange*	
		2	3.0			
			3.5			1
		1	4.0			
			4.5			
		0	5.0			1.1
			5.5		*5.8m: grey mottled red-brown*	
		-1	6.0			
			6.5		Exploratory hole terminated at 6.20 m Target depth	
		-2	7.0			
			7.5			

INSTALLATION DETAILS

ID : Type: Standpipe — Stick Up & RL : 0.61 m, 4.37 m — Tip Depth & Tip RL : 6.20 m, -1.22 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-112

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

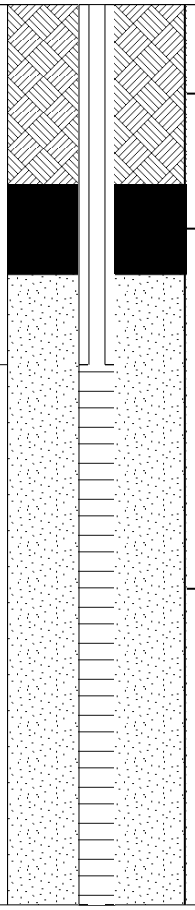
Client: Sydney Water **Location:** Camellia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317750.4 m	**Elevation:**	4.42 m	**Started:**	03/07/2024
Plant:	Comacchio Geo 305	**Northing:**	6254898.0 m	**Datum:**	AHD	**Finished:**	03/07/2024
Logged By:	MR **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V		4	0.5		FILL: Sandy CLAY: High plasticity, brown, medium to coarse grained sand	3.4
					FILL: Sandy CLAY: High plasticity, brown mottled grey and red, medium to coarse grained sand, with medium to fine grained gravel, black staining from 0.5-0.95 mbgl	2.8
			1.0		FILL: Sandy CLAY: high plasticity, dark grey mottled yellow, medium to coarse grained sand, trace fine grained sub angular gravel	
		3	1.5		*1.5-1.6: black staining and strong hydrocarbon odour*	5.1
			2.0			2.2
		2	2.5			
			3.0			2.8
		1	3.5		FILL: CLAY: High plasticity, dark grey, very soft *3.2-4.7: moderate hydrocarbon odour* *3.5: grey, firm*	0.6
			4.0			
		0	4.5			
			5.0		Sandy CLAY: High plasticity, brown mottled grey and red, medium to coarse grained sand	
		-1	5.5		Exploratory hole terminated at 5.00 m Target depth	
			6.0			
		-2	6.5			
			7.0			
		-3	7.5			

INSTALLATION DETAILS

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.70 m 3.72 m	5.00 m -0.58 m



Pre- Hydrated Cement-Bentonite Grout

Bentonite Plug

Sand: 8/16 (or finer) grade filter pack

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-GW-113

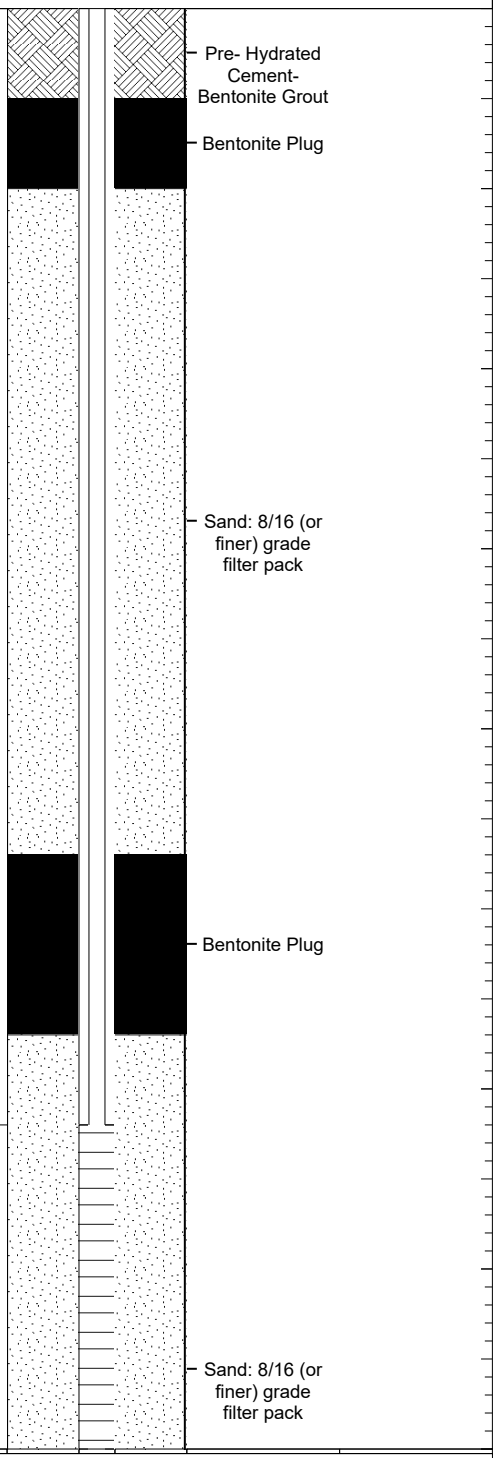
Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 2

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317973.3 m	**Elevation:**	4.67 m	**Started:**	05/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254867.7 m	**Datum:**	AHD	**Finished:**	05/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	05/07/2024	4	0.5		FILL: Gravelly CLAY: low plasticity, brown; fine to medium grained, fill gravel; with fine to coarse grained sand	2.9
					FILL: CLAY: medium to high plasticity, orange-brown; trace fine to coarse grained sand	2.2
			1.0		FILL: CLAY: high plasticity, grey mottled brown; trace fine to medium grained sand	
		3	1.5		*1.5-1.7m: moderate solvent odours*	5.7
			2.0			21.5
					CLAY: high plasticity, grey *2.0-2.45m: moderate solvent odours* *2.3m: increasing moisture content*	
		2	2.5		*2.8m: brown mottling*	
			3.0		*3.0-3.5m: slight solvent odours*	5.3
		1	3.5		*3.5-3.95m: strong solvent odours*	19.4
			4.0		CLAY: high plasticity, grey mottled orange-brown; trace subangular, fine grained, ironstone gravel	
		0	4.5		*4.4m: red-brown mottling*	
			5.0		CLAY: high plasticity, dark grey mottled brown, grey, orange and red-brown; trace fine to medium grained sand	3.5
		-1	5.5			
			6.0		*6.0-6.1m: strong hydrocarbon odours*	5.2
			6.5		*6.5-6.95m: visible hydrocarbon product or impacted groundwater (sheen) on soils*	3.9
		-2	7.0			
			7.5		*7.5m: increasing sand content*	
		-3				

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.74 m 3.93 m	9.42 m -4.75 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-GW-113

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 2

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317973.3 m	**Elevation:**	4.67 m	**Started:**	05/07/2024
Plant:	Comacchio Geo 300	**Northing:**	6254867.7 m	**Datum:**	AHD	**Finished:**	05/07/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
AD/V		8.5 -4 9.0 9.5 -5 10.0 10.5 -6 11.0 11.5 -7 12.0 12.5 -8 13.0 13.5 -9 14.0 14.5 -10 15.0 15.5 -11			CLAY: high plasticity, dark grey mottled brown, grey, orange and red-brown; trace fine to medium grained sand Sandy CLAY: medium to high plasticity, grey mottled brown and orange-brown; trace fine to medium grained sand; trace fine to medium grained, subrounded, sandstone gravel *9.0-9.2m: brown staining and strong hydrocarbon odour* SANDSTONE: red-brown, coarse grained, highly weathered, very low strength ...recovered as Gravelly CLAY: low plasticity, red-brown; fine to medium grained, subrounded to subangular, fine to medium grained, sandstone gravel; with fine to coarse grained sand Exploratory hole terminated at 9.42 m Target depth	1.8 6.4	9.20 m	Standpipe	0.74 m 3.93 m	9.42 m -4.75 m

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

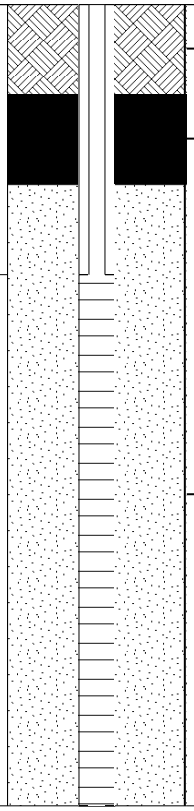
WRRF-GW-114

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318004.2 m	**Elevation:**	4.74 m	**Started:**	25/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254862.6 m	**Datum:**	AHD	**Finished:**	25/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE			INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
								Standpipe	0.68 m 4.06 m	4.45 m 0.29 m
AD/V	25/06/2024	4 3 2 1 0 -1 -2 -3	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: CLAY: medium plasticity, brown green	4.5				
					CLAY: medium plasicity, brown green mottled red *0.6-0.7m: moderate hydrocarbon odour*	14.8				
					1.0-1.45m: moderate sweet and hydrocarbon odour	526.5	1.50 m			
					CLAY: low plasticity, grey mottled brown red *2.0-2.95m: moderate hydrocarbon odour*	400.5				
						98				
					2.8m: trace ironstone gravel /siltstone gravel *2.85m: colour changing to grey mottled red*					
					3.5-3.7m: moderate hydrocarbon odour	58				
					CLAY: high plasticity, grey	3.9	4.45 m			
					Exploratory hole terminated at 4.45 m Target depth					



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

WRRF-GW-115

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318114.9 m	**Elevation:**	4.88 m	**Started:**	26/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6254835.1 m	**Datum:**	AHD	**Finished:**	26/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)	ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
								Standpipe	0.68 m 4.20 m	6.00 m -1.12 m
AD/V		4	0.5		FILL: CLAY: medium plasticity, brown; with subrounded to subangular, fine to medium grained, ironstone and sandstone gravel	3.2				
			1.0		FILL: CLAY: high plasticity, white-grey mottled orange; trace fine to medium grained, subrounded to subangular, siltstone and sandstone gravel	2.3			Pre- Hydrated Cement-Bentonite Grout Bentonite Plug	
			1.5				1.50 m			
		3	2.0		*1.7m: becoming brown mottled orange-brown, grey-brown and grey*	1				
			2.5		*2.5m: PVC fragment found* CLAY: high plasticity, grey mottled brown	0.9				
		2	3.0							
			3.5		*3.7m: trace rootlets*	1.1			Sand: 8/16 (or finer) grade filter pack	
		1	4.0		CLAY: high plasticity, grey mottled brown, orange-brown; trace fine grained, subangular, ironstone gravel *4.2m: trace fine grained, subangular ironstone gravel*					
			4.5							
		0	5.0		*5.2m: brown mottled dark brown, grey, orange-brown and dark grey*	1.1				
			5.5				6.00 m			
		-1	6.0		Exploratory hole terminated at 6.00 m Target depth					
			6.5							
		-2	7.0							
			7.5							
		-3								

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-116

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

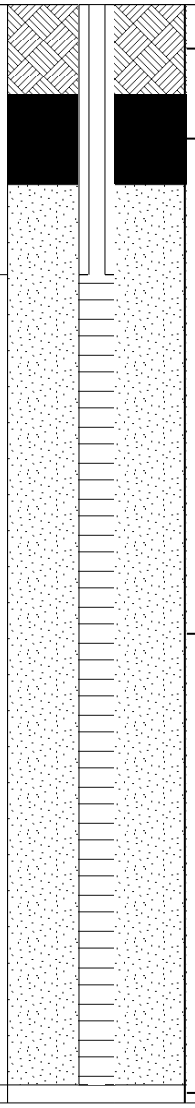
Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317893.0 m	**Elevation:**	5.32 m	**Started:**	28/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6254745.2 m	**Datum:**	AHD	**Finished:**	28/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V		5	0.5		FILL: Sandy CLAY: low to medium plasticity, brown; fine to coarse grained sand; with fine to medium grained, subrounded to subangular ironstone gravel	1.6
						1.8
			1.0		*0.8m: pale brown, with orange-brown mottling*	
		4	1.5		*1.3m: decreasing gravel content*	
			2.0			
		3	2.5			
			3.0		CLAY: high plasticity, grey mottled brown and orange-brown	108.5
		2	3.5		*2.8 - 3.0m: moderate hydrocarbon odour*	
			4.0		*3.5 - 3.95m: strong hydrocarbon odour*	217
		1	4.5		*3.8m: trace fine grained, subangular ironstone gravel*	
			5.0		*4.2m: grey*	6.4
		0	5.5			
			6.0		*5.9m: grey mottled brown and orange-brown*	
		-1	6.5		Exploratory hole terminated at 6.10 m Target depth	
			7.0			
		-2	7.5			

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.64 m 4.68 m	6.10 m -0.78 m



- Pre- Hydrated Cement-Bentonite Grout
- Bentonite Plug
- Sand: 8/16 (or finer) grade filter pack
- Backfill

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-117

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

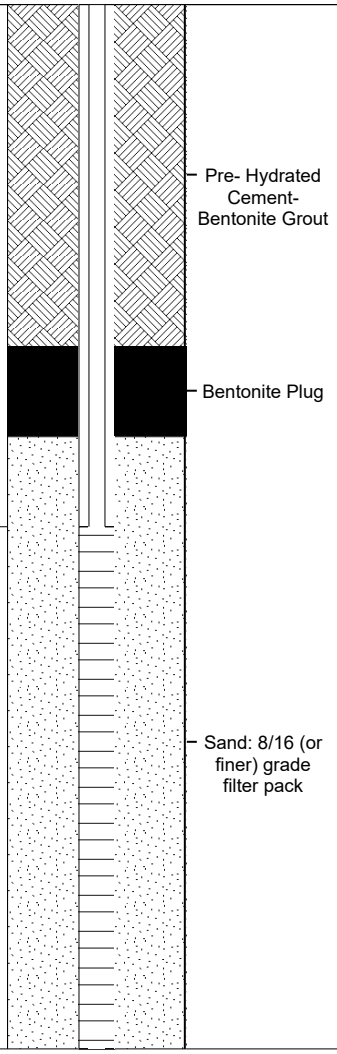
Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317884.3 m	**Elevation:**	5.02 m	**Started:**	21/06/2024
Plant:	Comacchio Geo 300	**Northing:**	6255163.0 m	**Datum:**	AHD	**Finished:**	21/06/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V	21/06/2024	4	0.5		FILL: Gravelly CLAY: low plasticity, brown; fine to medium grained, sub-angular, sandstone and siltstone gravel	1
					FILL: CLAY: low plasticity brown; with fine to coarse grained sand	1.1
			1.0		*0.7m: medium grained sub-rounded to sub-angular sandstone and siltstone gravel encountered* *0.8m: colour is grey mottled brown*	
			1.5		CLAY: high plasticity, brown mottled grey and orange-brown	
		3	2.0			33.1
			2.5		*2.7m: colour is red and brown* *2.8m: trace fine to medium grained sand*	
		2	3.0			
			3.5		*3.4m: colour is grey*	1.8
		1	4.0			
			4.5		*4.8m: some red-brown mottling*	
		0	5.0			0.9
			5.5			
		-1	6.0		Exploratory hole terminated at 5.80 m Target depth	
			6.5			
		-2	7.0			
			7.5			

ID : Type: Stick Up & RL : Tip Depth & Tip RL :

Standpipe 0.69 m 4.33 m 5.80 m -0.78 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

WRRF-GW-118

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

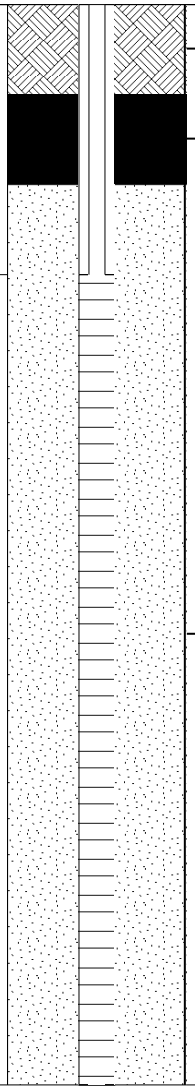
Client: Sydney Water **Location:** Camelia, NSW **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318025.7 m	**Elevation:**	5.31 m	**Started:**	25/06/2024
Plant:	Comacchio Geo 305	**Northing:**	6254995.7 m	**Datum:**	AHD	**Finished:**	25/06/2024
Logged By:	MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	PID (ppm)
AD/V		5	0.5		Sandy CLAY: High plasticity, brown, trace fine grained, sub angular to sub rounded, grey gravel. Sand is fine to coarse grained, sub rounded to rounded, dark grey	27.5
			1.0			
		4	1.5		*1.2m: colour is brown mottled red and sand is fine grained*	5.8
			2.0		CLAY: High plasticity, grey mottled red and yellow	
		3	2.5		*2.4m: with fine grained, sub rounded to sub angular, grey sand trace medium grained, sub angular to sub rounded gravel trace rootlets* *2.5m: trace fine to coarse grained, sub angular to angular ironstone gravel*	10.4
			3.0			
		2	3.5		*3.3m: becoming red mottled grey yellow* CLAY: Low plasticity, grey mottled brown	
			4.0			3.3
		1	4.5		*4.2m: becoming grey mottled red yellow*	
			5.0			
		0	5.5			1.4
			6.0		Exploratory hole terminated at 6.00 m Target depth	
		-1	6.5			
			7.0			
		-2	7.5			

ID :	Type:	Stick Up & RL :	Tip Depth & Tip RL :
	Standpipe	0.68 m 4.62 m	6.00 m -0.69 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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LEGEND

GENERAL

- PROJECT BOUNDARY

EXISTING GEOTECHNICAL LOCATIONS

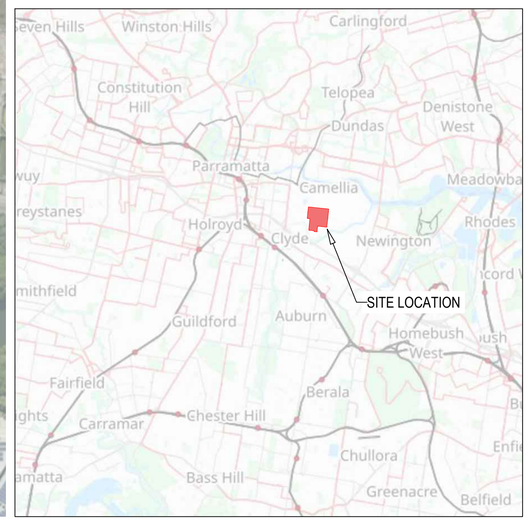
- BOREHOLE

PROPOSED GEOTECHNICAL LOCATIONS

- BOREHOLE
- TEST PIT (ALL CoPC)
- TEST PIT (PFAS ONLY)
- TEST PIT (ASBESTOS ONLY)
- CONE PENETRATION TEST (CPT)
- CONE PENETRATION TEST (CPT) PROVISIONAL
- SOIL VAPOUR PROBE
- NON DESTRUCTIVE DRILLING (NDD)
- BOREHOLE WITH PIEZOMETER
- SHALLOW PIEZOMETER
- DEEP PIEZOMETER (TO TOP OF BEDROCK)

KEY PLAN

NTS



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PLAN
1:1500

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FOR REVIEW AND COMMENT

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D	ISSUED FOR INFORMATION	S.I / 21.06.24		
C	ISSUED FOR INFORMATION	G.C. / 19.06.24		
B	ISSUED FOR INFORMATION	S.I. / 04.06.24		
A	ISSUED FOR INFORMATION	S.I. / 21.06.24		

COORDINATE SYSTEM: GDA2020 - MGA Zone 56

HEIGHT DATUM: A.H.D

SCALE:

15 0 15 30 45 60
1 : 1500 FULL SIZE A1

DESIGN LOT CODE:

CLIENT: Sydney WATER

PREPARED FOR:
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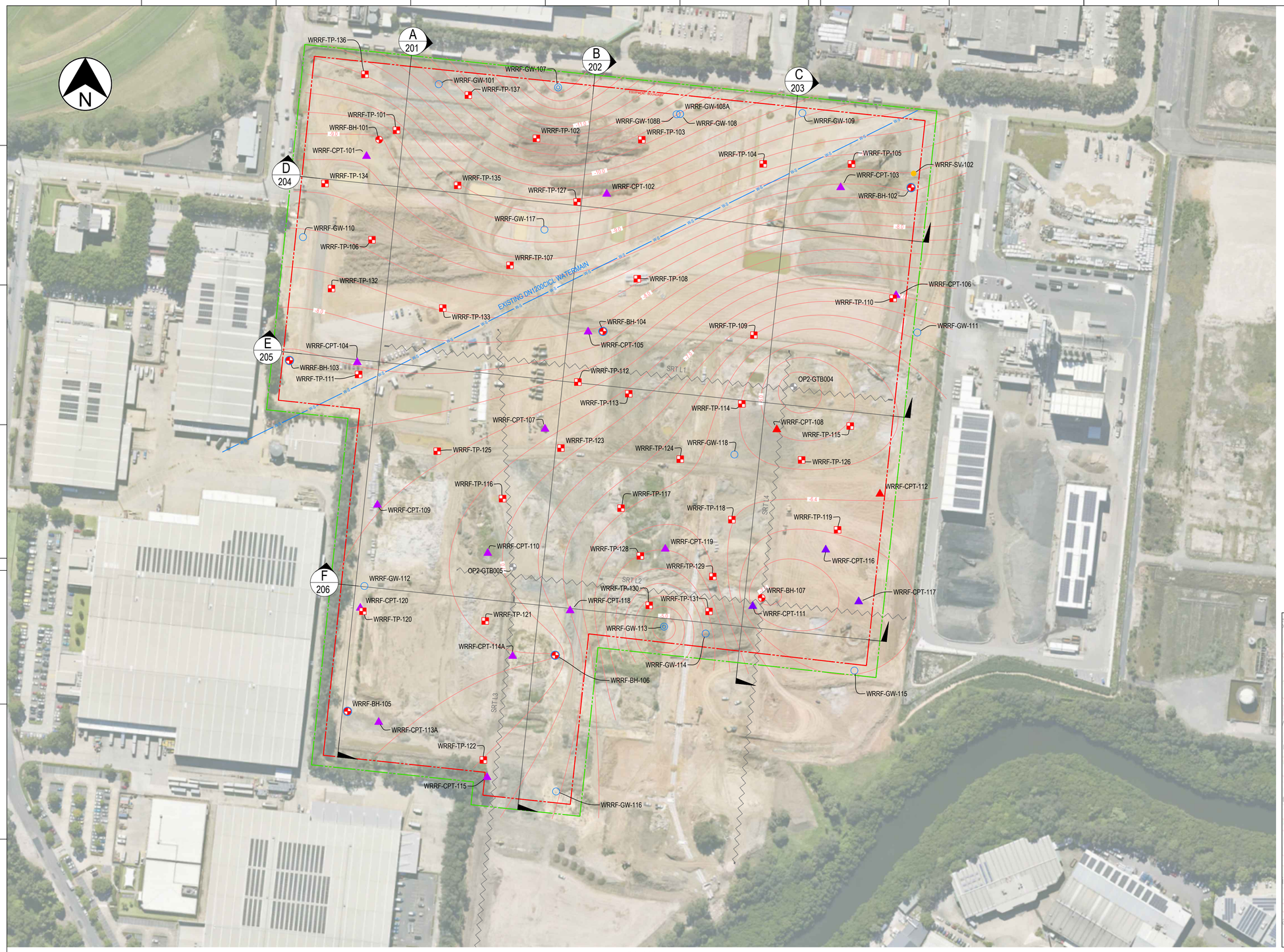
DRAWN _____ R.DAWIDOWICZ _____ 04.07.24
DESIGNED _____ S.IBRIC _____ 04.07.24
DRG CHECK _____
DESIGN CHECK _____
PROJ/DES MNGR _____
APPROVED _____

SYDNEY WATER
GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
PROPOSED SITE INVESTIGATION
PLAN

DRAWING SET No: -	PART:	SHEET: 1 OF 1	A1
STATUS: -	BRIDGE No: -		©

DRG No.	REV	VER	EDMS No.	AMD No.
IA319500-WRF-GT-SKT-000001	E	0	-	-

FILE NAME: IA319500-WRF-GT-SKT-000001.dwg
PLOT DATE & TIME: 4/07/2024 1:37:57 PM



LEGEND

GENERAL

- ACQUIRED LAND BOUNDARY
- EQUIPMENT BOUNDARY
- WATER MAIN

HISTORIC GEOTECHNICAL LOCATIONS

- BOREHOLE
- SEISMIC SURVEYS TRAVERSE

GEOTECHNICAL LOCATIONS (Jacobs 2024)

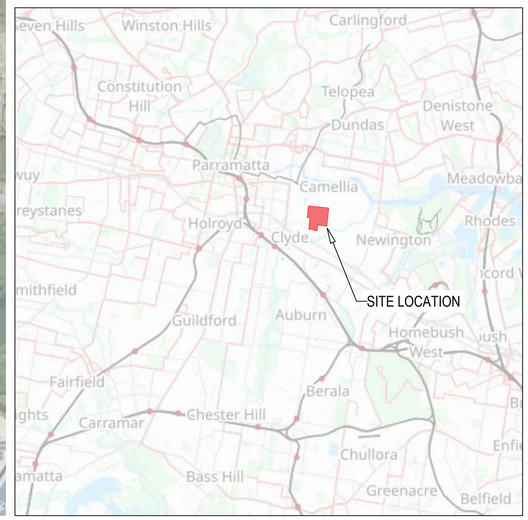
- BOREHOLE
- BOREHOLE WITH PIEZOMETER
- TEST PIT (ALL CoPC)
- CONE PENETRATION TEST (CPT)
- SOIL VAPOUR PROBE
- SHALLOW PIEZOMETER
- DEEP PIEZOMETER (TO TOP OF BEDROCK)

GEOLOGICAL FEATURES

- BEDROCK CONTOUR (200mm)

KEY PLAN

NTS



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A	PRELIMINARY ISSUE	S.I. / 19.07.24	S.R. / 19.07.24	

COORDINATE SYSTEM: GDA2020 - MGA Zone 56

HEIGHT DATUM: A.H.D

SCALE:

15 0 15 30 45 60
1 : 1500 FULL SIZE A1

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PREPARED FOR:
SYDNEY WATER

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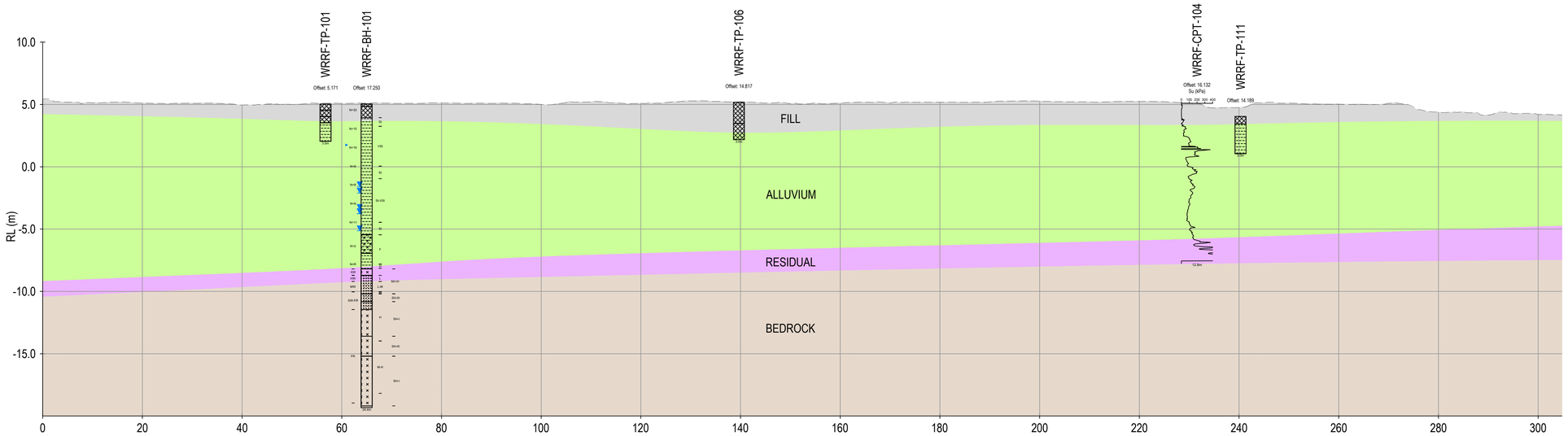
DRAWN	R.DAWIDOWICZ	16.08.24
DESIGNED	S.IBRIC	16.08.24
DRG CHECK	S.IBRIC	16.08.24
DESIGN CHECK	S.RAYNSFORD	16.08.24
PROJ/DES MNGR	A.LAYSON	16.08.24
APPROVED	A.LAYSON	16.08.24

SYDNEY WATER
GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
GEOTECHNICAL SITE INVESTIGATION
PLAN

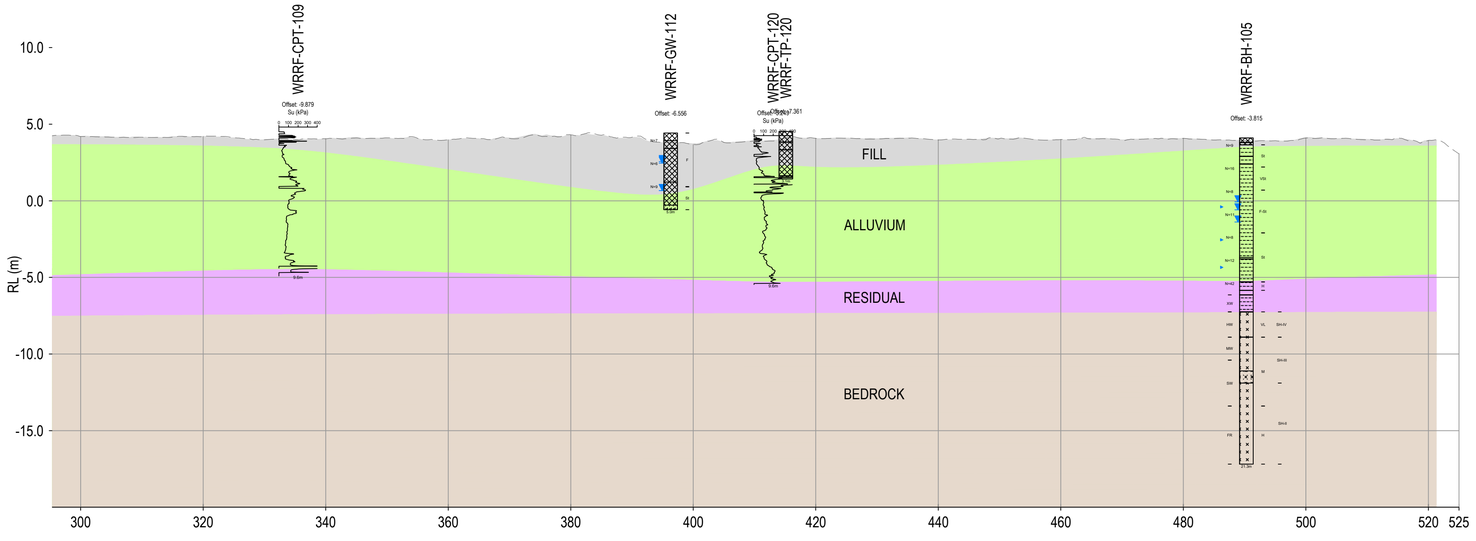
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STATUS: -	BRIDGE No: -		©

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FILE NAME: IA319500-WRF-GT-SKT-000101.dwg
PLOT DATE & TIME: 16/08/2024 2:30:56 PM



SECTION A 101
SCALE 1:500H 1:200V



SECTION A 101
SCALE 1:500H 1:200V

LEGEND

SECTION

INFERRED GEOLOGICAL BOUNDARY

STRATHOGRAPHY GRAPHIC

- FILL
- CLAY
- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- GRAVEL
- SILTSTONE
- SANDSTONE
- Interbedded SILTSTONE and SANDSTONE
- Interlaminated SILTSTONE and SANDSTONE

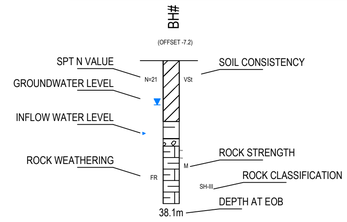
GEOTECHNICAL UNITS

- UNIT 1 FILL
- UNIT 2 ALLUVIUM
- UNIT 3 RESIDUAL SOIL / XW
- UNIT 4 BEDROCK

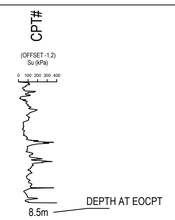
SOIL CONSISTENCY

VS	VERY SOFT	(S_u < 12 kPa)
S	SOFT	(S_u < 12 to 25 kPa)
F	FIRM	(S_u < 25 to 50 kPa)
St	STIFF	(S_u < 50 to 100kPa)
VSt	VERY STIFF	(S_u < 100 to 200 kPa)
H	HARD	(S_u > 200 kPa)

BOREHOLE STRIP



CPT with UNDRAINED SHEAR STRENGTH S_u (kPa)



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B	DRAFT GIR ISSUE	S.I. / 25.07.24	S.R. / 25.07.24	
A	PRELIMINARY ISSUE	S.I. / 19.07.24	S.R. / 19.07.24	

COORDINATE SYSTEM: GDA2020 - MGA Zone 56

HEIGHT DATUM: A.H.D

SCALE:

DESIGN LOT CODE:

CLIENT: Sydney WATER

PREPARED FOR: SYDNEY WATER

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DESIGN CHECK	S.RAYNSFORD	16.08.24
PROJ/DES MNGR	A.LAYSON	16.08.24
APPROVED	A.LAYSON	16.08.24

SYDNEY WATER

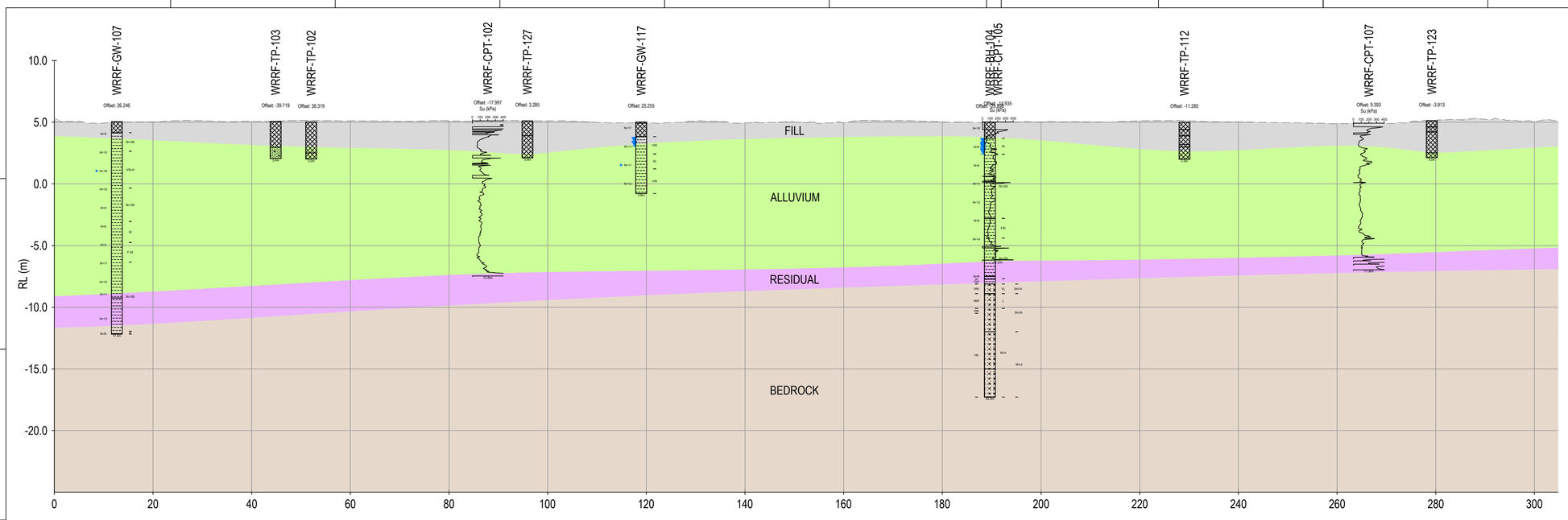
GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
GEOTECHNICAL PROFILE
SECTIONS - SHEET 1

DRAWING SET No: -	PART:	SHEET: 1 OF 6	A1
STATUS: -	BRIDGE No: -		©

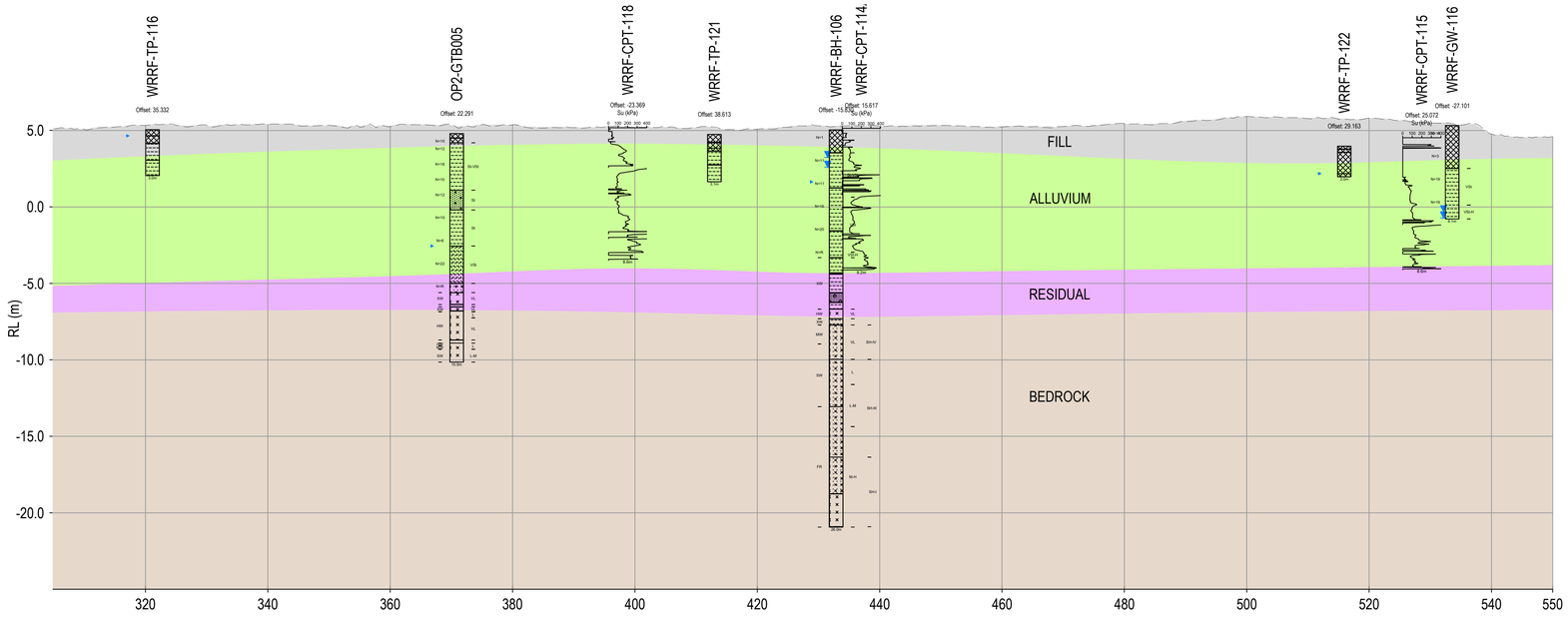
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IA319500-WRF-GT-SKT-000201	C	0	-	-

FILE NAME: IA319500-WRF-GT-SKT-000201.dwg

PLOT DATE & TIME: 16/08/2024 2:36:02 PM



SECTION B 101
SCALE 1:500H 1:200V



SECTION B 101
SCALE 1:500H 1:200V

LEGEND

SECTION

INFERRED GEOLOGICAL BOUNDARY

STRATHOGRAPHY GRAPHIC

- FILL
- CLAY
- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- GRAVEL
- SILTSTONE
- SANDSTONE
- Interbedded SILTSTONE and SANDSTONE
- Interlaminated SILTSTONE and SANDSTONE

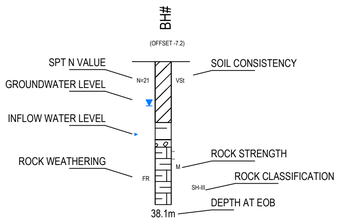
GEOTECHNICAL UNITS

- UNIT 1 FILL
- UNIT 2 ALLUVIUM
- UNIT 3 RESIDUAL SOIL / XW
- UNIT 4 BEDROCK

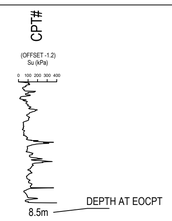
SOIL CONSISTENCY

VS	VERY SOFT	(S_u < 12 kPa)
S	SOFT	(S_u < 12 to 25 kPa)
F	FIRM	(S_u < 25 to 50 kPa)
St	STIFF	(S_u < 50 to 100kPa)
VSt	VERY STIFF	(S_u < 100 to 200 kPa)
H	HARD	(S_u > 200 kPa)

BOREHOLE STRIP



CPT with UNDRAINED SHEAR STRENGTH S_u (kPa)



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B	DRAFT GIR ISSUE	S.I. / 25.07.24	S.R. / 25.07.24	
A	PRELIMINARY ISSUE	S.I. / 19.07.24	S.R / 19.07.24	

COORDINATE SYSTEM: GDA2020 - MGA Zone 56

HEIGHT DATUM: A.H.D

SCALE:

DESIGN LOT CODE:

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DESIGN CHECK	S.RAYNSFORD	16.08.24
PROJ/DES MNGR	A.LAYSON	16.08.24
APPROVED	A.LAYSON	16.08.24

SYDNEY WATER

GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
GEOTECHNICAL PROFILE

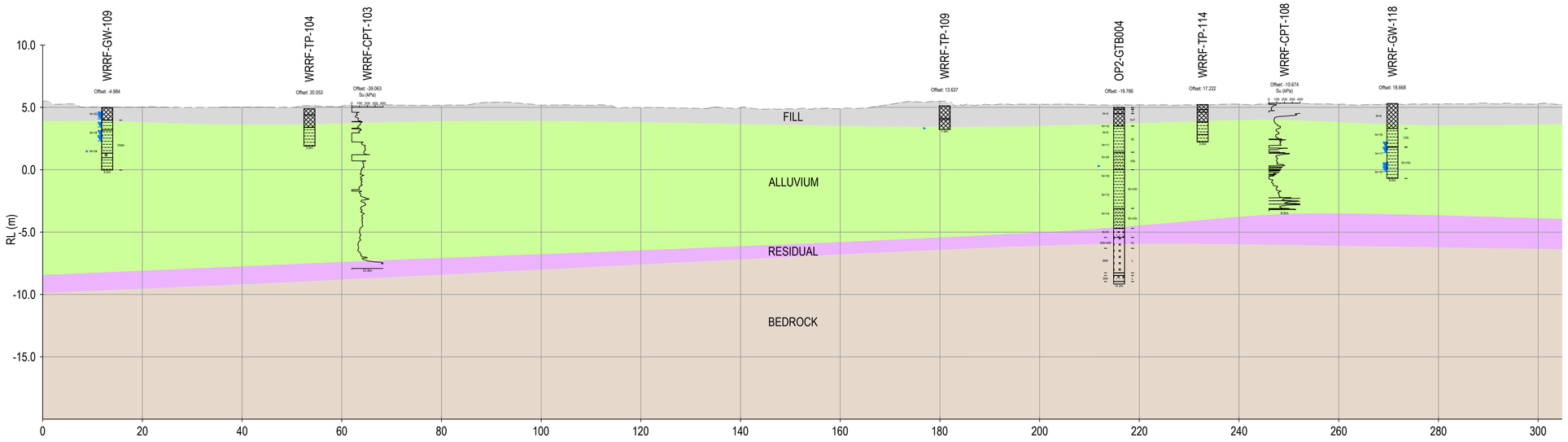
SECTIONS - SHEET 2

DRAWING SET No: -	PART:	SHEET: 2	OF 6	A1
STATUS: -	BRIDGE No: -			©

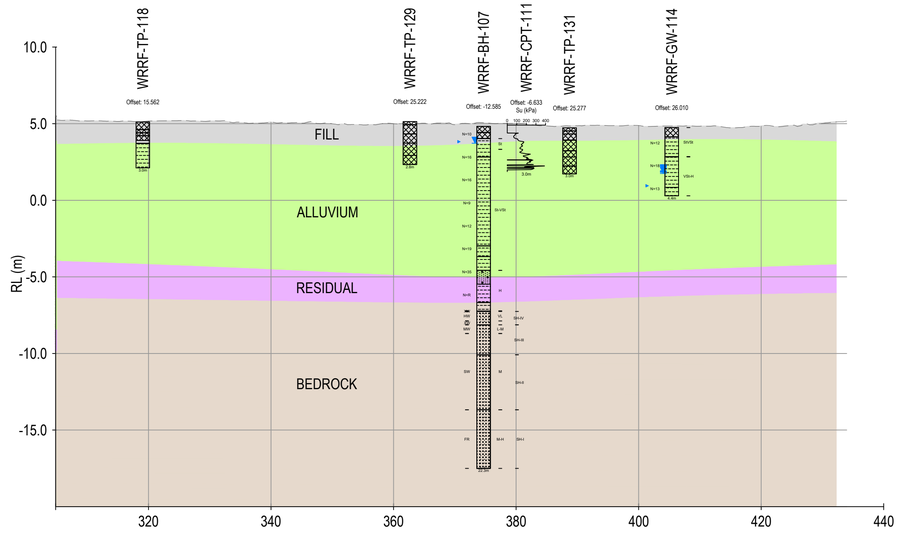
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PLOT DATE & TIME: 16/08/2024 2:33:49 PM



SECTION C
SCALE 1:500H 1:200V 101



SECTION C
SCALE 1:500H 1:200V 101

LEGEND

SECTION

INFERRED GEOLOGICAL BOUNDARY

STRATHOGRAPHY GRAPHIC

- FILL
- CLAY
- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- GRAVEL
- SILTSTONE
- SANDSTONE
- Interbedded SILTSTONE and SANDSTONE
- Interlaminated SILTSTONE and SANDSTONE

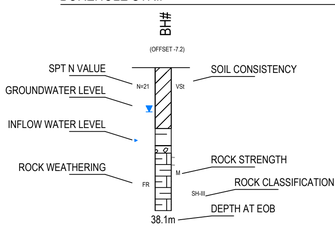
GEOTECHNICAL UNITS

- UNIT 1 FILL
- UNIT 2 ALLUVIUM
- UNIT 3 RESIDUAL SOIL / XW
- UNIT 4 BEDROCK

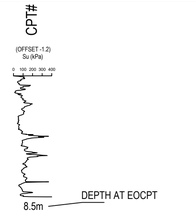
SOIL CONSISTENCY

VS	VERY SOFT	(S_u < 12 kPa)
S	SOFT	(S_u < 12 to 25 kPa)
F	FIRM	(S_u < 25 to 50 kPa)
St	STIFF	(S_u < 50 to 100kPa)
VSt	VERY STIFF	(S_u < 100 to 200 kPa)
H	HARD	(S_u > 200 kPa)

BOREHOLE STRIP



CPT with UNDRAINED SHEAR STRENGTH S_u (kPa)



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COORDINATE SYSTEM: GDA2020 - MGA Zone 56

HEIGHT DATUM: A.H.D

SCALE:

DESIGN LOT CODE:

CLIENT: Sydney WATER

PREPARED FOR: SYDNEY WATER

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DRG CHECK	S.IBRIC	16.08.24
DESIGN CHECK	S.RAYNSFORD	16.08.24
PROJ/DES MNGR	A.LAYSON	16.08.24
APPROVED	A.LAYSON	16.08.24

SYDNEY WATER

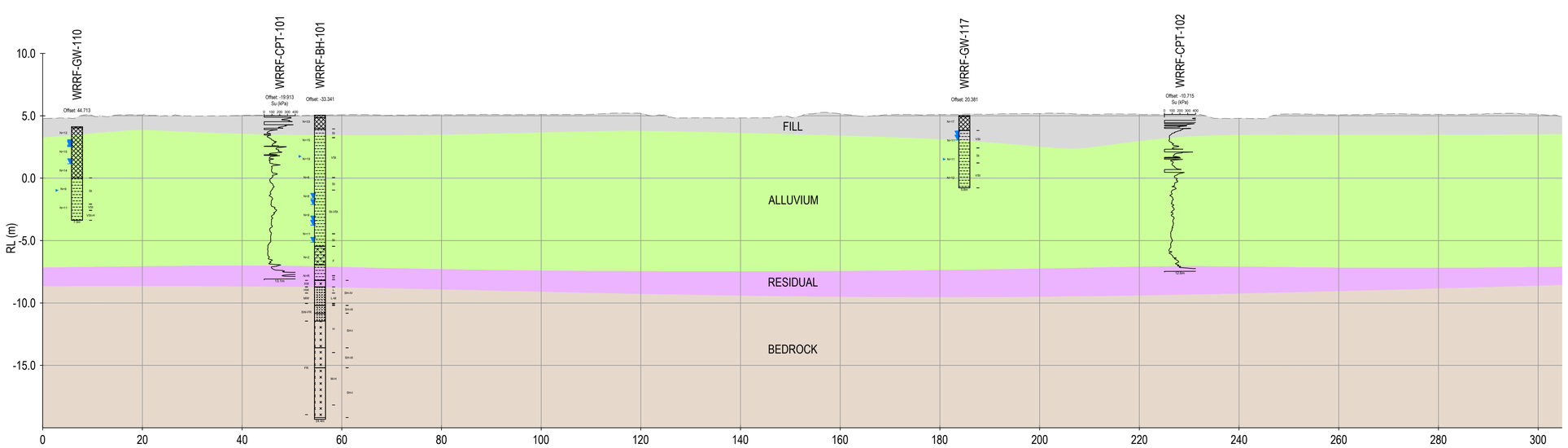
GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
GEOTECHNICAL PROFILE
SECTIONS - SHEET 3

DRAWING SET No: -	PART:	SHEET: 3	OF 6	A1
STATUS: -	BRIDGE No: -			©

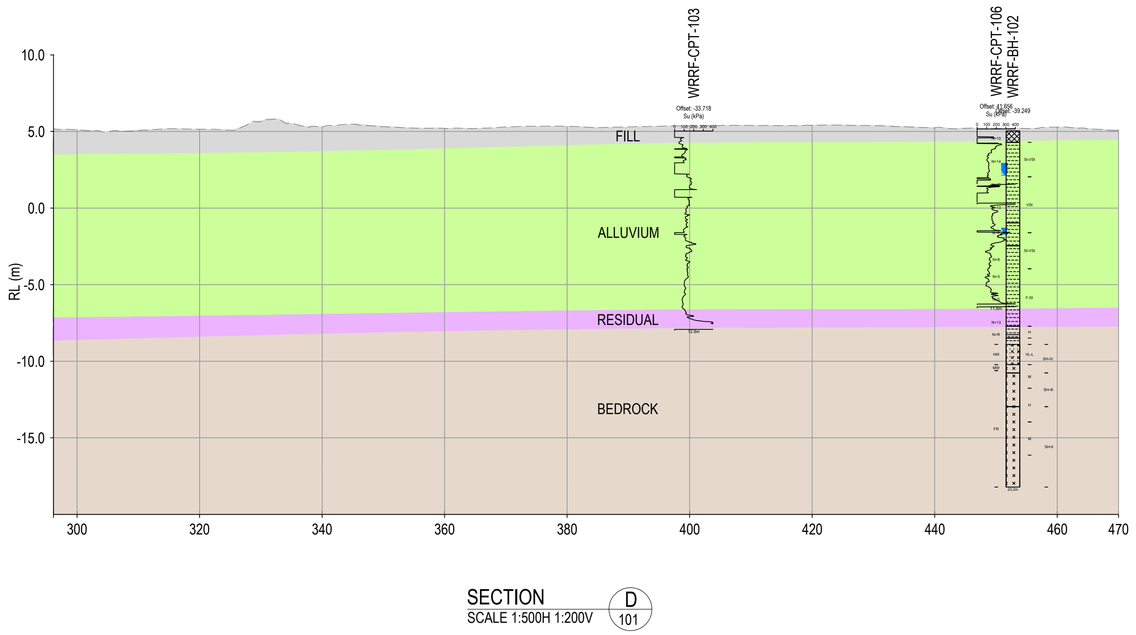
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PLOT DATE & TIME: 16/08/2024 2:35:21 PM



SECTION D 101
SCALE 1:500H 1:200V



SECTION D 101
SCALE 1:500H 1:200V

LEGEND

SECTION

INFERRED GEOLOGICAL BOUNDARY

STRATHOGRAPHY GRAPHIC

- FILL
- CLAY
- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- GRAVEL
- SILTSTONE
- SANDSTONE
- Interbedded SILTSTONE and SANDSTONE
- Interlaminated SILTSTONE and SANDSTONE

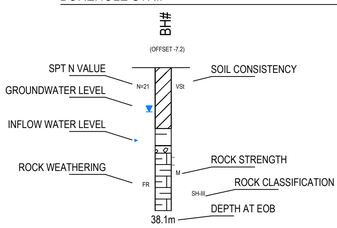
GEOTECHNICAL UNITS

- UNIT 1 FILL
- UNIT 2 ALLUVIUM
- UNIT 3 RESIDUAL SOIL / XW
- UNIT 4 BEDROCK

SOIL CONSISTENCY

VS	VERY SOFT	(S_u < 12 kPa)
S	SOFT	(S_u < 12 to 25 kPa)
F	FIRM	(S_u < 25 to 50 kPa)
St	STIFF	(S_u < 50 to 100kPa)
VSt	VERY STIFF	(S_u < 100 to 200 kPa)
H	HARD	(S_u > 200 kPa)

BOREHOLE STRIP



CPT with UNDRAINED SHEAR STRENGTH S_u (kPa)



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B	DRAFT GIR ISSUE	S.I. / 25.07.24	S.R. / 25.07.24	
A	PRELIMINARY ISSUE	S.I. / 19.07.24	S.R. / 19.07.24	

COORDINATE SYSTEM: GDA2020 - MGA Zone 56

HEIGHT DATUM: A.H.D

SCALE:

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SYDNEY WATER

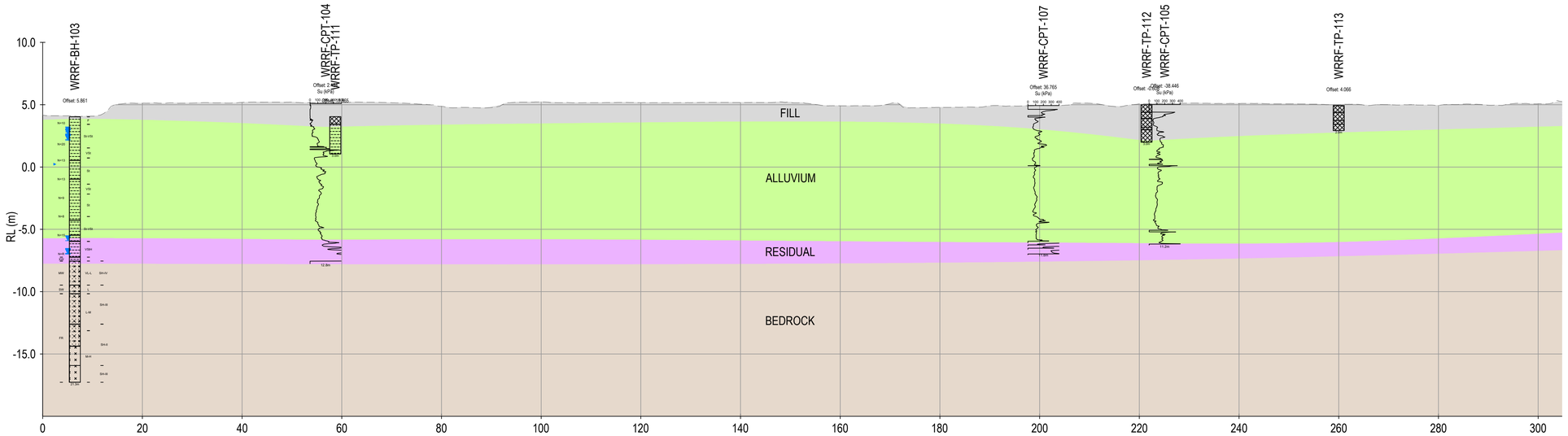
GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
GEOTECHNICAL PROFILE
SECTIONS - SHEET 4

DRAWING SET No: -	PART:	SHEET: 4 OF 6	A1
STATUS: -	BRIDGE No: -		©

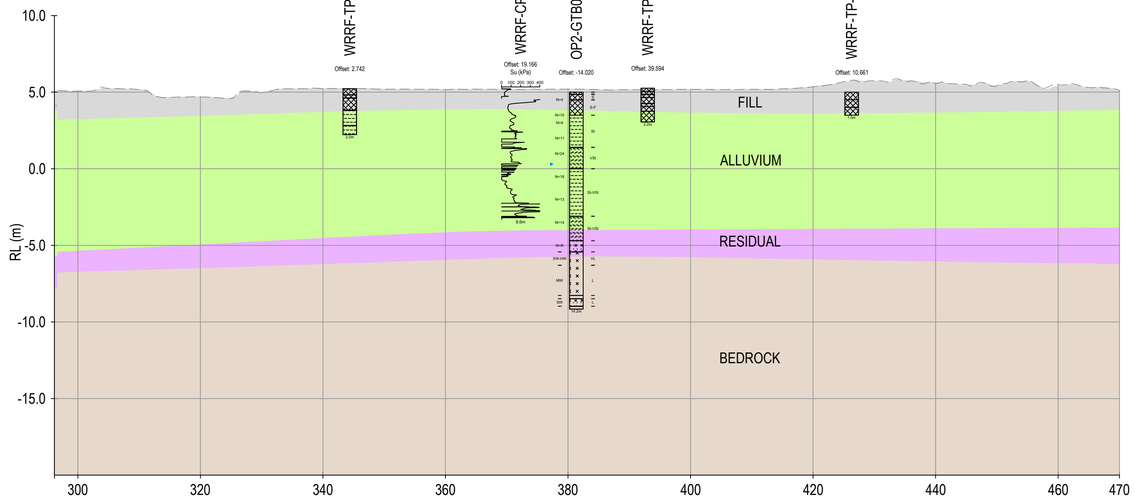
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FILE NAME: IA319500-WRF-GT-SKT-000204.dwg

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SECTION E
SCALE 1:500H 1:200V
101



SECTION E
SCALE 1:500H 1:200V
101

LEGEND

SECTION

INFERRED GEOLOGICAL BOUNDARY

STRATHOGRAPHY GRAPHIC

- FILL
- CLAY
- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- GRAVEL
- SILTSTONE
- SANDSTONE
- Interbedded SILTSTONE and SANDSTONE
- Interlaminated SILTSTONE and SANDSTONE

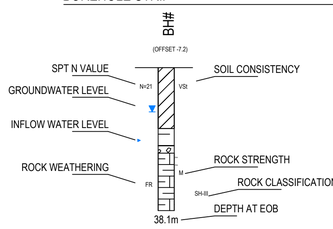
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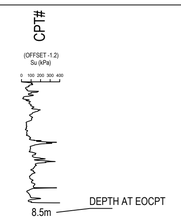
SOIL CONSISTENCY

VS	VERY SOFT	(S_u < 12 kPa)
S	SOFT	(S_u < 12 to 25 kPa)
F	FIRM	(S_u < 25 to 50 kPa)
St	STIFF	(S_u < 50 to 100kPa)
VSt	VERY STIFF	(S_u < 100 to 200 kPa)
H	HARD	(S_u > 200 kPa)

BOREHOLE STRIP



CPT with UNDRAINED SHEAR STRENGTH S_u (kPa)



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	B DRAFT GIR ISSUE	S.I. / 25.07.24	S.R. / 25.07.24		
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	REV DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	
	COORDINATE SYSTEM: GDA2020 - MGA Zone 56	HEIGHT DATUM: A.H.D			DESIGN LOT CODE:

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SYDNEY WATER

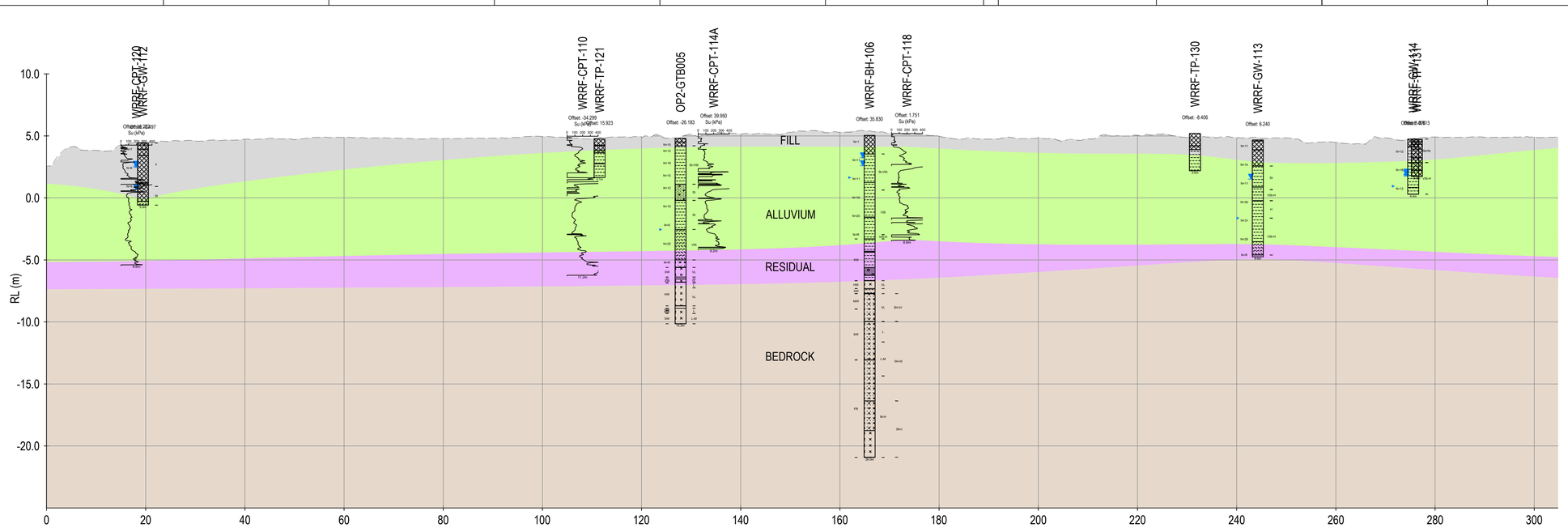
GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
GEOTECHNICAL PROFILE
SECTIONS - SHEET 5

DRAWING SET No: -	PART:	SHEET: 5	OF 6	A1
STATUS: -	BRIDGE No: -			©

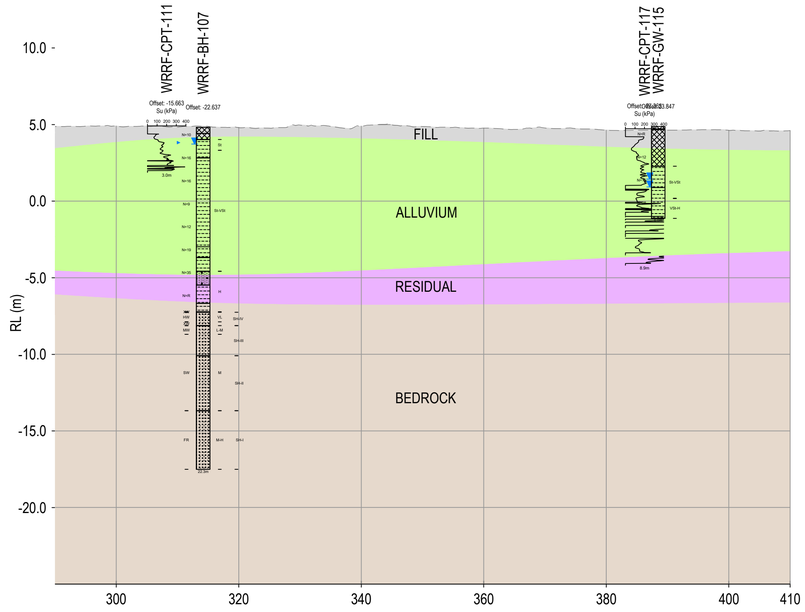
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FILE NAME: IA319500-WRF-GT-SKT-000205.dwg

PLOT DATE & TIME: 16/08/2024 2:39:23 PM



SECTION F
SCALE 1:500H 1:200V 101



SECTION F
SCALE 1:500H 1:200V 101

LEGEND

SECTION

INFERRED GEOLOGICAL BOUNDARY

STRATHOGRAPHY GRAPHIC

- FILL
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- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- GRAVEL
- SILTSTONE
- SANDSTONE
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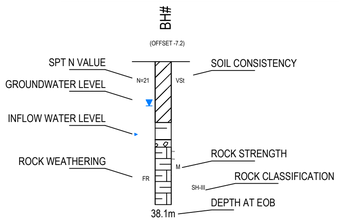
GEOTECHNICAL UNITS

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- UNIT 4 BEDROCK

SOIL CONSISTENCY

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S	SOFT	(S_u < 12 to 25 kPa)
F	FIRM	(S_u < 25 to 50 kPa)
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VSt	VERY STIFF	(S_u < 100 to 200 kPa)
H	HARD	(S_u > 200 kPa)

BOREHOLE STRIP



CPT with UNDRAINED SHEAR STRENGTH S_u (kPa)



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COORDINATE SYSTEM: GDA2020 - MGA Zone 56

HEIGHT DATUM: A.H.D

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SYDNEY WATER

GREATER PARRAMATTA AND OLYMPIC PENINSULA (GPOP)
CAMELLIA WRRF
GEOTECHNICAL PROFILE

SECTIONS - SHEET 6

DRAWING SET No: -	PART:	SHEET: 6	OF 6	A1
STATUS: -	BRIDGE No: -			©

DRG No.	REV	VER	EDMS No.	AMD No.
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FILE NAME: IA319500-WRF-GT-SKT-000206.dwg

PLOT DATE & TIME: 16/08/2024 2:40:25 PM

Table A- 2 List of Project Geotechnical Investigations - River release pipeline

Location	Borehole Type	Easting	Northing (m)	Surface Level (m AHD)	Final Depth (mbgl)	Termination Note
RRP-BH-102	Wide Auger	318166.9	6254459	9.3	10.12	Target depth
RRP-BH-103	Wide Auger	318320.6	6254419	8.8	2.5	Rig breakdown
RRP-BH-105	Wide Auger	318774.7	6254200	7.4	3.5	Target depth
RRP-BH-106	Wide Auger	318878.7	6254034	6.3	3.5	Target depth
RRP-BH-107	Wide Auger	319038.3	6254210	2.27	3.5	Target depth
RRP-BH-108	Borehole	319040.8	6254213	2.25	10.86	Target depth
RRP-BH-111	Wide Auger	319721.5	6253998	11.06	2.5	Target depth
RRP-BH-112	Wide Auger	319787.7	6254239	14.3	3.5	Target depth
RRP-BH-113	Wide Auger	319873.3	6254411	16.11	2.5	Target depth
RRP-BH-115	Wide Auger	320121.7	6254320	18.05	3.5	Target depth
RRP-BH-116	Wide Auger	320233.6	6254346	15.19	3.5	Target depth
RRP-BH-117	Borehole	320374.2	6254162	3.42	15.37	Target depth
RRP-BH-118	Borehole	320604.6	6254187	3.46	25.84	Target depth
RRP-BH-119	Borehole	320874.1	6254251	5.12	18.24	Target depth
RRP-BH-120	Wide Auger	320991.3	6254354	5.52	1.6	Refusal
RRP-BH-121	Wide Auger	321015.7	6254399	3.71	3.5	Target depth
RRP-BH-123	Wide Auger	321222.3	6254557	4.36	3.5	Target depth
RRP-BH-124	Borehole	321302.4	6254614	3.92	24.44	Target depth
RRP-BH-125	Borehole	321606.9	6255073	2.54	25.54	Target depth
RRP-BH-126	Borehole	321812.3	6255394	5.4	51.3	Target depth
RRP-BH-127	Borehole	322168	6255871	1.9	27.11	Target depth
RRP-BH-128	Borehole	322578.4	6256430	2.83	18.1	Target depth
RRP-BH-129	Wide Auger	322710.9	6256425	2.29	3.5	Target depth
RRP-BH-130	Wide Auger	322870.9	6256325	1.6	1.54	Refusal
RRP-BH-132	Wide Auger	322992.4	6256248	16.36	2.25	Target depth
RRP-BH-133	Borehole	323123.7	6256214	18.65	10	Target depth
RRP-BH-134	Borehole	323086	6256127	7.33	10.08	Target depth

Notes: AHD = Australian Height Datum; mbgl= metres below ground level; Coordinates to MGA2020 Zone 56

Engineering Log - Borehole

RRP-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Newton St (North), Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318166.9 m	**Elevation:**	9.31 m	**Started:**	23/09/2024
Plant:	Fraste multidrill PL G	**Northing:**	6254459.2 m	**Datum:**	AHD	**Finished:**	23/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
D							ASPHALT: dark grey, angular aggregate up to 10mm			ROAD SURFACE
			D	9	0.5		FILL: Clayey SAND: fine to coarse grained, brown; low plasticity clay; with bitumen fragments up to 15mm	W		FILL 0.30m: moisture does not represent true in situ condition between 0.07 - 0.65m
AD/T		Not Observed	SPT N=10 4,6,4	8	1.0		Sandy CLAY: medium plasticity, red mottled brown; fine to medium grained sand; trace fine grained, sub-angular to angular, iron stained siltstone gravel.		St	RESIDUAL SOIL 0.70m: HP = 360 kPa 0.80m: HP = 300 kPa 0.90m: HP = 270 kPa
			D		1.5		*...colour is becoming red mottled grey*	M <Wp		
AD/V			SPT N=46 9,16,30	7	2.0				H	2.00m: HP > 600 kPa 2.10m: HP > 600 kPa 2.20m: HP > 600 kPa
			D SPT N=R 2/130mm	6	2.5 3.0					2.80m: V-bit refusal; SPT terminated after 8 blows due to hammer bouncing and no further penetration at 3.14m 3.10m: HP > 600 kPa
							Continued as cored hole from 3.27m			
				5	3.5 4.0					
				4	4.5 5.0					
				3	5.5 6.0					
				2	6.5 7.0					
					7.5					

METHOD & SUPPORT	PENETRATION	GROUNDWATER
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow

SAMPLES & FIELD TESTS		MOISTURE
D Disturbed Sample	N SPT blows per 300mm	D = Dry
B Bulk Sample	HW SPT penetration by hammer weight	M = Moist
SPT SPT Sample	RW SPT penetration by rod weight	W = Wet
U Undisturbed Sample	HP Hand Penetrometer	Wp = Plastic Limit
E Enviro Sample	HV Hand Vane Shear	Wl = Liquid Limit
W Water Sample	(P: Peak Su R: Residual Su)	

DENSITY (N-value)		
VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}		
VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Newton St (North), Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318166.9 m	**Elevation:**	9.31 m	**Started:**	23/09/2024
Plant:	Fraste multidrill PL G	**Northing:**	6254459.2 m	**Datum:**	AHD	**Finished:**	23/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS			
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
		9	0.5									
			1.0									
		8	1.5									
			2.0									
		7	2.5									
			3.0		Starting coring from 3.27 m							
HQ3		6	3.5		SILTSTONE: grey and red, indistinctly laminated, highly weathered, low strength	HW		d=0.13 a=0.12	100	0		DB BP BP
			4.0									CZ
		5	4.5		*...bands of moderately weathered sandstone* *...bands of moderately weathered sandstone* *...bands of moderately weathered sandstone* *...bands of moderately weathered sandstone*			d=0.09 a=0.09	100	20		BP BP
			5.0									
		4	5.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey; with red and light brown bands, iron stained; fine grained sandstone	MW-HW		d=0.08 a=0.13	100	93		BP BP BP BP BP
			6.0									
		3	6.5		*...no iron staining or discolouration*			d=0.03 a=0.41				6.27m: no iron staining or discolourations BP BP BP BP BP BP
		2	7.0			FR		UCS = 30.00 d=0.59 a=1.43	100	79		BP 7.50m: groundwater well installed to 7.5m, well pumped dry during development after 30L of water was purged
			7.5									

WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN,S-RF

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Newton St (North), Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318166.9 m	**Elevation:**	9.31 m	**Started:**	23/09/2024
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Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

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HQ3		1 0 -1 -2 -3 -4 -5 -6	8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey; with red and light brown bands, iron stained; fine grained sandstone	FR		d=0.51 a=1.46 d=0.23 a=1.55	100	51		BP BP BP BP BP BP VN, 80°, PR, S, CN BP BP BP BP BP BP BP BP BP BP BP BP WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN,S-RF
					Exploratory hole terminated at 10.12 m Target depth							

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.



RRP-BH-102 Depth Range: 03.27-10.12m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-102
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** TMS	**Scale:** NTS	**Drawing Number:** 1/1

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Engineering Log - Pavement Hole

RRP-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Carnarvon St - Eastbound Shoulder, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318320.6 m	**Elevation:**	8.80 m	**Started:**	11/09/2024
Plant:	Drill Technologies D4APG	**Northing:**	6254419.2 m	**Datum:**	AHD	**Finished:**	11/09/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	8	0.5		ASPHALT: dark grey, angular aggregate up to 10mm FILL: Sandy GRAVEL: fine to medium grained, sub-angular to sub-rounded, dark brown sandstone gravel; fine to coarse grained sand	M			~~ROAD SURFACE~~ BASECOURSE
			D		1.0		FILL: CLAY: medium plasticity, brown; with fine grained, sub-angular to sub-rounded, siltstone gravel; with fine to coarse grained sand	M <Wp			FILL 0.50m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
				7	1.5		FILL: Sandy GRAVEL: fine to medium grained, sub-angular, pale brown siltstone gravel; fine to medium grained sand FILL: CLAY: high plasticity; red-brown mottled grey and orange-brown; with fine grained, sub-angular to sub-rounded, siltstone gravel; with fine to coarse grained sand	M M <Wp			1.20m: DCP terminated, 40 blows per 100mm, slight hammer bounce
			B		2.0						2.05m: HP = 300 kPa 2.10m: HP = 330 kPa 2.15m: HP = 320 kPa
				6	2.5		Exploratory hole terminated at 2.50 m Equipment failure				2.50m: Borehole terminated due to rig breakdown
				5	3.0						
				4	4.0						
				3	5.0						
				2	6.0						
				1	7.0						

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
DT Diatube NDD Non-destructive digging AD/V Auger - V-bit AD/T Auger - TC-bit PT Push Tube E Excavator BH Backhoe Bucket HA Hand Auger	No resistance ranging to refusal VE E F H VH	= Water level (static) = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs — Engineering Log - Pavement Hole

RRP-BH-105

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Suttor St (North bound shoulder), Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318774.7 m	**Elevation:**	7.41 m	**Started:**	24/09/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6254200 m	**Datum:**	AHD	**Finished:**	24/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	6	0.5		ASPHALT: dark grey, angular aggregate up to 10mm				ROAD SURFACE
							FILL: SAND: fine to medium grained, dark grey; with fine to medium grained, sub-angular to angular, gravel	D			FILL 0.30m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
			D				FILL: CLAY: medium plasticity, light brown mottled orange; with fine to coarse grained sand	M			
			D		1.0		CLAY: medium plasticity, red mottled grey and yellow, trace fine to medium grained sand	<Wp	VSt-H		RESIDUAL SOIL
			D	5	1.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): grey; with red and light brown bands, iron stained; fine grained sandstone ...recovered as CLAY: medium plasticity, red mottled grey and yellow, trace fine to medium grained sand				WEATHERED ROCK 1.22m: DCP terminated at 1.22 m. 20 blows for 20 mm. Hammer bouncing
			B		2.0						
			D	4	2.5						
			D		3.0						
				3	3.5		Exploratory hole terminated at 3.50 m Target depth				
					4.0						
				2	4.5						
					5.0						
				1	5.5						
					6.0						
				0	6.5						
					7.0						
				-1	7.5						

METHOD & SUPPORT
DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION
No resistance ranging to refusal
VE E F H VH

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Pavement Hole

RRP-BH-106

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1
Client: Sydney Water **Location:** Melton St (South bound shoulder), Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318878.7 m	**Elevation:**	6.26 m	**Started:**	24/09/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6254034 m	**Datum:**	AHD	**Finished:**	24/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description (SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	5	0.0		ASPHALT: dark grey, angular aggregate up to 10mm				ROAD SURFACE
							FILL: SAND: fine to medium grained, dark grey; with fine to medium grained, sub-angular to sub-rounded gravel	D			FILL
			D		0.5		FILL: Sandy CLAY: medium plasticity, orange and dark grey, fine to medium grained sand; with fine to medium grained, sub-angular to sub-rounded gravel; trace bitumen fragments up to 10mm				0.20m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
			D		1.0		CLAY: high plasticity, grey mottled red and brown; trace fine grained sand				RESIDUAL SOIL
			D		1.5		*...becoming red mottled grey and brown*				
			B	4	2.0			M <Wp	VSt/ H		1.87m: DCP terminated; 25 blows for 70 mm. 3 times >20 blows 2.00m: HP = 210 kPa 2.10m: HP = 160 kPa 2.20m: HP = 270 kPa
			D		2.5						
				3	3.0						
			D				Sandy CLAY: high plasticity, brown mottled grey and yellow; fine to medium grained sand				
					3.5		Exploratory hole terminated at 3.50 m Target depth				
				2	4.0						
					4.5						
				1	5.0						
					5.5						
				0	6.0						
					6.5						
				-1	7.0						
					7.5						
				-2							

METHOD & SUPPORT
DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION
No resistance ranging to refusal
VE E F H VH

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Pavement Hole

RRP-BH-107

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Vore St - Northbound Shoulder, Near Derby St, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319038.3 m	**Elevation:**	2.27 m	**Started:**	10/09/2024
Plant:	Drill Technologies D4APG	**Northing:**	6254210.0 m	**Datum:**	AHD	**Finished:**	10/09/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D D B B	2 1 0 -1 -2 -3 -4 -5	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		ASPHALT: dark grey, angular aggregate up to 15mm				ROAD SURFACE
							FILL: Sandy CLAY: low plasticity, dark brown mottled dark grey, fine to coarse grained sand; with fine grained, sub-angular sandstone gravel; trace asphalt fragments	M <Wp M =Wp			FILL 0.30m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
							CLAY: medium plasticity, brown mottled grey; trace rootlets		F-St		ALLUVIUM 1.30m: HP = 70 kPa 1.35m: HP = 100 kPa
							CLAY: high plasticity, grey mottled brown and dark orange-brown; with fine to medium grained, sub-angular to sub-rounded siltstone gravel	M <Wp	H		RESIDUAL SOIL
							SILTSTONE : brown; indistinctly laminated, highly weathered, low strength ...recovered as CLAY: high plasticity, orange-brown mottled grey; trace fine grained; sub-angular to sub-rounded, siltstone gravel; trace fine to coarse grained sand *...pale brown mottled grey and light grey*				2.32m: DCP terminated, 15 blows for 20mm, hammer bouncing 2.75m: HP = 430 kPa 2.80m: HP = 460 kPa 2.85m: HP = 480 kPa
							Exploratory hole terminated at 3.50 m Target depth				

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal

VE E F H VH

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-108

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Vore St Northbound shoulder near Derby St, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319192.7 m	**Elevation:**	3.5 m	**Started:**	12/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254104 m	**Datum:**	AHD	**Finished:**	12/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
DT				2	0.5		ASPHALT: dark grey, angular aggregate up to 10mm			ROAD SURFACE
AD/V		Not Observed	SPT N=6 5,3,3				FILL: Sandy CLAY: low plasticity, dark brown mottled dark grey, fine to coarse grained sand; with fine grained, sub-angular sandstone gravel	M <Wp		FILL 0.50m: HP = 150 kPa 0.60m: HP = 170 kPa 0.70m: HP = 160 kPa
				1	1.0		CLAY: medium plasticity, grey mottled brown and orange-brown	M =Wp	St	ALLUVIUM
					1.5		*...orange brown mottling, trace sub-rounded siltstone gravel*			
			SPT N=16 6,9,7	0	2.0		CLAY: high plasticity, grey mottled yellow-white, brown and orange brown; trace fine grained, sub-rounded, ironstone gravel			2.20m: HP = 220 kPa 2.30m: HP = 230 kPa 2.40m: HP = 220 kPa
					2.5		*...fine grained, sub-rounded to sub-angular ironstone gravel band*		VSt	
				-1	3.0		CLAY: high plasticity, grey mottled pale orange-brown	M <Wp		2.90m: Cuttings recovered loose on auger
					3.5		*...becoming grey*			
			SPT N=20 4,9,11				CLAY: high plasticity, grey			RESIDUAL SOIL 3.70m: HP > 600 kPa 3.80m: HP > 600 kPa 3.90m: HP = 510 kPa
			SPT N=24 3,9,15	-2	4.0		*...becoming orange-brown and brown mottling, trace sand*		VSt/H	4.20m: HP > 600 kPa 4.30m: HP > 600 kPa 4.40m: HP > 600 kPa
					4.5		*...becoming dark grey*			
							Continued as cored hole from 4.55m			4.55m: V-bit refusal
				-3	5.0					
					5.5					
				-4	6.0					
					6.5					
				-5	7.0					
					7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-108

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Vore St Northbound shoulder near Derby St, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319192.7 m	**Elevation:**	3.5 m	**Started:**	12/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254104 m	**Datum:**	AHD	**Finished:**	12/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		2	0.5										
			1.0										
		1	1.5										
			2.0										
		0	2.5										
			3.0										
		-1	3.5										
			4.0										
		-2	4.5		Starting coring from 4.55 m								
HQ3			5.0		NO CORE (660mm): 4.55-5.21m								
		-3	5.5		CLAY (XW SILTSTONE): high plasticity, dark grey mottled orange-brown; with fine to medium grained, sub-angular, siltstone gravel; hard	XW			64	0			
	20		6.0		SILTSTONE: fine grained; dark grey with orange and red-brown ironstaining, indistinctly laminated at 0°	HW						CZ, 200mm 6.20m: handling breaks CZ, 60mm	
		-4	6.5		NO CORE (50mm): 6.37-6.42m SILTSTONE: fine grained; dark grey with indistinct laminations at 0°	MW						SM, 20mm, Clay SM, 10mm, Clay SM, 10mm, Clay SM, 10mm, Clay	
			7.0		NO CORE (120mm): 6.90-7.02m							CZ, 60mm	
	100	-5	7.5		SILTSTONE: fine grained; dark grey with indistinct laminations at 0° *...with fine grained sandstone bedding*	MW SW			95	54		SM, 10mm, Clay JT, 40°, PR, S, Filled, Clay BP, 0°, PR, S, CN	

DRILLING

NMLC NMLC Coring — TCR % core run recovered
NQ NQ Coring — RQD % core run > 100mm long
HQ HQ Coring — (sound rock fraction only measured)
PQ PQ Coring

GROUNDWATER SYMBOLS
= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-108

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Vore St Northbound shoulder near Derby St, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319192.7 m	**Elevation:**	3.5 m	**Started:**	12/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254104 m	**Datum:**	AHD	**Finished:**	12/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS			
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	**Description of Strata** SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	100	-6	8.5		SILTSTONE: fine grained; dark grey with indistinct laminations at 0°	SW						8.00m: Core stuck in barrel, cauing some handling induced breaks when extracted	
		-7	9.0									BP, 0°, PR, S, Filled, Clayey Sand	
	95		9.5						100	100			
			10.0										
		-8	10.5										
			11.0		Exploratory hole terminated at 10.86 m Target depth								
		-9	11.5										
			12.0										
		-10	12.5										
			13.0										
		-11	13.5										
			14.0										
		-12	14.5										
			15.0										
		-13	15.5										

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.



RRP-BH-108 4.55-10.86m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-108
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG	**Checked:**	**Scale:** NTS	**Drawing Number:** 1/1

This figure was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Engineering Log - Pavement Hole

RRP-BH-111

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Day St N - Southbound Shoulder, Near Derby St, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319721.5 m	**Elevation:**	11.06 m	**Started:**	09/09/2024
Plant:	Drill Technologies D4APG	**Northing:**	6253998.2 m	**Datum:**	AHD	**Finished:**	09/09/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	11	0		ASPHALT: dark grey; angular aggregate up to 10mm				ROAD SURFACE
							FILL: Sandy GRAVEL: fine to medium grained, sub-angular to sub-rounded, sandstone gravel; dark brown; fine to coarse grained sand	M			BASECOURSE
					0.5		CLAY: high plasticity; pale brown mottled grey *...trace fine to medium grained sand*	M <Wp	St H		RESIDUAL SOIL 0.72m: DCP terminated, 15 blows for 20mm, hammer bouncing
			B	10	1.0		SILTSTONE: fine grained, grey mottled orange brown, highly weathered, very low strength ... recovered as Clayey GRAVEL: fine to coarse grained, sub-angular siltstone gravel; grey mottled orange and red-brown, low plasticity clay; with fine to coarse grained sand				WEATHERED ROCK 1.20m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
			D	9	2.0		SILTSTONE: fine grained, grey mottled grey-brown and red-brown, highly weathered, very low strength ... recovered as CLAY: high plasticity; grey-brown and red-brown; trace fine to coarse grained sand; trace fine grained, sub-angular, siltstone gravel				
					2.5		Exploratory hole terminated at 2.50 m				
				8	3.0						
					3.5						
				7	4.0						
					4.5						
				6	5.0						
					5.5						
				5	6.0						
					6.5						
				4	7.0						
					7.5						

METHOD & SUPPORT
DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION
No resistance ranging to refusal
VE E F H VH

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Pavement Hole

RRP-BH-112

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Day St N -South bound shoulder, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319787.7 m	**Elevation:**	14.30 m	**Started:**	25/09/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6254239.0 m	**Datum:**	AHD	**Finished:**	25/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description (SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture	Consistency Relative Density	DCP (blows/100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	14	0.0		ASPHALT: dark grey, angular aggregate up to 10mm				ROAD SURFACE
							FILL: Gravelly SAND: fine to coarse grained, dark grey; fine to coarse grained, sub-angular to sub-rounded, gravel	D			FILL 0.20m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
			D		0.5		FILL: CLAY: medium plasticity, light brown mottled orange; with fine to coarse grained sand; trace bitumen fragments up to 15mm	M <Wp			
			D		1.0		CLAY: medium plasticity, light brown mottled red and grey				RESIDUAL SOIL
			D	13			CLAY: high plasticity, red mottled grey and yellow				
					1.5		*...colour is becoming grey mottled red and yellow*	M =Wp	St		1.40m: trace rootlets
			D		2.0						
			D	12							2.20m: DCP terminated at 2.45 m. 15 blows for 50 mm. Hammer bouncing
					2.5		SILTSTONE: fine grained, grey mottled red, highly weathered, very low strength				WEATHERED ROCK
			B		3.0		...recovered as CLAY: low plasticity, grey mottled red; with fine to coarse grained, sub-angular to sub-rounded, iron stained siltstone gravel				2.60m: drill bit is hot at 2.5m
				11	3.5		Exploratory hole terminated at 3.50 m Target depth				
				10	4.0						
					4.5						
					5.0						
				9	5.5						
					6.0						
				8	6.5						
					7.0						
				7	7.5						

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal

VE E F H VH

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Pavement Hole

RRP-BH-113

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1
Client: Sydney Water **Location:** Fariola St - Eastbound Shoulder, Near Day St N, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319873.3 m	**Elevation:**	16.11 m	**Started:**	09/09/2024
Plant:	Drill Technologies D4APG	**Northing:**	6254410.8 m	**Datum:**	AHD	**Finished:**	09/09/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed		16	0		ASPHALT: dark grey; angular aggregate up to 15mm				ROAD SURFACE
							FILL: Sandy GRAVEL: fine to medium grained, sub-angular to sub-rounded gravel; fine to coarse grained sand; trace clay	D-M			BASECOURSE
					0.5		FILL: CLAY: high plasticity; dark orange-brown; trace fine to coarse grained sand; trace fine grained, sub-rounded siltstone gravel				FILL 0.60m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
			D	15	1.0						
					1.5		CLAY: high plasticity; grey mottled orange-brown; trace fine grained, sub-rounded siltstone gravel	M <Wp			RESIDUAL SOIL 1.70m: DCP terminated, 3 consecutive 20+ blows per 100mm
			B	14	2.0		CLAY: high plasticity; grey mottled brown; with fine to medium grained, sub-angular to sub-rounded siltstone gravel *...bands of increasing and decreasing gravel content*		H		EXTREMELY WEATHERED MATERIAL 2.00m: HP = 500 kPa 2.05m: HP = 580 kPa 2.10m: HP = 590 kPa
			D		2.5		Exploratory hole terminated at 2.50 m Target depth				
				13	3.0						
					3.5						
				12	4.0						
					4.5						
				11	5.0						
					5.5						
				10	6.0						
					6.5						
				9	7.0						
					7.5						

METHOD & SUPPORT
DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION
No resistance ranging to refusal
VE E F H VH

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Pavement Hole

RRP-BH-115

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Comaneci Ave - Eastbound Shoulder, Newington **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320121.7 m	**Elevation:**	18.05 m	**Started:**	12/09/2024
Plant:	Drill Technologies D4APG	**Northing:**	6254319.6 m	**Datum:**	AHD	**Finished:**	12/09/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	18	0.0		ASPHALT: dark grey; angular aggregate up to 10mm				ROAD SURFACE
							FILL: Clayey GRAVEL: fine grained, sub-angular to sub-rounded gravel, grey and brown; low plasticity clay; with fine to coarse grained sand				FILL 0.30m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
					0.5		*...gravel content decreasing*	M <Wp			
			D	17	1.0		CLAY: high plasticity; grey mottled brown; with fine grained, sub-angular to sub-rounded, siltstone gravel; trace fine to coarse grained sand		H		RESIDUAL SOIL 1.05m: HP > 600 kPa 1.10m: HP > 600 kPa 1.15m: DCP terminated at 1.55m, 21 blows for 50mm, hammer bouncing
					1.5						
			D	16	2.0		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): grey; with light brown bands; fine grained sandstone ...recovered as CLAY: high plasticity; grey mottled pale brown; with fine grained, sub-angular to sub-rounded, siltstone gravel; trace fine to coarse grained sand				WEATHERED ROCK 1.85m: HP > 600 kPa 1.90m: HP > 600 kPa 1.95m: HP > 600 kPa
					2.5						
			B	15	3.0						3.00m: Auger cuttings becoming loose
					3.5		Exploratory hole terminated at 3.50 m Target depth				
				14	4.0						
					4.5						
				13	5.0						
					5.5						
				12	6.0						
					6.5						
				11	7.0						
					7.5						

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal

VE E F H VH

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Pavement Hole

RRP-BH-116

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** PDC Park, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320233.6 m	**Elevation:**	15.19 m	**Started:**	16/09/2024
Plant:	Truck Mounted 04APG	**Northing:**	6254346.3 m	**Datum:**	AHD	**Finished:**	16/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	15	0.5		FILL: SAND: fine to medium grained, dark brown, trace rootlets	D			FILL
			D				Sandy CLAY: medium plasticity, dark brown mottled light grey, trace rootlets. Sand is fine grained				RESIDUAL SOIL
			D		1.0		CLAY: medium plasticity, light grey mottled red and yellow, trace fine grained sand	M <Wp	H		0.50m: Holes drilled using a large 300mm auger for the purposes of bulk sampling 0.80m: DCP terminated at 0.8m; hammer bouncing
			D	14	1.5		Interlaminated SILTSTONE and SANDSTONE: grey; with light brown bands; fine grained sandstone ...recovered as Clayey SAND: fine to coarse grained, sub-angular to angular, red mottled light grey, low plasticity clay; with fine to coarse grained, sub-angular to angular, red gravel *...colour is becoming light brown-grey mottled red*				WEATHERED ROCK
			B		2.0						
			D	13	2.5		*...colour is becoming light brown*				
			D		3.0						
			D	12	3.5						
							Exploratory hole terminated at 3.50 m Target depth				
				11	4.0						
					4.5						
					5.0						
				10	5.5						
					6.0						
				9	6.5						
					7.0						
				8	7.5						

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal



GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs — Engineering Log - Borehole

RRP-BH-117

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** PDC Park (south end), Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320374.2 m	**Elevation:**	3.42 m	**Started:**	08/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254162.4 m	**Datum:**	AHD	**Finished:**	08/11/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		Not Observed		3	0.5		TOPSOIL: Clayey SAND: fine to coarse grained, dark brown, low plasticity clay; trace rootlets	D		TOPSOIL
							FILL: SAND: fine to coarse grained, pale brown, trace fine grained, sub-angular gravel			FILL
			SPT N=25 7,11,14				FILL: Sandy CLAY: high plasticity, grey mottled red, fine to coarse grained sand; trace fine to medium grained, sub-angular to angular siltstone gravel			0.70m: HP > 600 kPa
					1.0					
			D	2						
					1.5					
			D							
					2.0		*...sand content is decreasing, trace rootlets*			2.00m: HP > 600 kPa
			SPT N=17 3,7,10	1						
					2.5			M <Wp		
			D		3.0		*...gravel is becoming fine to coarse grained, trace rootlets*			3.10m: Switch to TC-bit at 3.5m because V-bit causing difficulty to recover SPT samples due to presence of cuttings
				0	3.5		Sandy CLAY: high plasticity, grey, fine to coarse grained sand; trace fine grained, sub-angular gravel			RESIDUAL SOIL
AD/T			SPT N=24 11,12,12		4.0					3.95m: HP > 600 kPa
				-1	4.5				VSt	
			D							
			SPT N=R 7, 23/120mm		5.0		SILTSTONE: dark grey and light brown, fine grained, distinctly laminated, highly weathered, low strength			WEATHERED ROCK
				-2	5.5		Continued as cored hole from 5.27m			5.27m: TC-bit refusal, SPT attempted to confirm
					6.0					
				-3	6.5					
					7.0					
				-4	7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs Engineering Log - Cored Borehole

RRP-BH-117

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** PDC Park (south end), Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320374.2 m	**Elevation:**	3.42 m	**Started:**	08/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254162.4 m	**Datum:**	AHD	**Finished:**	08/11/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS			
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		3	0.5									
			1.0									
		2	1.5									
			2.0									
		1	2.5									
			3.0									
		0	3.5									
			4.0									
		-1	4.5									
			5.0		Starting coring from 5.27 m							
HQ3		-2	5.5		SILTSTONE: dark grey and light brown, fine grained, distinctly laminated at 0-5 degrees			d=0.03 a=0.07	100	0		
			6.0									
		-3	6.5			HW		d=0.02 a=0.06	100	100	SM, Clay, 60mm	
			7.0									
		-4	7.5					d=0.03 a=0.05				

WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, S-RF, CN

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs Engineering Log - Cored Borehole

RRP-BH-117

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** PDC Park (south end), Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320374.2 m	**Elevation:**	3.42 m	**Started:**	08/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254162.4 m	**Datum:**	AHD	**Finished:**	08/11/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3		-5	8.5		SILTSTONE: dark grey and light brown, fine grained, distinctly laminated at 0-5 degrees	HW		a=0.69					
						MW							
			9.0		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey banded pale grey, fine grained, distinctly laminated at 0-5 degrees			d=0.05 a=0.90				BP BP	
		-6	9.5										
			10.0					d=0.25 a=0.49				BP JT, 30°, PR, RF, CN	
		-7	10.5						100	87			
			11.0			SW		d=0.06 a=0.42				BP CZ, 40mm BP BP BP BP	
		-8	11.5										
			12.0					d=0.01 a=0.68				BP, 5°, UN, RF, CN JT, sub vertical joint from 12.55 to 12.59m BP BP BP BP BP	
		-9	12.5										
			13.0					d=0.10 a=1.05					
		-10	13.5						100	63			
			14.0			FR		d=1.17 a=2.05				BP BP	
		-11	14.5										
			15.0					d=0.02 a=0.53					
		-12	15.5		Exploratory hole terminated at 15.37 m Target depth								

WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, S-RF, CN

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

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> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

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CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-117 Depth Range: 05.27-15.37m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-117
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:**	TMS	**Scale:** NTS **Drawing Number:** 1/1

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Jacobs — Engineering Log - Borehole

RRP-BH-118

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 5

Client: Sydney Water **Location:** Corner of Avenue of Oceania and Hill Rd, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320604.6 m	**Elevation:**	3.46 m	**Started:**	05/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254187.2 m	**Datum:**	AHD	**Finished:**	07/11/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	-

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description (SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		Not Observed		3	0.5		TOPSOIL: Clayey SAND: fine to coarse grained, dark brown, low plasticity clay; with fine grained, sub-rounded, igneous gravel; trace rootlets	M		TOPSOIL
			SPT N=9 3,6,3				FILL: Sandy CLAY: medium plasticity, brown mottled pale brown and grey; with fine to coarse grained sand; trace fine grained, sub-rounded siltstone gravel.	M <Wp		FILL 0.30m: Auger tilts; possible cobble
			D		1.0		*...increasing moisture*			
				2	1.5		*...some red brown mottling*			
			SPT N=R 13,25,0/0mm		2.0		*...trace medium grained, sub-angular to sub-rounded siltstone gravel*	M =Wp		2.00m: HP > 600 kPa 2.10m: HP = 200 kPa
				1	2.5		*...plastic fragments*			2.30m: SPT hammer bouncing; sample had fibrous materials
							SILT: low plasticity, dark grey brown; with fine to medium grained, sub-angular sandstone gravel			ALLUVIUM
			D		3.0		SILT: low plasticity, dark grey brown			
			SPT N=0 0,0,0	0	3.5		SILT: low plasticity, dark grey, brown; with shell fragments; trace rootlets		VS	MARINE DEPOSITS 3.70m: SPT sank under hammer weight
					4.0		*...increasing brown*			
AD/T			D	-1	4.5		CLAY: high plasticity, grey mottled orange brown; trace fine to medium grained, sub-rounded siltstone gravel			ALLUVIUM
			SPT N=7 2,2,5		5.0			M >Wp	St	5.20m: HP = 120 kPa 5.30m: HP = 110 kPa 5.40m: HP = 90 kPa
				-2	5.5					
					6.0					
			SPT N=14 4,5,9	-3	6.5				VSt-H	6.70m: HP = 360 kPa 6.80m: HP = 340 kPa 6.90m: HP = 400 kPa
					7.0					
				-4	7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-118

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 5

Client: Sydney Water **Location:** Corner of Avenue of Oceania and Hill Rd, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320604.6 m	**Elevation:**	3.46 m	**Started:**	05/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254187.2 m	**Datum:**	AHD	**Finished:**	07/11/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	-

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/T		Not Observed	SPT N=9 2,4,5	-5	8.5		CLAY: high plasticity, grey mottled orange brown and brown			8.20m: HP = 200 kPa 8.30m: HP = 200 kPa 8.40m: HP = 150 kPa
					9.0					
			SPT N=9 3,4,5	-6	9.5				St-VSt	9.10m: HP = 220 kPa 9.20m: HP = 280 kPa 9.30m: HP = 190 kPa
					10.0					
				-7	10.5		*...trace fine to coarse grained sand* *...increasing moisture content*	M >Wp		
			SPT N=0 0,0,0		11.0					11.20m: HP = 80 kPa 11.30m: HP = 30 kPa 11.40m: HP = 30 kPa
				-8	11.5				VS	
					12.0					
			SPT N=7 3,3,4	-9	12.5					12.70m: HP = 200 kPa 12.80m: HP = 240 kPa 12.90m: HP = 190 kPa
					13.0				St-VSt	
				-10	13.5					
			SPT N=R 27, 17/50mm		14.0		SILTSTONE: dark grey and light brown, fine grained, indistinctly laminated ... recovered as CLAY: low plasticity, grey mottled brown, fine to medium grained, sub-angular siltstone gravel			WEATHERED ROCK 14.00m: HP = 200 kPa 14.10m: HP = 180 kPa
							Continued as cored hole from 14.20m			
				-11	14.5					
					15.0					
				-12	15.5					

METHOD & SUPPORT	PENETRATION	GROUNDWATER
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	= Water level (static) = Water inflow

SAMPLES & FIELD TESTS		MOISTURE
D Disturbed Sample	N SPT blows per 300mm	D = Dry
B Bulk Sample	HW SPT penetration by hammer weight	M = Moist
SPT SPT Sample	RW SPT penetration by rod weight	W = Wet
U Undisturbed Sample	HP Hand Penetrometer	Wp = Plastic Limit
E Enviro Sample	HV Hand Vane Shear	WI = Liquid Limit
W Water Sample	(P: Peak Su R: Residual Su)	

DENSITY (N-value)		
VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}		
VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-118

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 5

Client: Sydney Water **Location:** Corner of Avenue of Oceania and Hill Rd, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320604.6 m	**Elevation:**	3.46 m	**Started:**	05/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254187.2 m	**Datum:**	AHD	**Finished:**	07/11/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-5	8.5										
			9.0										
		-6	9.5										
			10.0										
		-7	10.5										
			11.0										
		-8	11.5										
			12.0										
		-9	12.5										
			13.0										
		-10	13.5										
			14.0		Starting coring from 14.20 m								
HQ3	0	-11	14.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey banded pale grey, fine grained, distinctly laminated at 0-5°	HW SW	○ □	d=0.15 a=0.57	100	56		JT, 5°, PR, S, SN BP JT, 5°, UN, S, SN CZ, 20mm BP BP BP BP CZ, 40mm BP	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, S-RF, CN
		-12	15.0										
	0		15.5			FR	○ □	d=0.08 a=0.56				BP BP	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-118

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 5

Client: Sydney Water **Location:** Corner of Avenue of Oceania and Hill Rd, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320604.6 m	**Elevation:**	3.46 m	**Started:**	05/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254187.2 m	**Datum:**	AHD	**Finished:**	07/11/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-13	16.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey banded pale grey, fine grained, distinctly laminated at 0-5°	FR		d=0.15 a=2.13	100	83		BP BP BP BP BP BP BP BP BP BP BP BP	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, S-RF, CN
		-14	17.0										
			17.5					d=0.05 a=1.68				BP	
			18.0									BP BP	
	0	-15	18.5					d=0.43 a=3.06	100	95		BP BP	
			19.0									BP	
		-16	19.5					d=0.48 a=2.28				BP	
			20.0									JT, 45°, PR, S, CN BP	
		-17	20.5					d=0.36 a=1.13				BP JT, 60°, UN, RF, CN	
			21.0										
					NO CORE (140mm)								
		-18	21.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey banded pale grey, fine grained, distinctly laminated at 0-5°			d=0.66 a=1.02				BP	
			22.0									BP JT, Sub Vertical Joint BP	
		-19	22.5					d=0.47 a=1.50	100	95		BP BP	
	0		23.0									BP JT, 15°, UN, S, CN JT, 15°, UN, S, CN CZ, 20mm	
		-20	23.5		SILTSTONE: dark grey, distinctly laminated; trace fine grained, sandstone laminations at 0-5°			d=0.08 a=0.69				JT, 15°, PR, S, CN BP	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

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SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-118

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 5

Client: Sydney Water **Location:** Corner of Avenue of Oceania and Hill Rd, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320604.6 m	**Elevation:**	3.46 m	**Started:**	05/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254187.2 m	**Datum:**	AHD	**Finished:**	07/11/2024
Logged By:	RG/MZ **Checked By:** TMS/IY	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-21	24.5		SILTSTONE: dark grey, distinctly laminated; trace fine grained, sandstone laminations at 0-5°	FR		d=0.58 a=1.30	100	37		BP BP CZ, 20mm	WHERE DEFECTS ARE NOTED ONLY AS BP THEY ARE BP, 0-15 DEGREES, PR, S-RF, CN
	0	-22	25.5					d=0.08 a=0.74					
			25.84		Exploratory hole terminated at 25.84 m Target depth								

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

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> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-118 Depth Range: 14.20-25.84m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-118
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG/MZ	**Checked:**	**Scale:** NTS	**Drawing Number:** 1/1

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Jacobs — Engineering Log - Borehole

RRP-BH-119

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4

Client: Sydney Water **Location:** P5A Carpark Northwest, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320874.1 m	**Elevation:**	5.12 m	**Started:**	24/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254250.9 m	**Datum:**	AHD	**Finished:**	25/10/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
DT				5	0		ASPHALT: dark grey; angular aggregate up to 10mm			ROAD SURFACE
			D				FILL: GRAVEL: medium grained, sub-angular to angular; grey mafic-igneous gravel; with fine to coarse grained sand			BASECOURSE
			SPT N=12 3,3,9		0.5		FILL: SAND: fine to coarse grained; brown; with fine to medium grained, sub-rounded sandstone gravel; trace clay			FILL
				4	1.0			M		1.00m: Water from diatubing possibly making soil wet
			D		1.5					
			SPT N=6 7,3,3	3	2.0					2.10m: HP = 180 kPa 2.20m: HP = 130 kPa 2.30m: HP = 150 kPa
					2.5		FILL: CLAY: medium plasticity; grey mottled red-brown; trace fine to coarse grained sand; trace fine to medium grained, sub-angular to sub-rounded sandstone gravel *...with fine to coarse grained sand*	M =Wp		
			D	2	3.0		*...becoming high plasticity, brown-grey*			3.00m: HP = 90 kPa 3.10m: HP = 120 kPa 3.20m: HP = 110 kPa
			SPT N=6 3,3,3		3.5					3.40m: PVC pipe fragments recovered on auger at 3.1m
AD/V				1	4.0					3.70m: HP = 190 kPa 3.80m: HP = 280 kPa 3.90m: HP = 90 kPa
			D		4.5		*...brown mottling*			
			SPT N=3 1,1,2	0	5.0		FILL: CLAY: low plasticity; dark brown mottled grey	M >Wp		5.10m: HP = 120 kPa 5.20m: HP = 180 kPa 5.30m: HP = 150 kPa 5.50m: Organic matter at bottom of SPT, slight odour
			D	-1	6.0					6.10m: PVC pipe fragments recovered on auger
			SPT N=0 0,0,0		6.5		SILT: low plasticity, brown mottled black; trace organics		VS	ALLUVIUM 6.50m: SPT sank 450mm due to hammer weight
				-2	7.0					
					7.5		CLAY: high plasticity; grey mottled orange-brown; trace organics	M =Wp	St	

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-119

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** P5A Carpark Northwest, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320874.1 m	**Elevation:**	5.12 m	**Started:**	24/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254250.9 m	**Datum:**	AHD	**Finished:**	25/10/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		24/10/2024	SPT N=10 4,4,6	-3	8.5		CLAY: high plasticity; grey mottled orange-brown; trace organics		St	8.10m: HP = 480 kPa 8.20m: HP = 490 kPa 8.30m: HP = 490 kPa
			D							
				-4	9.0					9.04m: groundwater strike; outside of SPT coated with water
			SPT N=4 1,2,2		9.5					9.50m: HP = 70 kPa 9.60m: HP = 20 kPa 9.70m: HP = 50 kPa
				-5	10.0				F	
					10.5		*...bands of low plasticity silt*	M =Wp		
			SPT N=5 2,2,3	-6	11.0					11.10m: HP = 220 kPa 11.20m: HP = 240 kPa 11.30m: HP = 250 kPa
					11.5					
				-7	12.0					
			SPT N=24 4,9,15		12.5				VSt	12.50m: SPT no sample recovered, shoe slipped off thread
				-8	13.0					
			SPT N=R 35, 0/0mm		13.20m: V-bit refusal, SPT hammer bouncing at 13.45m					
					13.5		Continued as cored hole from 13.45m			
				-9	14.0					
					14.5					
				-10	15.0					
					15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-119

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** P5A Carpark Northwest, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320874.1 m	**Elevation:**	5.12 m	**Started:**	24/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254250.9 m	**Datum:**	AHD	**Finished:**	25/10/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-3	8.5										
			9.0										
		-4	9.5										
			10.0										
		-5	10.5										
			11.0										
		-6	11.5										
			12.0										
		-7	12.5										
			13.0										
		-8	13.5		Starting coring from 13.45 m NO CORE (100mm): 13.45-13.55m								
HQ3	0				Gravelly CLAY: high plasticity; grey mottled pale brown; medium grained, sub-angular to sub-rounded sandstone gravel; trace fine to coarse grained sand; hard				67	0			
			14.0		NO CORE (940mm): 13.75-14.69m								
	0	-9	14.5		CLAY (XW SILTSTONE): high plasticity; grey mottled orange-brown; trace fine to coarse grained sand; trace fine to medium grained, sub-angular to sub-rounded siltstone gravel; hard *...fine to medium grained, sub-angular siltstone gravel band* *...fine to medium grained, sub-angular siltstone gravel band*	XW			62	0			
			15.0		SILTSTONE: fine grained, dark grey with red-brown iron staining; indistinctly laminated at 0 to 10°	HW						CZ, 40mm BP, 0°, PR, S, Filled, Clay SM, 10mm, Sandy Clay	
		-10	15.5									BP, 0°, PR, S, CT, Clay BP, 0°, PR, S, VNR, Clay	
	0												

DRILLING

NMLC NMLC Coring — TCR % core run recovered
NQ NQ Coring — RQD % core run > 100mm long (sound rock fraction only measured)
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS
= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-119

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** P5A Carpark Northwest, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320874.1 m	**Elevation:**	5.12 m	**Started:**	24/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254250.9 m	**Datum:**	AHD	**Finished:**	25/10/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-11	16.5		SILTSTONE: fine grained, dark grey with red-brown iron staining; indistinctly laminated at 0 to 10°	HW			100	66		BP, 5°, PR, S, CN	
					...healed joint							BP, 5°, PR, S, CT, Sand	
		-12	17.0		*...becoming distinctly laminated with grey laminations*							BP, 5°, CU, S, SN	
												JT, 40°, PR, S, SN	
			17.5		*... becoming grey*							SM, 50mm, Clay	
	0				SANDSTONE: fine grained, grey, indistinctly laminated at 0 to 5°	MW			100	95		SM, 50mm, Clay	
		-13	18.0									SM, 10mm, Clay	
					Exploratory hole terminated at 18.24 m Target depth								
			18.5										
			19.0										
		-14											
			19.5										
			20.0										
		-15											
			20.5										
			21.0										
		-16											
			21.5										
			22.0										
		-17											
			22.5										
			23.0										
		-18											
			23.5										

DRILLING

NMLC NMLC Coring — TCR % core run recovered
NQ NQ Coring — RQD % core run > 100mm long (sound rock fraction only measured)
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-119 13.45-18.24m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-119
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG	**Checked:**	**Scale:** NTS	**Drawing Number:** 1/1

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Engineering Log - Pavement Hole

RRP-BH-120

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** P5 Carpark, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320991.3 m	**Elevation:**	5.52 m	**Started:**	23/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6254353.9 m	**Datum:**	AHD	**Finished:**	23/10/2024
Logged By:	MZ **Checked By:** TMS/IY	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	5	0.5		ASPHALT: dark grey, angular aggregate up to 10mm FILL: Sandy GRAVEL: fine to medium grained, sub-angular to angular, brown gravel; fine to medium grained sand				ROAD SURFACE BASECOURSE
							FILL: Gravelly SAND: fine to coarse grained, light brown, fine to medium grained, sub-angular to sub-rounded gravel				FILL
			D					M			0.80m: DCP terminated at 1m; two greater than twenty blows
					1.0		*sandstone boulders, pale brown, highly weathered, fine to coarse grained*				
			D								
			D	4	1.5		Exploratory hole terminated at 1.60 m Refusal				1.60m: Drill bit is hot; TC-bit refusal; light grey powder on drill bit
					2.0						
				3	2.5						
					3.0						
				2	3.5						

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal



GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Pavement Hole

RRP-BH-121

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Holker Busway Median near Hill Rd, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321015.7 m	**Elevation:**	3.71 m	**Started:**	13/11/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6254398.9 m	**Datum:**	AHD	**Finished:**	13/11/2024
Logged By:	RG **Checked By:** TMS/IY	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	3	0.5		TOPSOIL: Sandy CLAY: low plasticity; dark brown; fine to coarse grained sand; with wood chips up to 50mm				TOPSOIL
							FILL: Sandy CLAY: low plasticity, orange and brown, fine to coarse grained sand; with fine grained, sub-angular to sub-rounded sandstone gravel				FILL
					1.0		FILL: CLAY: medium plasticity; grey mottled dark grey, dark brown and red-brown; trace fine to coarse grained sand; trace fine to medium grained, sub-angular to sub-rounded, siltstone gravel	M <Wp			0.50m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
				2	1.5						1.30m: HP = 100 kPa 1.40m: HP = 150 kPa 1.50m: HP = 100 kPa
			B		2.0			M =Wp			
				1	2.5			M >Wp			
			D		3.0		*siltstone gravel content increasing*				3.00m: HP = 180 kPa 3.10m: HP = 100 kPa 3.20m: HP = 100 kPa 3.30m: DCP terminated, hammer bouncing
				0	3.5		Exploratory hole terminated at 3.50 m Target depth				
					4.0						
				-1	4.5						
					5.0						
				-2	5.5						
					6.0						
				-3	6.5						
					7.0						
				-4	7.5						

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal

VE E F H VH

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs — Engineering Log - Borehole

RRP-BH-123

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** P5-C Carpark, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321222.3 m	**Elevation:**	4.36 m	**Started:**	23/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6254556.7 m	**Datum:**	AHD	**Finished:**	23/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	-

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/T		23/10/2024	D	4	0.5		ASPHALT: dark grey, angular aggregate up to 10mm Sandy GRAVEL: fine to medium grained, sub-angular to angular, dark grey, gravel, fine to coarse grained sand FILL: Gravelly SAND: fine to coarse grained, grey mottled red and brown , fine to medium grained, sub-angular to angular gravel FILL: SAND: fine to medium grained, yellow; with fine to coarse grained, sub-angular to angular sandstone gravel	M		ROAD SURFACE BASECOURSE FILL 0.50m: DCP Test 1 terminated; 33 blows for 50mm; possible coarse gravel or cobble
			D		1.0					1.00m: DCP Test 2 attempted 1.10m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
			B	3	1.5					
					2.0		CLAY: high plasticity, grey mottled red			FILL
			D	2	2.5		Sandy CLAY: high plasticity, grey mottled red, fine to medium grained sand	M =Wp	F/St	2.10m: DCP Test 2 terminated; 25 blows for 50mm; hammer bouncing 2.40m: Groundwater strike
			D		3.0		Sandy CLAY: high plasticity, brown mottled red, fine to medium grained sand; with fine to coarse grained, sub-angular to sub-rounded sandstone gravel			
				1	3.5		*...colour is grey*	M >Wp		
					4.0		Exploratory hole terminated at 3.50 m Target depth			
				0	4.5					
					5.0					
				-1	5.5					
					6.0					
				-2	6.5					
					7.0					
				-3	7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs — Engineering Log - Borehole

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 5

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description (SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture	Consistency Relative Density	Field Test Data & Other Observations
D							ASPHALT: dark grey; angular aggregate up to 10mm			ROAD SURFACE
			D				FILL: Clayey SAND: fine to coarse grained; grey; with fine to medium grained; sub-angular to angular gravel			FILL
			SPT N=9 6,6,3	3	0.5		*...gravel content decreasing*	M		0.50m: HP = 360 kPa 0.60m: HP = 500 kPa 0.70m: HP > 600 kPa
					1.0		*...band of fine to coarse grained, pale grey sand*			
			D		1.5		FILL: Sandy CLAY: low plasticity; dark grey; fine to coarse grained sand; trace fine grained, sub-angular to sub-rounded sandstone gravel	M =Wp		
		29/10/2024		2	2.0					
			SPT N=5 2,1,4		2.5		FILL: Silty SAND: fine grained; dark grey and brown, low plasticity silt; trace fine to coarse grained, sub-angular to sub-rounded sandstone gravel; trace slag fragments up to 15mm			2.30m: Standing groundwater measured after standing overnight 2.50m: SPT missed at 2m, hence new SPT depth (hole saturated because of using LEL device)
				1	3.0		*...band of fine to coarse grained, pale grey sand*	W		
		28/10/2024	D		3.5					3.50m: Groundwater strike
			SPT N=5 2,2,3	0	4.0		FILL: CLAY: low plasticity; brown mottled grey; with fine grained silt; trace fine to coarse grained, sub-rounded to sub-angular sandstone gravel; trace slag fragments up to 20mm; trace rootlets			
AD/V					4.5					
			SPT N=0 0,0,0	-1	5.0					5.00m: SPT sank 450mm under hammer weight
					5.5		CLAY: low plasticity; dark grey; with shell fragments up to 15mm			ALLUVIUM
			D	-2	6.0			M >Wp		6.00m: Strong organic odour
			SPT N=0 0,0,0	-3	6.5				VS	6.50m: SPT sank 450mm under hammer weight
					7.0					
					7.5					
				-4						

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 5

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			SPT N=0 0,0,0	8.5	9.0		CLAY: low plasticity; dark grey; with shell fragments up to 15mm *...becoming brown*			8.00m: SPT sank 450mm under hammer weight
			D				CLAY: low plasticity; brown mottled red; with fine to coarse grained, sub-angular to angular masonry gravel; trace rootlets			
			SPT N=0 0,0,0		9.5		CLAY: low plasticity; brown; trace fine to medium grained; sub-angular to angular sandstone gravel	M >Wp	VS	9.50m: SPT sank 450mm under hammer weight
			SPT N=0 0,0,0	11.0	10.0		*...becoming brown mottled orange-brown*			11.00m: SPT sank 450mm under hammer weight
			SPT N=13 0,6,7	12.0	12.5					
WB			SPT N=11 4,5,6	14.0	13.0		CLAY: medium plasticity; grey; with fine grained sand	M =Wp	St	14.00m: switch to wash boring as disturbed samples not needed 14.40m: HP = 210 kPa 14.50m: HP = 220 kPa 14.60m: HP = 190 kPa
			SPT N=14 5,7,7	15.0	15.5		*...becoming high plasticity, orange-brown mottling*			

METHOD & SUPPORT	PENETRATION	GROUNDWATER
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	= Water level (static) = Water inflow

SAMPLES & FIELD TESTS		MOISTURE
D Disturbed Sample	N SPT blows per 300mm	D = Dry
B Bulk Sample	HW SPT penetration by hammer weight	M = Moist
SPT SPT Sample	RW SPT penetration by rod weight	W = Wet
U Undisturbed Sample	HP Hand Penetrometer	Wp = Plastic Limit
E Enviro Sample	HV Hand Vane Shear	Wl = Liquid Limit
W Water Sample	(P: Peak Su R: Residual Su)	

DENSITY (N-value)		
VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}		
VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 5

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
WB				-13	16.5		CLAY: medium plasticity; grey; with fine grained sand	M =Wp	St	
			SPT N=36 14,25,11		17.0					17.10m: HP = 410 kPa
			SPT N=R 8/30mm		17.5		Clayey SAND: fine to coarse grained; grey and grey-white with dark grey streaking; low plasticity clay; relict rock fabric visible	M	D	EXTREMELY WEATHERED MATERIAL
				-14	18.0		Continued as cored hole from 17.49m			
					18.5					
				-15	19.0					
					19.5					
				-16	20.0					
					20.5					
				-17	21.0					
					21.5					
				-18	22.0					
					22.5					
				-19	23.0					
					23.5					
				-20						

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 5

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-13	16.5 17.0		Starting coring from 17.49 m								
HQ3			17.5		NO CORE (410mm): 17.49-17.90m								
	0	-14	18.0		SANDSTONE: fine to coarse grained; light grey and grey; indistinctly laminated at 0 to 10°	SW			56	56			
			18.5										
		-15	19.0									SM, 5mm, Sandy Clay	
			19.5		...carbonaceous lamination							BP, 5°, PR, RF, CN BP, 10°, PR, RF, CN 5°, PR, RF, CN	
	0	-16	20.0						100	97		SM, 10mm, Sandy Clay BP, 0°, PR, RF, Filled, Sandy Clay JT, 45°, PR, RF, CN	
		-17	20.5 21.0			FR							
			21.5										
		-18	22.0									SM, 20mm, Sandy Clay	
	0		22.5		...carbonaceous lamination				100	98		BP, 10°, PR, RF, CT, Sand	
		-19	23.0		...carbonaceous lamination ...carbonaceous lamination								
			23.5		...becoming grey							BP, 10°, PR, RF, Filled, Sandy Clay SM, 5mm, Sandy Clay	
		-20											

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 5

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE						ROCK MASS DEFECTS			
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0				SANDSTONE: fine to coarse grained; light grey and grey; indistinctly laminated at 0 to 10° *...carbonaceous lamination*	FR						BP, 10°, PR, RF, CT, Clay BP, 10°, PR, RF, CT, Sand BP, 5°, PR, RF, CT, Clay	
			24.5		Exploratory hole terminated at 24.44 m								
		-21	25.0										
			25.5										
		-22	26.0										
			26.5										
		-23	27.0										
			27.5										
		-24	28.0										
			28.5										
		-25	29.0										
			29.5										
		-26	30.0										
			30.5										
		-27	31.0										
			31.5										
		-28											

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-124 17.49-24.44m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-124
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ/RG	**Checked:**	**Scale:** NTS	**Drawing Number:** 1/1

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Jacobs — Engineering Log - Borehole

RRP-BH-125

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 5

Client: Sydney Water **Location:** Hill Rd near Stromboli Strait, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321606.9 m	**Elevation:**	2.54 m	**Started:**	31/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255073.1 m	**Datum:**	AHD	**Finished:**	01/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description (SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture	Consistency Relative Density	Field Test Data & Other Observations
NDD				2	0.5		NO DATA (NDD TO 1.4m)			FILL 0.20m: No data due to potholing
			D	1	1.5		FILL: Clayey SAND: fine to coarse grained; brown; low plasticity clay; with fine to medium grained, sub-angular sandstone and mafic-igneous gravel	D-M		
			SPT N=1 1,0,1		2.0		FILL: Gravelly CLAY: low plasticity; brown and dark grey; fine to medium grained; sub-angular to sub-rounded sandstone and mafic-igneous gravel; with fine to coarse grained sand	M <Wp		
				0	2.5		*...becoming brown*	M =Wp		2.50m: Water poured down hole due to using LEL device
			D		3.0		CLAY: medium plasticity; dark grey; trace fine to coarse grained sand; trace fine grained, sub-angular siltstone gravel; trace wood fibres			ALLUVIUM
		Not Observed	SPT N=0 0,0,0	-1	3.5				VS/S	3.50m: SPT sank 450mm under own weight 3.70m: HP = 40 kPa 3.80m: HP = 40 kPa 3.90m: HP = 30 kPa
			D	-2	4.0 4.5		CLAY: high plasticity; grey mottled brown; trace fine to coarse grained sand		St	4.20m: HP = 120 kPa 4.30m: HP = 170 kPa 4.40m: HP = 120 kPa
AD/V			SPT N=20 4,8,12	-3	5.0 5.5		*...becoming orange-brown mottling*	M >Wp	VSt-H	5.10m: HP = 400 kPa 5.20m: HP = 500 kPa 5.30m: HP = 450 kPa
			SPT N=7 2,3,4	-4	6.0 6.5					
					7.0				F-St	
			D	-5	7.5					7.50m: HP = 170 kPa 7.60m: HP = 200 kPa 7.70m: HP = 110 kPa

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-125

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 5

Client: Sydney Water **Location:** Hill Rd near Stromboli Strait, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321606.9 m	**Elevation:**	2.54 m	**Started:**	31/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255073.1 m	**Datum:**	AHD	**Finished:**	01/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		Not Observed	SPT N=8 4,3,5	-6	8.5		CLAY: high plasticity; grey mottled brown; trace fine to coarse grained sand			8.10m: HP = 280 kPa 8.20m: HP = 310 kPa 8.30m: HP = 210 kPa
					9.0		*...becoming dark grey mottled brown*			
			SPT N=5 2,2,3	-7	9.5				F-St	9.50m: HP = 220 kPa 9.60m: HP = 190 kPa 9.70m: HP = 170 kPa
					10.0					
				-8	10.5			M >Wp		
			SPT N=6 3,3,3		11.0					11.10m: HP = 100 kPa 11.20m: HP = 110 kPa 11.30m: HP = 110 kPa
				-9	11.5					
			D		12.0					
				-10	12.5		*...becoming dark grey mottled red-brown*		VSt-H	
			SPT N=15 4,7,8							12.60m: HP = 570 kPa 12.70m: HP = 320 kPa 12.80m: HP = 570 kPa
					13.0					
				-11	13.5		*...becoming grey*			
			SPT N=12 4,5,7		14.0					14.00m: HP = 240 kPa 14.10m: HP = 270 kPa 14.20m: HP = 250 kPa
				-12	14.5		*...trace fine grained, sub-angular to sub-rounded, siltstone gravel band*	M =Wp	St-VSt	
					15.0					
			SPT N=16 5,7,9	-13	15.5			M <Wp	VSt	15.50m: HP = 360 kPa 15.60m: HP = 510 kPa 15.70m: HP = 450 kPa

METHOD & SUPPORT	PENETRATION	GROUNDWATER
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	= Water level (static) = Water inflow

SAMPLES & FIELD TESTS		MOISTURE
D Disturbed Sample	N SPT blows per 300mm	D = Dry
B Bulk Sample	HW SPT penetration by hammer weight	M = Moist
SPT SPT Sample	RW SPT penetration by rod weight	W = Wet
U Undisturbed Sample	HP Hand Penetrometer	Wp = Plastic Limit
E Enviro Sample	HV Hand Vane Shear	WI = Liquid Limit
W Water Sample	(P: Peak Su R: Residual Su)	

DENSITY (N-value)		
VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}		
VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-125

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 5

Client: Sydney Water **Location:** Hill Rd near Stromboli Strait, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321606.9 m	**Elevation:**	2.54 m	**Started:**	31/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255073.1 m	**Datum:**	AHD	**Finished:**	01/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		Not Observed	SPT N=15 5,6,9	-14	16.5		CLAY: high plasticity; grey mottled brown; trace fine to coarse grained sand	M <Wp	VSt	17.10m: HP = 200 kPa 17.20m: HP = 270 kPa 17.30m: HP = 200 kPa
				-15	17.0					
					17.5			M =Wp		
			SPT N=R 6/130mm		18.0		SANDSTONE: fine grained, grey, indistinctly laminated, highly weathered, very low strength ... recovered as Gravelly CLAY: low plasticity; grey; fine to medium grained, subangular sandstone gravel Continued as cored hole from 18.13m			BEDROCK 18.13m: V-bit refusal, SPT hammer bouncing
				-16	18.5					
					19.0					
				-17	19.5					
					20.0					
				-18	20.5					
					21.0					
				-19	21.5					
					22.0					
				-20	22.5					
					23.0					
				-21	23.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-125

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 5

Client: Sydney Water **Location:** Hill Rd near Stromboli Strait, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321606.9 m	**Elevation:**	2.54 m	**Started:**	31/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255073.1 m	**Datum:**	AHD	**Finished:**	01/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-14	16.5										
			17.0										
		-15	17.5										
			18.0		Starting coring from 18.13 m								
HQ3	0	-16	18.5		SANDSTONE: fine to medium grained, grey with dark grey streaks, indistinctly laminated at 0 to 5°				100	100			
			19.0		NO CORE (870mm): 18.59-19.46m								
	0	-17	19.5		SANDSTONE: fine to medium grained, grey with dark grey streaks, indistinctly laminated at 0 to 5°	SW			61	61		JT, 0°, PR, RF, SN	
		-18	20.0										
			20.5									SM, 100mm, Clayey Sand	
	0		21.0		SANDSTONE: fine to medium grained, grey with indistinct dark grey laminations at 45 to 60°				100	80		SM, 30mm, Clay	
		-19	21.5		SANDSTONE: fine to medium grained, grey, indistinctly laminated at 0 to 10°							JT, 0°, CU, RF, CT, Sand	
			22.0									JT, 70°, PR, RF, CN	
												JT, 70°, PR, RF, CN	
					...carbonaceous lamination							SM, 5mm, Clay	
					...carbonaceous lamination	HW						JT, 70°, PR, RF, CN	
		-20	22.5		...becoming distinctly laminated at 0 to 10°							JT, 60°, PR, RF, CN	
	0								100	99		JT, 75°, PR, RF, CN	
			23.0									JT, 50°, PR, RF, CN	
		-21	23.5		...siltstone band of 50 mm thickness, dark grey							JT, 70°, PR, RF, CN	

DRILLING

NMLC NMLC Coring — TCR % core run recovered
NQ NQ Coring — RQD % core run > 100mm long (sound rock fraction only measured)
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS
= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-125

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 5

Client: Sydney Water **Location:** Hill Rd near Stromboli Strait, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321606.9 m	**Elevation:**	2.54 m	**Started:**	31/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255073.1 m	**Datum:**	AHD	**Finished:**	01/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS			
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-22	24.5		SANDSTONE: fine to medium grained, grey, indistinctly laminated at 0 to 10°							SM, 40mm, Sandy Clay	
					...becoming medium to coarse grained							BP, 0°, PR, RF, CN	
	0		25.0			HW			100	100		BP, 0°, PR, RF, CN	
					...ibecoming ndistinctly laminated							JT, 45°, PR, RF, CN	
												JT, 30°, PR, RF, CN	
		-23	25.5										
					Exploratory hole terminated at 25.54 m								
		-24	26.5										
		-25	27.5										
		-26	28.5										
		-27	29.5										
		-28	30.5										
		-29	31.5										

DRILLING

NMLC NMLC Coring — TCR % core run recovered
NQ NQ Coring — RQD % core run > 100mm long
HQ HQ Coring — (sound rock fraction only measured)
PQ PQ Coring

GROUNDWATER SYMBOLS

▼ = Water level (static)
▶ = Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-125 18.13-25.54m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-125
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG	**Checked:**	TMS	**Scale:** NTS **Drawing Number:** 1/1

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Jacobs — Engineering Log - Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
NDD				5	0.5		NO DATA: NON-DESTRUCTIVE DIGGING TO 1.9m			FILL 0.20m: No data due to potholing
				4	1.0					
					1.5					
					2.0		FILL: CLAY: medium to high plasticity; brown mottled yellow-red; trace fine to medium grained sand *...becoming dark grey*			
				3	2.5					
					3.0		*...with medium to coarse grained sand*			
				2	3.5					
					4.0		CLAY: high plasticity, grey mottled red	M =Wp	St	ALLUVIUM
AD/V				1	4.5					
					5.0					
		29/11/2024		0	5.5					
					6.0		*...becoming grey mottled yellow; trace fine grained sand*			6.00m: Groundwater inflow
				-1	6.5			M >Wp	F	
					7.0			M <Wp	St	
				-2	7.5			M >Wp	F	

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit WI = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V				-3	8.5		CLAY: high plasticity, grey mottled red	M <Wp	St-VSt	
					9.0					
				-4	9.5					
					10.0					
				-5	10.5					
					11.0					
				-6	11.5					
					12.0					
				-7	12.5					
					13.0					
				-8	13.5		Sandy CLAY: medium plasticity; red-yellow; fine grained sand	M >Wp	F	RESIDUAL SOIL
				-9	14.0					
					14.5					
					15.0					
				-10	15.5		*...becoming grey*			

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V				-11	16.5		Sandy CLAY: medium plasticity; red-yellow; fine grained sand	M >Wp	F	RESIDUAL SOIL
				-12	17.0		Continued as cored hole from 17.30m			
				-13	17.5					
				-14	18.0					
				-15	18.5					
				-16	19.0					
				-17	19.5					
				-18	20.0					
					20.5					
					21.0					
					21.5					
					22.0					
					22.5					
					23.0					
					23.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-11	16.5										
			17.0		Starting coring from 17.30 m								
HQ3	0	-12	17.5		SANDSTONE: medium grained, grey, massive	FR		d=0.97 a=0.86	100	100		BP, 0°, IR, RF, Filled, Silt	
			18.0					d=1.03 a=0.93				BP, 0°, IR, RF, Filled, Silt	
	0	-13	18.5		SANDSTONE: medium grained, grey, cross bedded at 5 to 10°				100	98		JT, 0°, IR, RF, Filled, Silt	
			19.0					d=0.96 a=1.25					
		-14	19.5										
			20.0					d=1.62 a=1.55				SM, 0°, Clay, 20mm	
		-15	20.5									SM, Clay, 15mm	
			21.0										
		-16	21.5		*...rip-up clasts*							SM, Clay, 20mm	
			22.0					d=1.13 a=1.35	100	98		SM, Clay, 5mm SM, Clay, 5mm	
	0	-17	22.5									JT, 0°, IR, RF, CN	
			23.0					d=1.66 a=2.03					
		-18	23.5		*...rip-up clasts*							JT, 5°, IR, RF, CN	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-19	24.5		SANDSTONE: medium grained, grey, cross bedded at 5 to 10°			d=1.98 a=1.79				SM, 0°, Clay, 10mm JT, 5°, IR, RF, CN	
			25.0					d=1.33 a=1.54				BP, 5°, PR, RF, CT, Clay	
	0	-20	25.5						100	100			
			26.0					d=1.72 a=2.03					
		-21	26.5										
			27.0					d=1.12 a=1.48					
		-22	27.5									BP, 15°, PR, RF, CN BP, 5°, PR, RF, CN	
			28.0			FR		d=0.86 a=1.53				BP, 0°, PR, RF, VNR, Clay BP, 0°, PR, S, Filled, Clay	
		-23	28.5		*...becoming massive*							SM, Clay, 20mm	
	0				*...rip-up clasts*				100	77		BP, 5°, PR, S, VNR, Clay	
			29.0					d=1.21 a=1.02				BP, 0°, PR, RF, CN JT, 20°, IR, RF, CN JT, 20°, IR, RF, CN	
		-24	29.5		*...rip-up clasts* *...siltstone interlayer 400mm*							SM, 0°, Clay, 20mm	
			30.0					d=0.92 a=1.20				JT, 15°, PR, S, VNR, Clay	
		-25	30.5										
	0		31.0		SANDSTONE: medium grained, grey, cross bedded at 5 to 20°			d=1.31 a=0.83	100	99			
		-26	31.5										

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 6 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-27	32.5		SANDSTONE: medium grained, grey, cross bedded at 5 to 20°			d=1.35 a=1.59				SM, 5°, Clay, 20mm	
			33.0										
		-28	33.5										
			34.0					d=1.19 a=1.22				BP, 5°, PR, S, VNR, Clay BP, 5°, PR, S, VNR, Clay	
					...becoming massive							JT, 30°, PR, S, CT, Clay	
	0	-29	34.5						100	96			
			35.0					d=0.78 a=1.16					
		-30	35.5									BP, 5°, PR, RF, CN	
					...cross bedded at 5 to 10°								
					...siltstone rip-up clast			d=0.54 a=1.50				JT, 30°, PR, S, CN	
			36.0			FR						SM, 0°, Clay, 5mm BP, 0°, PR, S, Filled, Clay	
		-31			*...siltstone bed 300mm*							BP, 0°, PR, S, VNR, Clay	
			36.5		*...siltstone bed 400mm*							BP, 0°, PR, S, CT, Clay	
								d=0.98 a=1.05					
			37.0					d=0.87 a=1.29					
		-32											
			37.5									BP, 10°, PR, S, CT, Clay	
	0								100	100			
			38.0					d=0.93 a=1.46					
		-33			*...becoming massive*								
			38.5									JT, 10°, PR, RF, CN	
			39.0		*...becoming cross bedded at 0 to 5°*			d=1.12 a=1.03				BP, 5°, PR, S, CN	
		-34											
			39.5										
	0												

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
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ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 7 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-35	40.5		SANDSTONE: medium grained, grey, cross bedded at 0 to 10°	FR		d=0.90 a=1.37	100	99		SM, 0°, Clay, 10mm	
			41.0										
		-36	41.5					d=1.19 a=1.44					
			42.0										
	0	-37	42.5					d=1.19 a=0.88	100	99			
			43.0										
		-38	43.5					d=1.21 a=0.48					
			44.0										
		-39	44.5					d=0.94 a=1.03					
			45.0									SM, 0°, Clay, 10mm	
		-40	45.5					d=1.32 a=0.23					
			46.0										
	0	-41	46.5					d=1.61 a=1.31	100	100			
			47.0										
		-42	47.5					d=1.82 a=1.85					

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

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▶ = Water inflow

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CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
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Jacobs Engineering Log - Cored Borehole

RRP-BH-126

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 8 of 8

Client: Sydney Water **Location:** Hill Rd, opposite Nuvolari Place **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321812.3 m	**Elevation:**	5.40 m	**Started:**	29/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6255394.0 m	**Datum:**	AHD	**Finished:**	31/10/2024
Logged By:	MR **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-43	48.5		SANDSTONE: medium grained, grey, cross bedded at 0 to 10°								
			49.0					d=1.47 a=1.21					
		-44	49.5			FR			100	100		BP, 10°, IR, S, CT, Clay	
	0		50.0					d=1.03 a=1.61					
		-45	50.5										
			51.0					d=1.33 a=1.28					
		-46	51.5		Exploratory hole terminated at 51.30 m Target depth								
			52.0										
		-47	52.5										
			53.0										
		-48	53.5										
			54.0										
		-49	54.5										
			55.0										
		-50	55.5										

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

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= Water inflow

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ROCK STRENGTH (Is50 MPa)

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1.0-3.0	High (H)
3.0-10	Very High (VH)
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DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
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CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-126 17.3-25m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-126
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MR	**Checked:** TMS	**Scale:** NTS	**Drawing Number:** 1/5

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RRP-BH-126 25-33m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-126
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MR	**Checked:**	TMS	**Scale:** NTS **Drawing Number:** 2/5

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RRP-BH-126 33-41m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-126
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MR	**Checked:**	**Scale:** NTS	**Drawing Number:** 3/5

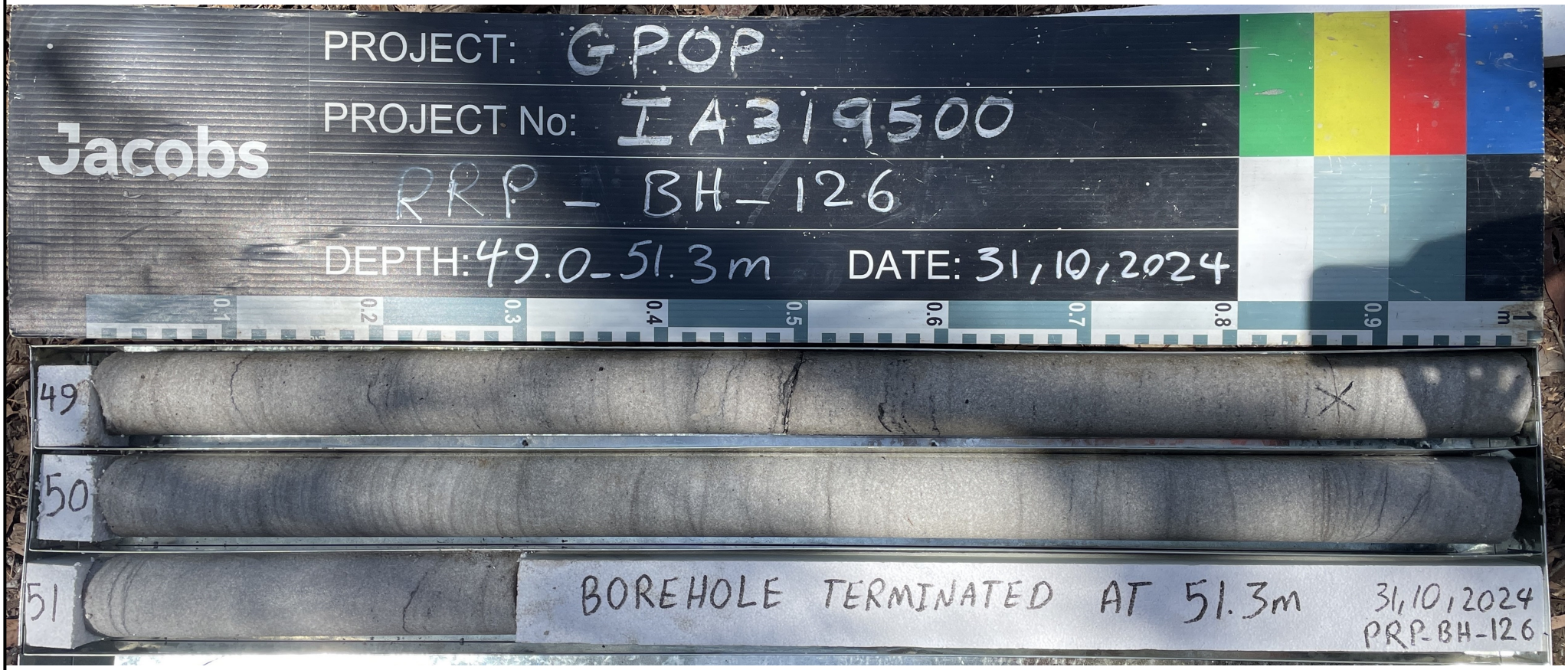
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RRP-BH-126 41-49m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-126
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MR	**Checked:**	TMS	**Scale:** NTS **Drawing Number:** 4/5

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RRP-BH-126 49-51.3m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-126
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MR	**Checked:** TMS	**Scale:** NTS	**Drawing Number:** 5/5

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Jacobs — Engineering Log - Borehole

RRP-BH-127

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 5

Client: Sydney Water **Location:** Hill Rd near Parramatta River, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322168.0 m	**Elevation:**	1.90 m	**Started:**	21/10/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6255870.8 m	**Datum:**	AHD	**Finished:**	22/10/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		21/10/2024	D				FILL: Sandy CLAY: low plasticity; dark grey and brown; fine to coarse grained sand; with coarse grained, sub-angular siltstone gravel	M		FILL 0.20m: Drilled on a wharf on Parramatta river
			SPT N=16 5,6,10	1	0.5 1.0					0.95m: Siltstone fragment at end of SPT
			D	0	1.5 2.0			M =Wp		1.90m: Standing water level is at 1.95m measured on 21/10/2024
			SPT N=2 1,0,2	-1	2.5 3.0		Sandy CLAY: low plasticity, dark grey-brown; fine to coarse grained sand; with shells			MARINE DEPOSITS
			D		3.5					3.50m: SPT sank 450mm under hammer weight
			SPT N=0 0,0,0	-2	4.0		*...with clay bands, increasing shell content*			3.60m: HP = 30 kPa 3.70m: HP = 20 kPa 3.80m: HP = 30 kPa
					4.5		*...sand bands*			
			SPT N=0 0,0,0	-3	5.0		CLAY: low plasticity, dark grey-brown; with fine to coarse grained sand; with shells	M >Wp	VS	5.00m: SPT sank 450mm under hammer weight
				-4	5.5 6.0		*...sand bands*			
			SPT N=0 0,0,0	-5	6.5 7.0					6.50m: SPT sank 450mm under hammer weight
				-6	7.5					

METHOD & SUPPORT	PENETRATION	GROUNDWATER
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow

SAMPLES & FIELD TESTS		MOISTURE
D Disturbed Sample	N SPT blows per 300mm	D = Dry
B Bulk Sample	HW SPT penetration by hammer weight	M = Moist
SPT SPT Sample	RW SPT penetration by rod weight	W = Wet
U Undisturbed Sample	HP Hand Penetrometer	Wp = Plastic Limit
E Enviro Sample	HV Hand Vane Shear	Wl = Liquid Limit
W Water Sample	(P: Peak Su R: Residual Su)	

DENSITY (N-value)		
VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}		
VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-127

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 5

Client: Sydney Water **Location:** Hill Rd near Parramatta River, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322168.0 m	**Elevation:**	1.90 m	**Started:**	21/10/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6255870.8 m	**Datum:**	AHD	**Finished:**	22/10/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			SPT N=0 0,0,0	-7	8.5		CLAY: low plasticity, dark grey-brown; with fine to coarse grained sand; with shells			8.00m: SPT sank 450mm under hammer weight
			SPT N=0 0,0,0	-8	9.0 9.5					9.50m: SPT sank 450mm under hammer weight
			SPT N=0 0,0,0	-9	10.0 10.5 11.0			M >Wp	VS	11.00m: SPT sank 450mm under hammer weight
			SPT N=2 0,0,2	-10	11.5 12.0 12.5		...rootlet encountered			12.50m: SPT sank 450mm under hammer weight
			SPT N=0 1,0,0	-11 -12	13.0 13.5 14.0		...band of fine to coarse grained sand			14.45m: switch to wash boring as disturbed samples not needed
WB			SPT N=3 3,1,2	-13 -14	14.5 15.0 15.5		SAND: fine to coarse grained, grey brown; trace silt	W	VL	ALLUVIUM

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-127

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 5

Client: Sydney Water **Location:** Hill Rd near Parramatta River, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322168.0 m	**Elevation:**	1.90 m	**Started:**	21/10/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6255870.8 m	**Datum:**	AHD	**Finished:**	22/10/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
WB		0		-15	16.5		SAND: fine to coarse grained, grey brown; trace silt	W	VL	ALLUVIUM
					17.0				MD	
			SPT N=R 3/0mm		17.5		Continued as cored hole from 17.61m			17.61m: SPT hammer bouncing at 17.61
				-16	18.0					
					18.5					
				-17	19.0					
					19.5					
				-18	20.0					
					20.5					
				-19	21.0					
					21.5					
				-20	22.0					
					22.5					
				-21	23.0					
					23.5					
				-22						

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-127

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 5

Client: Sydney Water **Location:** Hill Rd near Parramatta River, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322168.0 m	**Elevation:**	1.90 m	**Started:**	21/10/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6255870.8 m	**Datum:**	AHD	**Finished:**	22/10/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-15	16.5 17.0 17.5		Starting coring from 17.61 m								
HQ3		-16	18.0 18.5		SANDSTONE: medium to coarse grained, pale grey, dark grey and yellow, indistinctly laminated at 0-20 degrees			d=0.09 a=0.67	100	100		BP BP JT, 20°, PR, RF, SN	
		-17	19.0 19.5					d=0.48 a=0.89				JT, 20°, PR, RF, SN	
					No core 19.5 - 19.61m (110mm)				97	98			
		-18	20.0		SANDSTONE: medium to coarse grained, pale grey, dark grey and yellow, indistinctly laminated at 0-20 degrees	SW							
		-19	20.5 21.0					d=0.62 a=0.84				JT, 20°, PR, RF, SN JT BP	
		-20	21.5 22.0					d=0.26 a=0.65				BP, 10°, UN, RF, SN BP	
	0	-21	22.5 23.0		SANDSTONE: medium to coarse grained, pale grey, dark grey and red, distinctly laminated at 10-30 degrees	MW		d=0.28 a=0.37 UCS = 26.00	100	98		JT JT, 20°, PR, RF, VNR BP, 10°, UN, RF, CN HB JT JT	
								d=0.48 a=0.54				BP, 10°, PR, RF, VNR JT JT	
		-22											

WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN, S-RF

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-127

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 5

Client: Sydney Water **Location:** Hill Rd near Parramatta River, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322168.0 m	**Elevation:**	1.90 m	**Started:**	21/10/2024
Plant:	Fraste Multidrill PL G	**Northing:**	6255870.8 m	**Datum:**	AHD	**Finished:**	22/10/2024
Logged By:	RG/MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3	0	-23 / -24 / -25 / -26 / -27 / -28 / -29 / -30	24.5 / 25.0 / 25.5 / 26.0 / 26.5 / 27.0 / 27.5 / 28.0 / 28.5 / 29.0 / 29.5 / 30.0 / 30.5 / 31.0 / 31.5		SANDSTONE: medium to coarse grained, pale grey, dark grey and red, distinctly laminated at 10-30 degrees	MW		d=0.37 a=0.95	100	89		JT, 20°, PR, RF, SN JT	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN, S-RF
								d=0.04 a=0.36				JT, 15°, PR, RF, SN SM, Clay, 5mm BP BP	
					SANDSTONE: medium to coarse grained, pale grey and grey, indistinctly laminated at 0-15 degrees	FR		d=0.95 a=1.40 UCS = 28.00				JT BP DB HB	
					Exploratory hole terminated at 27.11 m Target depth								

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-127 Depth Range: 17.61-27.11m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-127
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG/MZ	**Checked:**	**Scale:** NTS	**Drawing Number:** 1/1

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Jacobs — Engineering Log - Borehole

RRP-BH-128

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322578.4 m	**Elevation:**	2.83 m	**Started:**	10/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256430.4 m	**Datum:**	AHD	**Finished:**	11/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		10/10/2024	D	2	0.5		TOPSOIL: Sandy CLAY: medium plasticity, dark brown, fine to coarse grained sand; with fine grained, angular gravel; trace rootlets			TOPSOIL
			D		1.0		FILL: Sandy CLAY: medium plasticity, dark brown, fine to coarse grained sand	M <Wp		FILL 0.65m: HP > 600 kPa
			SPT N=R 2, 2/50mm		1.5					
			D	1	2.0		FILL: Sandy CLAY: low plasticity, brown, fine grained sand; trace fine to medium grained, sub-angular to angular gravel	M =Wp		
			SPT N=8 2,6,2		2.5		FILL: SAND: fine to medium grained, light brown; with fine to coarse grained, sub-rounded to sub-angular gravel			2.00m: Groundwater strike at 2m 2.20m: Soil appears saturated 2.30m: Shell fragment upto 30mm
				0	3.0		Clayey SAND: fine grained, dark grey; trace fine to coarse grained, sub-angular to angular gravel	W	MD	MARINE DEPOSITS
			D		3.5					
			SPT N=6 2,2,4	-1	4.0		CLAY: high plasticity, grey mottled light brown *...colour is becoming red mottled grey*			3.60m: HP = 110 kPa 3.70m: HP = 130 kPa 3.80m: HP = 120 kPa
		0			4.5					
			D	-2	5.0				F/St	
			SPT N=5 1,1,4		5.5					5.00m: Shell fragment upto 30mm found in SPT sample 5.20m: HP = 200 kPa 5.30m: HP = 280 kPa 5.40m: HP = 270 kPa
			D	-3	6.0		CLAY: high plasticity, grey mottled red; with fine grained sand; trace shell fragments up to 30mm	M =Wp		
			SPT N=12 3,4,8		6.5					6.50m: HP = 250 kPa 6.60m: HP = 350 kPa 6.70m: HP = 310 kPa
				-4	7.0		CLAY: high plasticity, grey mottled red and yellow		St/ VSt	
			D	-5	7.5		*...colour is becoming red mottled grey*			

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-128

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322578.4 m	**Elevation:**	2.83 m	**Started:**	10/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256430.4 m	**Datum:**	AHD	**Finished:**	11/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			SPT N=13 3,6,7	8.5	9.0		CLAY: high plasticity, grey mottled red and yellow *...trace sand pockets*			
			D	-6	9.5		*...colour is becoming grey*		St/ VSt	9.50m: HP = 350 kPa 9.60m: HP = 270 kPa 9.70m: HP = 300 kPa
			SPT N=11 3,5,6	-7	10.0			M =Wp		
			D	-8	10.5		CLAY: medium plasticity, grey; trace fine to medium grained, sub-rounded to rounded gravel; trace shell fragments up to 30mm			11.00m: HP = 90 kPa 11.10m: HP = 110 kPa 11.20m: HP = 320 kPa
			SPT N=10 3,3,7	-9	11.5 12.0		Sandy CLAY: low plasticity, grey mottled black; fine grained sand		St	
			D		12.5					12.40m: Shell fragment upto 30mm/marine deposit found
			SPT N=R 4,15,0/0mm	-10	13.0		Sandy CLAY: high plasticity, grey mottled yellow; fine grained sand		VSt/H	12.50m: HP = 400 kPa 12.60m: HP = 300 kPa 12.65m: HP = 310 kPa
							Continued as cored hole from 13.10m			
				-11	13.5 14.0					
				-12	14.5 15.0					
				-13	15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-128

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322578.4 m	**Elevation:**	2.83 m	**Started:**	10/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256430.4 m	**Datum:**	AHD	**Finished:**	11/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-6	8.5										
			9.0										
			9.5										
		-7	10.0										
			10.5										
		-8	11.0										
			11.5										
		-9	12.0										
			12.5										
		-10	13.0		Starting coring from 13.10 m								
HQ3					NO CORE (90mm)								
			13.5		SANDSTONE: fine to medium grained, pale brown, massive	FR		d=0.07 a=0.14	84	26		13.19m: Initial breakage drill induced DB BP BP BP HB SM, XW, 80mm HB	
		-11	14.0										
			14.5					d=0.09 a=0.04	100	71		SM, Clay, 240mm JT	
		-12	15.0		...sandstone is becoming iron stained	SW						JT, 60°, PR, RF, CN BP BP BP SM, XW, 80mm	
			15.5		SANDSTONE: fine to medium grained, grey, red and black, distinctly laminated at 0-10 degrees	FR		UCS = 0.17 d=0.01 a=0.02	100	77		SM, Clay, 70mm SM, Clay, 10mm SM, Clay, 10mm SM, Clay, 10mm SM, Clay, 10mm	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN, S-RF
		-13											

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-128

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322578.4 m	**Elevation:**	2.83 m	**Started:**	10/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256430.4 m	**Datum:**	AHD	**Finished:**	11/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3		-14	16.5		SANDSTONE: fine to medium grained, grey, red and black, distinctly laminated at 0-10 degrees	FR	○	d=0.02 a=0.04	100	48		JT, 60°, PR, RF, CN SM, Clay, 10mm SM, Clay, 10mm SM, Clay, 10mm SM, Clay, 10mm JT, 10°, PR, S, CN BP JT, 20°, PR, S, CN	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN,S-RF
			17.0		SANDSTONE: coarse grained, red and white, massive	SW						BP BP BP BP	
		-15	17.5			FR	○	UCS = 34.00 d=1.22 a=1.05					
			18.0		Exploratory hole terminated at 18.10 m Target depth							BP	
		-16	18.5										
			19.0										
		-17	19.5										
			20.0										
		-18	20.5										
			21.0										
		-19	21.5										
			22.0										
		-20	22.5										
			23.0										
		-21	23.5										

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

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FR	fresh

ROCK STRENGTH (Is50 MPa)

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DEFECT ABBREVIATIONS

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SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-128 Depth Range: 13.10-18.10m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-128
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** TMS	**Scale:** NTS	**Drawing Number:** 1/1

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Jacobs Engineering Log - Pavement Hole

RRP-BH-129

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322710.9 m	**Elevation:**	2.29 m	**Started:**	09/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256424.8 m	**Datum:**	AHD	**Finished:**	09/10/2024
Logged By:	YD **Checked By:** TMS/IY	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
HA				2	0.5		TOPSOIL: Clayey SAND: fine to medium grained, dark brown; trace fine grained, sub-angular siltstone gravel; trace rootlets	M			TOPSOIL
AD/T		09/10/2024	D		1.0		FILL: Sandy CLAY: low plasticity, brown, fine to medium grained sand; with fine to medium grained, sub-angular sandstone gravel	M <Wp			FILL 0.30m: Holes drilled using a large 300mm auger for the purposes of bulk sampling 0.50m: DCP terminated; hammer bouncing
				1	1.5		FILL: Clayey SAND: fine grained, brown, low plasticity clay; with fine to medium grained, sub-angular, sandstone gravel (potential builder rubble)	M			FILL
			B	0	2.0						2.00m: Groundwater strike; Cuttings are saturated, difficult to log
					2.5			W			
			D	-1	3.0						
					3.5		Exploratory hole terminated at 3.50 m Target depth				

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal

VE E F H VH

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample

HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Excavation

RRP-BH-130

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Memorial Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322870.9 m	**Elevation:**	1.60 m	**Started:**	09/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256324.5 m	**Datum:**	AHD	**Finished:**	09/10/2024
Logged By:	YD **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		09/10/2024	B	1	0.5		TOPSOIL: Clayey SAND: fine to medium grained, dark brown, low plasticity clay; with fine grained, sub angular sandstone gravel; trace rootlets				TOPSOIL
							FILL: Clayey SAND: fine to medium grained, dark brown, low plasticity clay; with fine to medium grained, sub-angular sandstone gravel				FILL
							FILL: Silty SAND: fine to medium grained, yellow-brown mottled grey	M			0.50m: Holes drilled using a large 300mm auger for the purposes of bulk sampling
					1.0						1.00m: DCP terminated at 1.1m; 30 blows for 50mm; hammer bouncing
							...with fine to medium grained, sub angular sandstone gravel				
			SPT N=R 10/40mm	0	1.5		SANDSTONE: fine grained, grey, massive, highly weathered, low strength				1.40m: Groundwater strike at 1.5m BEDROCK
							Exploratory hole terminated at 1.54 m Refusal				1.60m: TC-bit refusal at 1.5m on suspected sandstone. SPT attempted to confirm
				-1	2.5						
				-2	3.5						
				-3	4.5						
				-4	5.5						
				-5	6.5						
				-6	7.5						

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
N Natural/Existing cutting E Excavator BH Backhoe Bucket B Buldozer R Ripper	No resistance ranging to refusal 	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs — Engineering Log - Excavation

RRP-BH-132

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** Meadowbank Crescent, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322992.4 m	**Elevation:**	16.36 m	**Started:**	14/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256247.7 m	**Datum:**	AHD	**Finished:**	14/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description (SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture	Consistency Relative Density	DCP (blows/100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	16	0.5		ASPHALT: dark grey, angular aggregate up to 10mm				ROAD SURFACE
							Gravelly SAND: fine to coarse grained, brown, medium to coarse grained, sub-angular to sub-rounded, grey and red gravel	M			BASECOURSE 0.20m: Holes drilled using a large 300mm auger for the purposes of bulk sampling 0.30m: sandstone outcrops near borehole location
			B	15	1.0 1.5		SAND: fine to medium grained, light brown; with medium to coarse grained, sub-angular to sub-rounded, brown and iron stained sandstone gravel		VD		RESIDUAL SOIL 1.50m: DCP test terminated at 1.7m; 15 blows for 50mm; hammer bouncing
					2.0		SANDSTONE: fine grained, light grey mottled red, indistinctly laminated, highly weathered, low strength ...recovered as SAND: fine grained, grey and red, with fine to medium grained, sub-angular to sub-rounded sandstone gravel				WEATHERED ROCK
				14	2.5		Exploratory hole terminated at 2.25 m Target depth				2.25m: Drill bit is hot; TC-bit refusal
				13	3.0 3.5						
				12	4.0 4.5						
				11	5.0 5.5						
				10	6.0 6.5						
				9	7.0 7.5						

METHOD & SUPPORT
N Natural/Existing cutting
E Excavator
BH Backhoe Bucket
B Buldozer
R Ripper

PENETRATION
No resistance ranging to refusal
VE E F H VH

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

RRP-BH-133

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Meadowbank Crescent, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323123.7 m	**Elevation:**	18.65 m	**Started:**	15/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256213.5 m	**Datum:**	AHD	**Finished:**	15/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/T							ASPHALT: dark grey, angular aggregate up to 10mm			ROAD SURFACE
			D				FILL: Gravelly SAND: fine to medium grained, brown and dark grey, medium grained, sub-rounded to sub-angular gravel			BASECOURSE 0.30m: sandstone outcrop near borehole location
AD/V		Not Observed	SPT N=12 5,7,5	18	0.5		*...iron stained sandstone gravel content increases*	M		
					1.0					
			D		1.5		SANDSTONE: fine to medium grained, light grey mottled red, indistinctly laminated, highly weathered, low strength ...recovered as SAND: fine grained, grey and red, with fine to medium grained, sub-angular to sub-rounded gravel			WEATHERED ROCK
			D	17			*...colour is becoming red mottled grey*			1.60m: V-bit refusal at 1.82m; Drill bit is hot; SPT attempted to confirm 1.82m: HP = 200 kPa 1.84m: HP = 180 kPa
SPT			SPT N=R 6, 15/100mm		2.0					
							Continued as cored hole from 2.07m			
				16	2.5					
					3.0					
					3.5					
				15	4.0					
					4.5					
				14	5.0					
					5.5					
				13	6.0					
					6.5					
				12	7.0					
					7.5					
				11						

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	▼ = Water level (static) ▶ = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-133

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Meadowbank Crescent, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323123.7 m	**Elevation:**	18.65 m	**Started:**	15/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256213.5 m	**Datum:**	AHD	**Finished:**	15/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		18	0.5										
			1.0										
		17	1.5										
			2.0		Starting coring from 2.07 m								
HQ3					SANDSTONE: medium to coarse grained, grey, red and yellow, distinctly laminated at 0-10 degrees	HW		d=0.45 a=0.65	100	94		BP BP, 10°, PR, RF, SN	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, CN, S-RF
		16	2.5										
			3.0			MW						BP, 10°, PR, RF, SN JT, 30°, PR, RF, SN	
		15	3.5		SANDSTONE: coarse grained, red mottled yellow, massive			d=0.81 a=1.74 UCS = 22.00	100	96		BP BP	
			4.0		SANDSTONE: medium to coarse grained, grey and yellow, distinctly laminated at 0-10 degrees	SW							
		14	4.5					d=0.40 a=0.67					
			5.0									SM, Clay, 10mm	
		13	5.5			FR		d=0.63 a=1.43	100	100		BP	
			6.0										
		12	6.5					d=0.74 a=0.59	100	100		BP	
			7.0										
		11	7.5					d=1.12 a=0.97				BP JT, 10°, PR, RF, SN	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

RRP-BH-133

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Meadowbank Crescent, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323123.7 m	**Elevation:**	18.65 m	**Started:**	15/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256213.5 m	**Datum:**	AHD	**Finished:**	15/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS			
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3		10 9	8.5 9.0 9.5 10.0		SANDSTONE: medium to coarse grained, grey and yellow, distinctly laminated at 0-10 degrees	FR		d=0.89 a=1.45 UCS = 27.00 d=0.53 a=0.80	100 100	100 100		BP BP	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, CN, S-RF
		8 7 6 5 4 3	10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5		Exploratory hole terminated at 10.00 m Target depth								

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-133 Depth Range: 2.07-10.00m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-133
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** TMS	**Scale:** NTS	**Drawing Number:** 1/1

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Jacobs — Engineering Log - Borehole

RRP-BH-134

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Memorial Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323086.0 m	**Elevation:**	7.33 m	**Started:**	16/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256126.9 m	**Datum:**	AHD	**Finished:**	16/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		Not Observed	D	7	0.5		TOPSOIL: Clayey SAND: fine to coarse grained, dark brown; trace rootlets			TOPSOIL
							FILL: Clayey SAND: fine to coarse grained, light brown; trace fine to medium grained, sub-angular gravel; trace pockets of fine to medium grained, pale grey and yellow sand			FILL
			SPT N=15 2,3,12					M		
			SPT N=35 14,19,16	6	1.0					0.97m: V-bit refusal; V-bit is hot; SPT attempted
					1.5		FILL: SAND: fine grained, pale grey and orange; trace fine to medium grained, sub-angular to angular sandstone gravel			1.40m: V-bit refusal at 1.76m; V-bit is hot;
			D				Clayey SAND: fine to medium grained, dark brown, low plasticity clay; with tree root fragments up to 70mm; trace fine to medium grained, sub-angular to angular gravel		D	organic odour observed; SPT attempted to confirm
SP	T		SPT N=R 10/140mm		2.0					RESIDUAL SOIL
				5	2.5		SANDSTONE: coarse grained, red and light grey, indistinctly laminated, highly weathered, low strength ...recovered as SAND: fine to medium grained, red; with fine to medium grained, sub-angular, iron stained sandstone gravel Continued as cored hole from 1.90m			WEATHERED ROCK
					3.0					
				4	3.5					
					4.0					
				3	4.5					
					5.0					
				2	5.5					
					6.0					
				1	6.5					
					7.0					
				0	7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

RRP-BH-134

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Memorial Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323086.0 m	**Elevation:**	7.33 m	**Started:**	16/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256126.9 m	**Datum:**	AHD	**Finished:**	16/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Starting coring from 1.90 m

SANDSTONE: coarse grained, red, grey and yellow, distinctly laminated at 0-15 degrees

SANDSTONE: coarse grained, pale brown, black and grey, indistinctly laminated at 10-45 degrees

Depth (m)	RL (m)	Weathering	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
2.0	5	MW	d=0.81 a=0.87	100	79	SM, Clay, 20mm SM, Clay, 140mm BP
2.5		FR				
3.0						SM, Clay, 50mm
3.5	4	MW	d=0.88 a=1.07	100	69	SM, Clay, 60mm
4.0						BP SM, Clay, 90mm SM, Clay, 70mm
4.5	3		d=0.21 a=0.50			BP SM
5.0						SM, Clay, 80mm
5.5	2	SW	d=0.74 a=0.40	100	53	BP JT, 55°, PR, RF, CN BP JT, 15°, PR, RF, CN BP BP BP BP JT, 20°, UN, RF, CN JT, 30°, PR, RF, CN BP CS, 20mm BP
6.0						
6.5	1		d=1.18 a=1.16			
7.0						JT, 30°, PR, RF, CN
7.5	0	MW	d=0.97 a=0.57	100	71	BP, 10°, UN, RF, CN JT, 25°, PR, RF, CN BP JT, 15°, PR, RF, CN BP BP BP JT, 45°, UN, RF, CN

HQ3

WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN,S-RF

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)
= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs Engineering Log - Cored Borehole

RRP-BH-134

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Memorial Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323086.0 m	**Elevation:**	7.33 m	**Started:**	16/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256126.9 m	**Datum:**	AHD	**Finished:**	16/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
HQ3		-1	8.5		SANDSTONE: coarse grained, pale brown, black and grey, indistinctly laminated at 10-45 degrees	MW		d=1.01 a=0.94	100	95		BP BP, 10°, PR, RF, VNR BP
		-2	9.0									BP
			9.5					d=1.26 a=1.00	100	24		JT, 20°, PR, RF, SN BP
			10.0		Exploratory hole terminated at 10.08 m Target depth							
		-3	10.5									
			11.0									
		-4	11.5									
			12.0									
		-5	12.5									
			13.0									
		-6	13.5									
			14.0									
		-7	14.5									
			15.0									
		-8	15.5									

WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15, PR, CN,S-RF

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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RRP-BH-134 Depth Range: 1.90-10.08m

Jacobs	**Client:**	Sydney Water		**Title:**	RRP-BH-134
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	MZ	**Checked:** TMS	**Scale:** NTS	**Drawing Number:** 1/1

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Piezometer Installation Details

RRP-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 2

Client: Sydney Water **Location:** Newton St (North), Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318166.9 m	**Elevation:**	9.31 m	**Started:**	23/09/2024
Plant:	Fraste multidrill PL G	**Northing:**	6254459.2 m	**Datum:**	AHD	**Finished:**	23/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-102	Type: Standpipe	Tip Depth & Tip RL : 10.12 m -0.81 m
AD/T		9	0.5		ASPHALT: dark grey, angular aggregate up to 10mm FILL: Clayey SAND: fine to coarse grained, brown; low plasticity clay; with bitumen fragments up to 15mm			Cement GP
AD/T		8	1.0		Sandy CLAY: medium plasticity, red mottled brown; fine to medium grained sand; trace fine grained, sub-angular to angular, iron stained siltstone gravel.			Bentonite
AD/T			1.5			1.50 m		
AD/T					*...colour is becoming red mottled grey*			
AD/V		7	2.0					
AD/V			2.5					
AD/V			3.0					
HQ3		6	3.5		Gravelly CLAY (XW Siltstone): high plasticity, grey mottled red; fine to coarse grained, sub-angular to angular siltstone gravel *...bands of moderately weathered sandstone*			
HQ3			4.0					
HQ3		5	4.5		*...bands of moderately weathered sandstone* *...bands of moderately weathered sandstone*			Sand
HQ3			5.0		*...bands of moderately weathered sandstone* *...bands of moderately weathered sandstone*			
HQ3		4	5.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey; with red and light brown bands, iron stained; fine grained sandstone			
HQ3			6.0					
HQ3		3	6.5		*...no iron staining or discolouration*			
HQ3			7.0					
HQ3		2	7.5			7.50 m		Bentonite
						8.00 m		

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

RRP-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 2

Client: Sydney Water **Location:** Newton St (North), Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	318166.9 m	**Elevation:**	9.31 m	**Started:**	23/09/2024
Plant:	Fraste multidrill PL G	**Northing:**	6254459.2 m	**Datum:**	AHD	**Finished:**	23/09/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-102	Type: Standpipe		Tip Depth & Tip RL : 10.12 m -0.81 m
HQ3		1 0 -1 -2 -3 -4 -5 -6	8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey; with red and light brown bands, iron stained; fine grained sandstone Exploratory hole terminated at 10.12 m Target depth	10.12 m		Sand	

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-108

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 2

Client: Sydney Water **Location:** Vore St Northbound shoulder near Derby St, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319192.7 m	**Elevation:**	3.51 m	**Started:**	12/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254103.7 m	**Datum:**	AHD	**Finished:**	12/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-108	Type: Standpipe	Tip Depth & Tip RL : 10.86 m -7.35 m
PT					ASPHALT: dark grey, angular aggregate up to 10mm			
AD/V		3	0.5		FILL: Sandy CLAY: low plasticity, dark brown mottled dark grey, fine to coarse grained sand; with fine grained, sub-angular sandstone gravel			Grout and bentonite
			1.0		CLAY: medium plasticity, grey mottled brown and orange-brown			Sand
		2	1.5		*...orange brown mottling, trace sub-rounded siltstone gravel*			
			2.0		CLAY: high plasticity, grey mottled yellow-white, brown and orange brown; trace fine grained, sub-rounded, ironstone gravel			Bentonite seal
		1	2.5		*...fine grained, sub-rounded to sub-angular ironstone gravel band*	2.00 m		
			3.0		CLAY: high plasticity, grey mottled pale orange-brown			
		0	3.5		*...becoming grey*			
			4.0		CLAY: high plasticity, grey			Sand
					...becoming orange-brown and brown mottling, trace sand			
		-1	4.5		*...becoming dark grey*			
HQ3			5.0		NO CORE (660mm): 4.55-5.21m			
		-2	5.5		CLAY (XW SILTSTONE): high plasticity, dark grey mottled orange-brown; with fine to medium grained, sub-angular, siltstone gravel; hard			
			6.0		SILTSTONE: fine grained; dark grey with orange and red-brown ironstaining, indistinctly laminated at 0°	6.00 m		Bentonite seal
		-3	6.5		NO CORE (50mm): 6.37-6.42m SILTSTONE: fine grained; dark grey with indistinct laminations at 0°	6.50 m		
			7.0		NO CORE (120mm): 6.90-7.02m			
		-4	7.5		SILTSTONE: fine grained; dark grey with indistinct laminations at 0° *...with fine grained sandstone bedding*			

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

RRP-BH-108

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 2

Client: Sydney Water **Location:** Vore St Northbound shoulder near Derby St, Silverwater **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	319192.7 m	**Elevation:**	3.51 m	**Started:**	12/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254103.7 m	**Datum:**	AHD	**Finished:**	12/11/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID :	Type:		Tip Depth & Tip RL :
						RRP-BH-108	Standpipe		10.86 m -7.35 m
HQ3		-5	8.5		SILTSTONE: fine grained; dark grey with indistinct laminations at 0°			Sand	
			9.0						
		-6	9.5						
			10.0						
		-7	10.5			10.86 m			
			11.0		Exploratory hole terminated at 10.86 m Target depth				
		-8	11.5						
			12.0						
		-9	12.5						
			13.0						
		-10	13.5						
			14.0						
		-11	14.5						
			15.0						
		-12	15.5						

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-117

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 2

Client: Sydney Water **Location:** PDC Park (south end), Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320374.2 m	**Elevation:**	3.42 m	**Started:**	08/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254162.4 m	**Datum:**	AHD	**Finished:**	08/11/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-117	Type: Standpipe	Tip Depth & Tip RL : 15.37 m -11.95 m
AD/V		3	0.5		TOPSOIL: Clayey SAND: fine to coarse grained, dark brown, low plasticity clay; trace rootlets			Grout and bentonite
					FILL: SAND: fine to coarse grained, pale brown, trace fine grained, sub-angular gravel			
					FILL: Sandy CLAY: high plasticity, grey mottled red, fine to coarse grained sand; trace fine to medium grained, sub-angular to angular siltstone gravel			Sand
		2	1.5					Bentonite seal
			2.0		*...sand content is decreasing, trace rootlets*	2.00 m		
		1	2.5					
			3.0		*...gravel is becoming fine to coarse grained, trace rootlets*			
		0	3.5					
AD/T					Sandy CLAY: high plasticity, grey, fine to coarse grained sand; trace fine grained, sub-angular gravel			Sand
		-1	4.5					
			5.0		SILTSTONE: dark grey and light brown, fine grained, distinctly laminated, highly weathered, low strength			
HQ3		-2	5.5		SILTSTONE: dark grey and light brown, fine grained, distinctly laminated at 0-5 degrees			
			6.0			6.00 m		
		-3	6.5			6.50 m		Bentonite seal
			7.0					
		-4	7.5					

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-117

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 2

Client: Sydney Water **Location:** PDC Park (south end), Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320374.2 m	**Elevation:**	3.42 m	**Started:**	08/11/2024
Plant:	Comacchio Geo 305	**Northing:**	6254162.4 m	**Datum:**	AHD	**Finished:**	08/11/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-117	Type: Standpipe	Tip Depth & Tip RL : 15.37 m -11.95 m
HQ3		-5	8.5		SILTSTONE: dark grey and light brown, fine grained, distinctly laminated at 0-5 degrees			
		-6	9.0 9.5		Interlaminated SILTSTONE (80%) and SANDSTONE (20%): dark grey banded pale grey, fine grained, distinctly laminated at 0-5 degrees			
		-7	10.0 10.5					
		-8	11.0 11.5				Sand	
		-9	12.0 12.5					
		-10	13.0 13.5					
		-11	14.0 14.5					
		-12	15.0 15.5		Exploratory hole terminated at 15.37 m Target depth	15.37 m		

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

RRP-BH-119

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** P5A Carpark Northwest, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320874.1 m	**Elevation:**	5.12 m	**Started:**	24/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254250.9 m	**Datum:**	AHD	**Finished:**	25/10/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-119	Type: Standpipe	Tip Depth & Tip RL : 18.24 m -13.12 m
DT		5	0		ASPHALT: dark grey; angular aggregate up to 10mm			Asphalt
					FILL: GRAVEL: medium grained, sub-angular to angular; grey mafic-igneous gravel; with fine to coarse grained sand			Grout and bentonite
			0.5		FILL: SAND: fine to coarse grained; brown; with fine to medium grained, sub-rounded sandstone gravel; trace clay			Sand
		4	1.0					Bentonite seal
			1.5			1.50 m		
			2.0					
		3			FILL: CLAY: medium plasticity; grey mottled red-brown; trace fine to coarse grained sand; trace fine to medium grained, sub-angular to sub-rounded sandstone gravel			
			2.5		*...with fine to coarse grained sand*			
			3.0		*...becoming high plasticity, brown-grey*			
		2						
			3.5					
AD/V			4.0					
		1						
			4.5		*...brown mottling*			
			5.0		FILL: CLAY: low plasticity; dark brown mottled grey			
		0						
			5.5					
			6.0					
		-1						
			6.5		SILT: low plasticity, brown mottled black; trace organics			
			7.0					Sand
		-2						
			7.5					
					CLAY: high plasticity; grey mottled orange-brown; trace organics			

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

RRP-BH-119

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** P5A Carpark Northwest, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320874.1 m	**Elevation:**	5.12 m	**Started:**	24/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254250.9 m	**Datum:**	AHD	**Finished:**	25/10/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations
AD/V	24/10/2024	-3	8.5		CLAY: high plasticity; grey mottled orange-brown; trace organics
		-4	9.0		
			9.5		
		-5	10.0		
			10.5		*...bands of low plasticity silt*
		-6	11.0		
			11.5		
		-7	12.0		
			12.5		
		-8	13.0		
			13.5		NO CORE (100mm): 13.45-13.55m
					Gravelly CLAY: high plasticity; grey mottled pale brown; medium grained, sub-angular to sub-rounded sandstone gravel; trace fine to coarse grained sand; hard
		-9	14.0		NO CORE (940mm): 13.75-14.69m
HQ3			14.5		
		-10	15.0		CLAY (XW SILTSTONE): high plasticity; grey mottled orange-brown; trace fine to coarse grained sand; trace fine to medium grained, sub-angular to sub-rounded siltstone gravel; hard *...fine to medium grained, sub-angular siltstone gravel band* *...fine to medium grained, sub-angular siltstone gravel band*
			15.5		SILTSTONE: fine grained, dark grey with red-brown iron staining; indistinctly laminated at 0 to 10°

INSTALLATION DETAILS

ID : RRP-BH-119 Type: Standpipe Tip Depth & Tip RL : 18.24 m -13.12 m

13.00 m

Bentonite seal

13.50 m

Sand

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

RRP-BH-119

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** P5A Carpark Northwest, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	320874.1 m	**Elevation:**	5.12 m	**Started:**	24/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254250.9 m	**Datum:**	AHD	**Finished:**	25/10/2024
Logged By:	RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-119	Type: Standpipe	Tip Depth & Tip RL : 18.24 m -13.12 m
HQ3		-11	16.5		SILTSTONE: fine grained, dark grey with red-brown iron staining; indistinctly laminated at 0 to 10°			
					...healed joint			
		-12	17.0		*...becoming distinctly laminated with grey laminations*			
			17.5		*... becoming grey*			
		-13	18.0		SANDSTONE: fine grained, grey, indistinctly laminated at 0 to 5°	18.24 m		
					Exploratory hole terminated at 18.24 m Target depth			
			18.5					
		-14	19.0					
			19.5					
		-15	20.0					
			20.5					
		-16	21.0					
			21.5					
		-17	22.0					
			22.5					
		-18	23.0					
			23.5					

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4

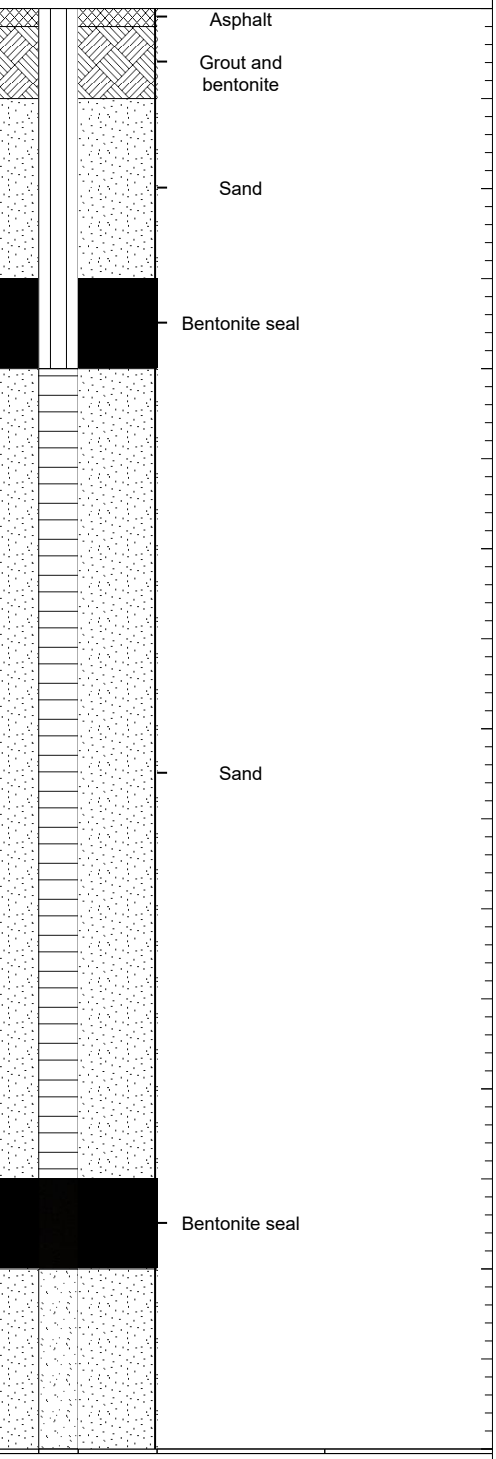
Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations
AD/V	29/10/2024 28/10/2024	3 2 1 0 -1 -2 -3 -4	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		ASPHALT: dark grey; angular aggregate up to 10mm FILL: Clayey SAND: fine to coarse grained; grey; with fine to medium grained; sub-angular to angular gravel *...gravel content decreasing* *...band of fine to coarse grained, pale grey sand* FILL: Sandy CLAY: low plasticity; dark grey; fine to coarse grained sand; trace fine grained, sub-angular to sub-rounded sandstone gravel FILL: Silty SAND: fine grained; dark grey and brown, low plasticity silt; trace fine to coarse grained, sub-angular to sub-rounded sandstone gravel; trace slag fragments up to 15mm *...band of fine to coarse grained, pale grey sand* FILL: CLAY: low plasticity; brown mottled grey; with fine grained silt; trace fine to coarse grained, sub-rounded to sub-angular sandstone gravel; trace slag fragments up to 20mm; trace rootlets CLAY: low plasticity; dark grey; with shell fragments up to 15mm

ID : RRP-BH-124 Type: Standpipe Tip Depth & Tip RL : 24.44 m -20.52 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	**Description of Strata** LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID :	Type:	Tip Depth & Tip RL :
						RRP-BH-124	Standpipe	24.44 m -20.52 m
AD/V			8.5		CLAY: low plasticity; dark grey; with shell fragments up to 15mm			
		-5	9.0		*...becoming brown*			
			9.5		CLAY: low plasticity; brown mottled red; with fine to coarse grained, sub-angular to angular masonry gravel; trace rootlets			
		-6	10.0		CLAY: low plasticity; brown; trace fine to medium grained; sub-angular to angular sandstone gravel			
			10.5					
		-7	11.0		*...becoming brown mottled orange-brown*			
			11.5					
		-8	12.0					
			12.5					
		-9	13.0					
			13.5					
		-10	14.0					
WB			14.5		CLAY: medium plasticity; grey; with fine grained sand			
		-11	15.0		*...becoming high plasticity, orange-brown mottling*			
			15.5					
		-12						Sand

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Piezometer Installation Details

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID :	Type:	Tip Depth & Tip RL :
						RRP-BH-124	Standpipe	24.44 m -20.52 m
WB			16.5		CLAY: medium plasticity; grey; with fine grained sand			
		-13	17.0					
					Clayey SAND: fine to coarse grained; grey and grey-white with dark grey streaking; low plasticity clay; relict rock fabric visible			
			17.5		NO CORE (410mm): 17.49-17.90m			
		-14	18.0		SANDSTONE: fine to coarse grained; light grey and grey; indistinctly laminated at 0 to 10°			
			18.5					
		-15	19.0					
			19.5		*...carbonaceous lamination*			
		-16	20.0					
			20.5					
HQ3		-17	21.0					
			21.5					
		-18	22.0					
			22.5		*...carbonaceous lamination*			
		-19	23.0		*...carbonaceous lamination*			
					...carbonaceous lamination			
			23.5		*...becoming grey*			
		-20						

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-124

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** P5C Carpark Northeast, Sydney Olympic Park **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	321302.4 m	**Elevation:**	3.92 m	**Started:**	28/10/2024
Plant:	Comacchio Geo 305	**Northing:**	6254613.5 m	**Datum:**	AHD	**Finished:**	30/11/2024
Logged By:	MZ/RG **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID :	Type:	Tip Depth & Tip RL :
						RRP-BH-124	Standpipe	24.44 m -20.52 m
HQ3					SANDSTONE: fine to coarse grained; light grey and grey; indistinctly laminated at 0 to 10°			
					...carbonaceous lamination	24.44 m		
			24.5		Exploratory hole terminated at 24.44 m			
		-21	25.0					
			25.5					
		-22	26.0					
			26.5					
		-23	27.0					
			27.5					
		-24	28.0					
			28.5					
		-25	29.0					
			29.5					
		-26	30.0					
			30.5					
		-27	31.0					
			31.5					
		-28						

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-128

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

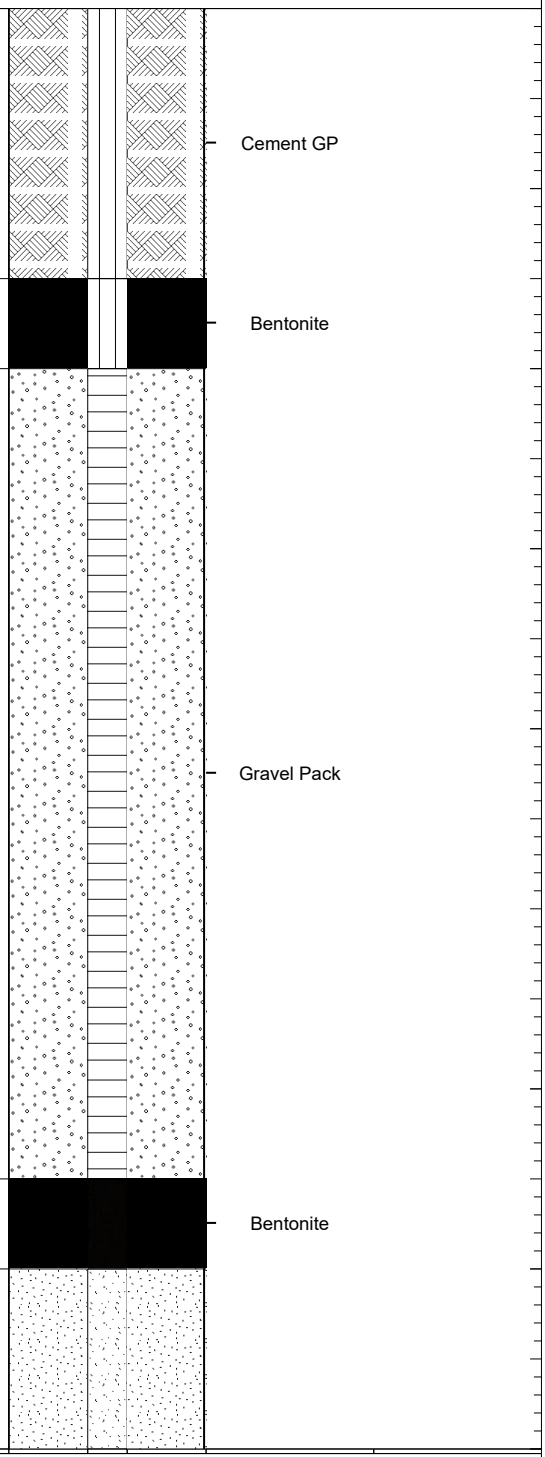
Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322578.4 m	**Elevation:**	2.83 m	**Started:**	10/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256430.4 m	**Datum:**	AHD	**Finished:**	11/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations
AD/V	10/10/2024	2	0.5		TOPSOIL: Sandy CLAY: medium plasticity, dark brown, fine to coarse grained sand; with fine grained, angular gravel; trace rootlets
			1.0		FILL: Sandy CLAY: medium plasticity, dark brown, fine to coarse grained sand
			1.5		
		1	2.0		FILL: Sandy CLAY: low plasticity, brown, fine grained sand; trace fine to medium grained, sub-angular to angular gravel
			2.5		FILL: SAND: fine to medium grained, light brown; with fine to coarse grained, sub-rounded to sub-angular gravel
		0	3.0		Clayey SAND: fine grained, dark grey; trace fine to coarse grained, sub-angular to angular gravel
			3.5		CLAY: high plasticity, grey mottled light brown
		-1	4.0		*...colour is becoming red mottled grey*
			4.5		
		-2	5.0		
			5.5		
		-3	6.0		CLAY: high plasticity, grey mottled red; with fine grained sand; trace shell fragments up to 30mm
			6.5		
		-4	7.0		CLAY: high plasticity, grey mottled red and yellow
			7.5		*...colour is becoming red mottled grey*
		-5			

INSTALLATION DETAILS

ID: RRP-BH-128 Type: Standpipe Tip Depth & Tip RL: 18.10 m -15.27 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

RRP-BH-128

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322578.4 m	**Elevation:**	2.83 m	**Started:**	10/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256430.4 m	**Datum:**	AHD	**Finished:**	11/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-128	Type: Standpipe	Tip Depth & Tip RL : 18.10 m -15.27 m
AD/V			8.5		CLAY: high plasticity, grey mottled red and yellow			
					...trace sand pockets			
		-6	9.0					
					...colour is becoming grey			
			9.5					
		-7	10.0					
			10.5					
		-8	11.0		CLAY: medium plasticity, grey; trace fine to medium grained, sub-rounded to rounded gravel; trace shell fragments up to 30mm			
					Sandy CLAY: low plasticity, grey mottled black; fine grained sand			
			11.5					
		-9	12.0					
			12.5					Sand
					Sandy CLAY: high plasticity, grey mottled yellow; fine grained sand			
		-10	13.0					
					NO CORE (90mm)			
HQ3					SANDSTONE: fine to medium grained, pale brown, massive			
			13.5					
		-11	14.0					
			14.5					
		-12	15.0		*...sandstone is becoming iron stained*			
					SANDSTONE: fine to medium grained, grey, red and black, distinctly laminated at 0-10 degrees			
			15.5					
		-13						

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-128

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Meadowbank Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	322578.4 m	**Elevation:**	2.83 m	**Started:**	10/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256430.4 m	**Datum:**	AHD	**Finished:**	11/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : RRP-BH-128	Type: Standpipe	Tip Depth & Tip RL : 18.10 m -15.27 m
HQ3		-14	16.5		SANDSTONE: fine to medium grained, grey, red and black, distinctly laminated at 0-10 degrees			
			17.0		SANDSTONE: coarse grained, red and white, massive			
		-15	17.5					
			18.0		Exploratory hole terminated at 18.10 m Target depth	18.10 m		
		-16	18.5					
			19.0					
			19.5					
		-17	20.0					
			20.5					
		-18	21.0					
			21.5					
		-19	22.0					
			22.5					
		-20	23.0					
			23.5					
		-21						

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Piezometer Installation Details

RRP-BH-134

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 2

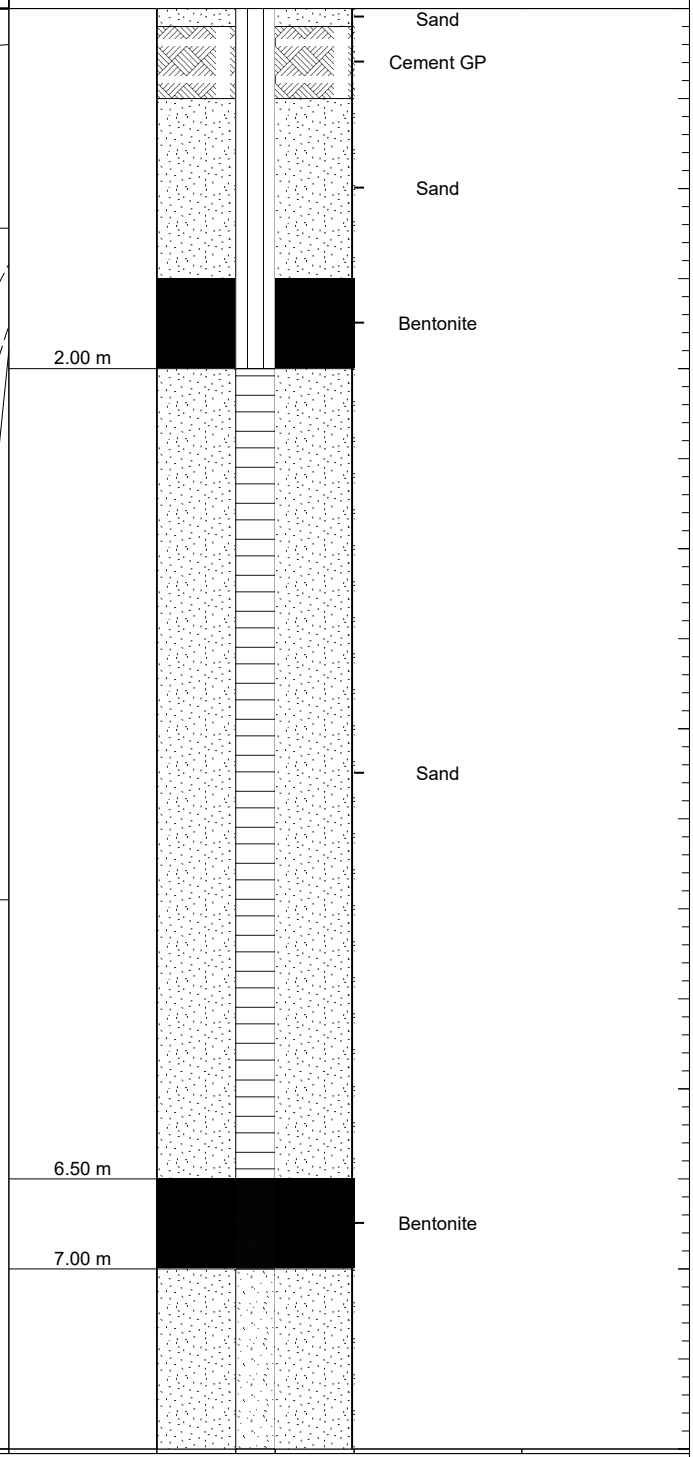
Client: Sydney Water **Location:** Memorial Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323086.0 m	**Elevation:**	7.33 m	**Started:**	16/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256126.9 m	**Datum:**	AHD	**Finished:**	16/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations
AD/V		7	0.5		TOPSOIL: Clayey SAND: fine to coarse grained, dark brown; trace rootlets
					FILL: Clayey SAND: fine to coarse grained, light brown; trace fine to medium grained, sub-angular gravel; trace pockets of fine to medium grained, pale grey and yellow sand
			1.0		
		6			FILL: SAND: fine grained, pale grey and orange; trace fine to medium grained, sub-angular to angular sandstone gravel
			1.5		Clayey SAND: fine to medium grained, dark brown, low plasticity clay; with tree root fragments up to 70mm; trace fine to medium grained, sub-angular to angular gravel
SP					
			2.0		SANDSTONE: coarse grained, red and light grey, indistinctly laminated, highly weathered, low strength ...recovered as SAND: fine to medium grained, red; with fine to medium grained, sub-angular, iron stained sandstone gravel
		5	2.5		SANDSTONE: coarse grained, red, grey and yellow, distinctly laminated at 0-15 degrees
			3.0		
		4	3.5		
			4.0		
		3	4.5		
HQ3			5.0		SANDSTONE: coarse grained, pale brown, black and grey, indistinctly laminated at 10-45 degrees
		2	5.5		
			6.0		
		1	6.5		
			7.0		
		0	7.5		

ID : RRP-BH-134 Type: Standpipe Tip Depth & Tip RL : 10.08 m -2.75 m



DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static) Water level (during drilling)

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Piezometer Installation Details

RRP-BH-134

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 2

Client: Sydney Water **Location:** Memorial Park, Meadowbank **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	323086.0 m	**Elevation:**	7.33 m	**Started:**	16/10/2024
Plant:	Fraste multidrill PL G	**Northing:**	6256126.9 m	**Datum:**	AHD	**Finished:**	16/10/2024
Logged By:	MZ **Checked By:** TMS	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS			
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID :	Type:		Tip Depth & Tip RL :
						RRP-BH-134	Standpipe		10.08 m -2.75 m
HQ3		-1 -2 -3 -4 -5 -6 -7 -8	8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5		SANDSTONE: coarse grained, pale brown, black and grey, indistinctly laminated at 10-45 degrees Exploratory hole terminated at 10.08 m Target depth	10.08 m		Sand	

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Jacobs — Engineering Log - Pavement Hole

INF-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1
Client: Sydney Water **Location:** Rosehill Gardens Circus Ground North **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.1 m	**Elevation:**	4.69 m	**Started:**	16/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256240.1 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T		Not Observed	D	4	0.5		FILL: SILTSTONE COBBLES in a Sandy GRAVEL matrix: fine to coarse grained, sub-angular to angular, siltstone gravel; brown; fine to coarse grained sand; trace low plasticity clay *...asphalt fragments encountered* *...increasing clay content*				FILL 0.10m: Auger grinding on siltstone cobbles
					1.0						1.00m: HP = 150 kPa
			D		1.5		FILL: CLAY: high plasticity; brown; with sandstone cobbles; trace fine to coarse grained sand	M <Wp			1.40m: HP = 150 kPa 1.45m: HP = 150 kPa
			B	3	2.0		Sandy CLAY: high plasticity; grey mottled brown, red and orange-brown; fine to coarse grained sand				ALLUVIUM
									VSt		1.85m: HP = 150 kPa 1.90m: HP = 160 kPa
					2.5				H		2.25m: HP = 200 kPa 2.30m: HP = 320 kPa 2.35m: HP = 410 kPa
				2			*...increasing grey mottling*				
			D		3.0			M =Wp	F-St		2.90m: HP = 130 kPa 2.95m: HP = 80 kPa 3.00m: HP = 80 kPa
			D		3.5						3.35m: HP = 90 kPa
				1			Exploratory hole terminated at 3.50 m Target depth				3.40m: HP = 80 kPa 3.45m: HP = 80 kPa
					4.0						
				0	4.5						
					5.0						
				-1	5.5						
					6.0						
				-2	6.5						
					7.0						
				-3	7.5						

METHOD & SUPPORT
DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION
No resistance ranging to refusal
VE E F H VH

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs — Engineering Log - Borehole

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 4

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		13/12/2024	D	3	0.5		FILL: Clayey SAND: fine to coarse grained; brown mottled grey, orange-brown and white; low plasticity clay; fine to medium grained, sub-angular to sub-rounded, siltstone gravel	M		FILL
			SPT N=8 5,5,3							0.70m: HP = 200 kPa
				2	1.0		FILL: CLAY: low plasticity; brown and grey-brown; with fine to coarse grained sand	M <Wp		0.80m: HP = 380 kPa 0.90m: HP = 380 kPa
							...becoming grey			
					1.5		Sandy CLAY: low plasticity; brown mottled grey; fine to coarse grained sand			ALLUVIUM
				1	2.0		*...increasing grey mottling and coarse grained sand*			
			SPT N=5 4,2,3				*...fine to medium grained, subrounded, sandstone gravel band*	M =Wp		2.10m: HP = 80 kPa 2.20m: HP = 120 kPa 2.30m: HP = 170 kPa
			D	0	3.0					3.04m: Water strike during drilling
			SPT N=9 4,6,3		3.5		*...trace fine to medium grained, sub-rounded to angular, siltstone and sandstone gravel*		F-St	3.60m: HP = 230 kPa 3.70m: HP = 70 kPa 3.80m: HP = 30 kPa
				-1	4.0					
					4.5			M >Wp		
			SPT N=6 3,3,3	-2	5.0					5.10m: HP = 120 kPa 5.20m: HP = 100 kPa 5.30m: HP = 110 kPa
					5.5					
					6.0				St	
				-3	6.5				VSt-H	
			SPT N=35 5,16,19							6.60m: HP = 560 kPa 6.70m: HP = 400 kPa
					7.0		Sandy CLAY: high plasticity; brown mottled white and orange-brown; fine to coarse grained sand; with fine to medium grained, sub-angular to sub-rounded, ironstone gravel			EXTREMELY WEATHERED MATERIAL 6.90m: HP > 600 kPa
			SPT N=53 5,23,30	-4						7.10m: HP = 500 kPa 7.20m: HP > 600 kPa
					7.5			M <Wp	H	7.30m: HP > 600 kPa
							...becoming pale grey mottled red-brown; increasing fine grained sand; trace gravel content			

METHOD & SUPPORT	PENETRATION	GROUNDWATER	SAMPLES & FIELD TESTS	MOISTURE	DENSITY (N-value)	CONSISTENCY (SU) {N-value}
HA Hand Auger AS Auger AD/V Auger - V-bit AD/T Auger - TC-bit WB Washbore RR Rock Roller SNC Sonic Drilling AH Air Hammer C Casing PT Push Tube	No resistance ranging to refusal	= Water level (static) = Water inflow	D Disturbed Sample B Bulk Sample SPT SPT Sample U Undisturbed Sample E Enviro Sample W Water Sample N SPT blows per 300mm HW SPT penetration by hammer weight RW SPT penetration by rod weight HP Hand Penetrometer HV Hand Vane Shear (P: Peak Su R: Residual Su)	D = Dry M = Moist W = Wet Wp = Plastic Limit Wl = Liquid Limit	VL Very Loose 0 - 4 L Loose 4 - 10 MD Medium Dense 10 - 30 D Dense 30 - 50 VD Very Dense 50 - 100	VS Very Soft < 12 kPa {0-2} S Soft 12 - 25 {2-4} F Firm 25 - 50 {4-8} St Stiff 50 - 100 {8-15} VSt Very Stiff 100 - 200 {15-30} H Hard > 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 4

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			SPT N=R 30/140mm	-5	8.5		Sandy CLAY: high plasticity; brown mottled white and orange-brown; fine to coarse grained sand; with fine to medium grained, sub-angular to sub-rounded, ironstone gravel *...increasing siltstone gravel content* Continued as cored hole from 8.14m	M <Wp	H	
				-6	9.0					
				-7	9.5					
				-8	10.0					
				-9	10.5					
				-10	11.0					
				-11	11.5					
				-12	12.0					
					12.5					
					13.0					
					13.5					
					14.0					
					14.5					
					15.0					
					15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 4

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
					Starting coring from 8.14 m								
HQ3		-5	8.5		NO CORE (280mm)								
					Interlaminated SANDSTONE (80%) and SILTSTONE (20%): fine grained, dark grey banded grey, distinctly laminated at 0-10 degrees	HW			74	74		Zone of multiple closely spaced BP's and JT,80 degrees, IR,RF	WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, CN,S-RF
			9.0									CN, 120mm wide SM, 20mm, Sandy Clay	
		-6	9.5									BP, 0°, PR, S, VNR BP, 0°, PR, S, VNR BP, 0°, PR, S, VNR BP BP BP BP BP BP BP BP BP BP BP BP BP BP BP BP BP BP BP BP BP, 0°, PR, S, VNR HB JT, 30°, PR, S, CN	
			10.0										
		-7	10.5						100	71			
			11.0										
		-8	11.5									BP BP	
			12.0										
		-9	12.5			FR						JT, 30°, UN, RF, CN JT, 30°, UN, RF, CN SM, 10°, IR, angular gravel, 50mm BP BP BP BP BP	
			13.0										
		-10	13.5						100	88		JT, 15°, PR, RF, CN	
			14.0									BP BP	
		-11	14.5										
			15.0										
		-12	15.5		SANDSTONE: medium to coarse grained, cross bedded at 0-30 degrees								

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▶ = Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 4

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS			
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
HQ3		-13	16.5		SANDSTONE: medium to coarse grained, cross bedded at 0-30 degrees	FR			100	87		BP BP
		-14	17.0									
			17.5									BP
			18.0									BP BP BP
		-15	18.5									BP
			19.0						100	76		JT, 15°, PR, S, CN
		-16	19.5									BP
			20.0		Exploratory hole terminated at 20.00 m Target depth							BP BP
		-17	20.5									
			21.0									
		-18	21.5									
			22.0									
		-19	22.5									
			23.0									
		-20	23.5									

WHERE DEFECTS ARE NOTED ONLY AS 'BP' THEY ARE BP, 0-15 DEGREES, PR, CN,S-RF

General

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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INF-BH-102 (1)

Jacobs	**Client:**	Sydney Water		**Title:**	INF-BH-102
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG/MZ	**Checked:**	PH	**Scale:** NTS **Drawing Number:** 1/1

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Piezometer Installation Details

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : INF-BH-102	Type: Standpipe	Tip Depth & Tip RL : 20.00 m -16.69 m
AD/V	13/12/2024	3 2 1 0 -1 -2 -3 -4	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: Clayey SAND: fine to coarse grained; brown mottled grey, orange-brown and white; low plasticity clay; fine to medium grained, sub-angular to sub-rounded, siltstone gravel FILL: CLAY: low plasticity; brown and grey-brown; with fine to coarse grained sand *...becoming grey* Sandy CLAY: low plasticity; brown mottled grey; fine to coarse grained sand *...increasing grey mottling and coarse grained sand* *...fine to medium grained, subrounded, sandstone gravel band* *...trace fine to medium grained, sub-rounded to angular, siltstone and sandstone gravel* Sandy CLAY: high plasticity; brown mottled white and orange-brown; fine to coarse grained sand; with fine to medium grained, sub-angular to sub-rounded, ironstone gravel *...becoming pale grey mottled red-brown; increasing fine grained sand; trace gravel content*	1.50 m 6.50 m 7.00 m	Soil Bentonite and grout Sand Bentonite Sand Bentonite	

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Jacobs — Piezometer Installation Details

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID :	Type:	Tip Depth & Tip RL :
						INF-BH-102	Standpipe	20.00 m -16.69 m
AD/V					Sandy CLAY: high plasticity; brown mottled white and orange-brown; fine to coarse grained sand; with fine to medium grained, sub-angular to sub-rounded, ironstone gravel			
		-5	8.5		*...increasing siltstone gravel content*			
					NO CORE (280mm)			
			9.0		Interlaminated SANDSTONE (80%) and SILTSTONE (20%): fine grained, dark grey banded grey, distinctly laminated at 0-10 degrees			
		-6	9.5					
			10.0					
		-7	10.5					
			11.0					
		-8	11.5					
HQ3			12.0					
		-9	12.5					
			13.0					
		-10	13.5					Sand
			14.0					
		-11	14.5					
			15.0					
		-12	15.5		SANDSTONE: medium to coarse grained, cross bedded at 0-30 degrees			

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Jacobs — Piezometer Installation Details

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : INF-BH-102	Type: Standpipe	Tip Depth & Tip RL : 20.00 m -16.69 m
HQ3		-13	16.5		SANDSTONE: medium to coarse grained, cross bedded at 0-30 degrees			
			17.0					
		-14	17.5					
			18.0					
		-15	18.5					
			19.0					
		-16	19.5					
			20.0			20.00 m		
		-17	20.5		Exploratory hole terminated at 20.00 m Target depth			
			21.0					
		-18	21.5					
			22.0					
		-19	22.5					
			23.0					
		-20	23.5					

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

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Jacobs — Engineering Log - Borehole

INF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 6

Client: Sydney Water **Location:** Rosehill Gardens Racecourse **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317297.5 m	**Elevation:**	7.16 m	**Started:**	11/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6255757.7 m	**Datum:**	AHD	**Finished:**	12/12/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V		11/12/2024	SPT N=9 5,4,5	7	0.5		Sandy CLAY: medium to high plasticity; orange-brown streaked dark grey; fine to coarse grained sand		H	ALLUVIUM 0.60m: HP = 440 kPa 0.70m: HP > 600 kPa 0.80m: HP = 350 kPa
			D	6	1.0		CLAY: high plasticity; orange-brown mottled grey; trace fine to coarse grained sand	M <Wp		
					1.5		*...becoming grey mottled orange-brown and brown*			
			SPT N=15 4,7,8	5	2.0				VSt	2.10m: HP = 250 kPa 2.20m: HP = 370 kPa 2.30m: HP = 320 kPa
					2.5		*...increasing sand content*			
				4	3.0			M =Wp		3.10m: Water strike during drilling at 3.15m
			SPT N=9 3,4,5		3.5		Sandy CLAY: low plasticity; grey mottled orange-brown and brown; fine to medium grained sand			3.50m: HP = 170 kPa 3.60m: HP = 280 kPa 3.70m: HP = 160 kPa
			D	3	4.0		*...trace fine grained, sub-angular to sub-rounded, sandstone gravel*			
			SPT N=6 3,2,4	2	5.0				St-VSt	
					5.5			M =Wp-M >Wp		
				1	6.0					RESIDUAL SOIL
			SPT N=11 3,3,8		6.5					6.50m: HP = 150 kPa 6.60m: HP = 120 kPa 6.70m: HP = 320 kPa
				0	7.0		*...trace medium grained, sub-angular to sub-rounded, sandstone gravel* *...trace medium grained, sub-angular to sub-rounded, sandstone gravel*			
					7.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

INF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 6

Client: Sydney Water **Location:** Rosehill Gardens Racecourse **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317297.5 m	**Elevation:**	7.16 m	**Started:**	11/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6255757.7 m	**Datum:**	AHD	**Finished:**	12/12/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			SPT N=44 8,16,28	-1			Sandy CLAY: low plasticity; grey mottled orange-brown and brown; fine to medium grained sand *...trace medium grained, sub-angular to sub-rounded, sandstone gravel*	M =Wp-M >Wp M <Wp	St-VSt H	8.20m: HP = 550 kPa 8.30m: HP > 600 kPa
					8.5		Sandy CLAY: high plasticity; dark red-brown mottled pale grey-brown and orange brown; fine to coarse grained sand; with fine to medium grained, sub-angular to sub-rounded, siltstone gravel Continued as cored hole from 8.45m			8.40m: HP = 510 kPa
				-2	9.0					
					9.5					
				-3	10.0					
					10.5					
				-4	11.0					
					11.5					
				-5	12.0					
					12.5					
				-6	13.0					
					13.5					
				-7	14.0					
					14.5					
				-8	15.0					
					15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

INF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 6

Client: Sydney Water **Location:** Rosehill Gardens Racecourse **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317297.5 m	**Elevation:**	7.16 m	**Started:**	11/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6255757.7 m	**Datum:**	AHD	**Finished:**	12/12/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
		-1			Starting coring from 8.45 m								
HQ3			8.5		NO CORE (190mm): 8.45-8.64m								
			9.0		CLAY: medium plasticity; brown mottled orange-brown and pale grey; fine to coarse grained sand	XW			69	45			
		-2			SANDSTONE: fine to medium grained; brown and orange brown; indistinctly laminated at 0 degree	HW						BP, 0°, CU, RF, CN SM, clay and gavel, 40mm	
			9.5		CLAY: high plasticity; grey mottled white, orange-brown and brown *...20mm wide siltstone bands*	XW							
			10.0		INTERBEDDED SILTSTONE (50%) AND SANDSTONE (50%): fine grained; dark grey banded grey with red, orange-brown iron staining; indistinctly laminated at 0 to 5 degrees							BP, 0°, PR, RF, SN BP, 0°, PR, RF, SN SM, Clay, 10mm SM, Clay, 40mm BP, 0°, PR, S, SN BP BP, 0°, PR, S, SN BP, 0°, PR, S, Filled, Clayey Gravel BP, 0°, PR, S, Filled, Clayey Gravel BP, 0°, PR, RF, SN SM, Clay, 60mm BP, 0°, PR, RF, SN BP, 0°, PR, RF, SN	
		-3	10.5			MW-HW			100	44			
		-4	11.0										
			11.5			MW							
		-5	12.0									BP, 0°, PR, RF, VNR, Clay	
			12.5									BP, 0°, PR, S, CN	
			13.0									BP, 0°, PR, S, CN	
		-6			SANDSTONE: medium to coarse grained; grey; indistinctly cross bedded at 0 to 20 degrees							CS, Sandy Clay, 20mm	
			13.5			SW			100	100			
		-7	14.0										
			14.5										
		-8	15.0										
			15.5									BP, 0°, PR, S, CN BP, 0°, PR, S, CN SM, Sandy Clay, 5mm	

Defects are BP, 0-15 degrees, PR, CN, S-RF unless otherwise noted

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

INF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 4 of 6

Client: Sydney Water **Location:** Rosehill Gardens Racecourse **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317297.5 m	**Elevation:**	7.16 m	**Started:**	11/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6255757.7 m	**Datum:**	AHD	**Finished:**	12/12/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm)	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3		-9	16.5		SANDSTONE: medium to coarse grained; grey; indistinctly cross bedded at 0 to 20 degrees *...becoming indistinctly laminated at 20 degrees*							BP, 20°, IR, RF, CN	Defects are BP, 0-15 degrees, PR, CN, S-RF unless otherwise noted
			17.0		*...becoming indistinctly laminated at 5 to 15 degrees* *...becoming indistinctly laminated at 0 to 10 degrees*				100	91		BP, 0°, PR, S, CN	
		-10	17.5		SANDSTONE: fine to medium grained; grey banded dark grey; indistinctly laminated at 0 to 10 degrees	FR-SW						- 5°, PR, S, CN 5°, PR, S, CN CS, 10mm 10°, PR, S, CN 10°, PR, S, CN 10°, PR, S, CN -	
			18.0		Interlaminated SANDSTONE (80%) and SILTSTONE (20%): fine grained, dark grey banded grey, distinctly laminated at 0-10 degrees								
		-11	18.5		SANDSTONE: fine to medium grained; grey; cross bedded at 0-20 degrees							-	
			19.0										
		-12	19.5						100	89		BP, 5°, PR, RF, CN BP, 5°, PR, RF, CN BP, 5°, PR, RF, CN	
			20.0									- BP, 5°, IR, RF, CN BP, 5°, IR, RF, CN JT, 5°, PR, RF, VNR, Clay BP, 0°, PR, RF, VNR, Clay CS, 10mm CS, 20mm - BP, 20°, PR, RF, CN	
		-13	20.5										
			21.0									-	
		-14	21.5			FR						- BP, 0°, PR, RF, Filled, Clay	
			22.0									BP, 5°, PR, RF, CN SM, Sandy Clay, 10mm - - - - -	
		-15	22.5						100	90		BP, 5°, PR, RF, CN CS, Pyrite, 5mm	
			23.0		*...pyritic lamination* *...30mm siltstone clast* *...30mm siltstone clast* *...30mm siltstone clast* *...130mm siltstone clast*								
		-16	23.5		*...massive*							JT, 75°, PR, RF, CN	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

= Water level (static)

= Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

INF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 5 of 6

Client: Sydney Water **Location:** Rosehill Gardens Racecourse **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317297.5 m	**Elevation:**	7.16 m	**Started:**	11/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6255757.7 m	**Datum:**	AHD	**Finished:**	12/12/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE					ROCK MASS DEFECTS				
Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3		-17	24.5		SANDSTONE: fine to medium grained; grey; cross bedded at 0-20 degrees *...becoming distinctly laminated at 0 degrees*				100	100			
		-18	25.0									-	
			25.5		*...becoming medium to coarse grained*							-	
		-19	26.0										
			26.5										
		-20	27.0										
			27.5									BP, 5°, PR, RF, CN BP, 5°, PR, RF, Filled, Clayey Sand	
		-21	28.0			FR			100	99			
			28.5										
		-22	29.0										
			29.5		*...50mm zone of dark grey silty laminations*								
		-23	30.0										
			30.5									-	
		-24	31.0		SANDSTONE: medium to coarse grained; pale grey banded grey and dark grey; indistinctly cross bedded at 0 to 10 degrees *...becoming coarse grained*				100	97		-	
			31.5										

Defects are BP, 0-15 degrees, PR, CN, S-RF unless otherwise noted

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

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DEFECT ABBREVIATIONS

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CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs Engineering Log - Cored Borehole

INF-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 6 of 6

Client: Sydney Water **Location:** Rosehill Gardens Racecourse **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	317297.5 m	**Elevation:**	7.16 m	**Started:**	11/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6255757.7 m	**Datum:**	AHD	**Finished:**	12/12/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)	General
HQ3		-25 -26 -27 -28 -29 -30 -31 -32	32.5 33.0 33.5 34.0 34.5 35.0 35.5 36.0 36.5 37.0 37.5 38.0 38.5 39.0 39.5		SANDSTONE: medium to coarse grained; pale grey banded grey and dark grey; indistinctly cross bedded at 0 to 10 degrees								
					INTERBEDDED SANDSTONE (60%) AND SILTSTONE (40%): fine grained; pale grey banded dark grey; indistinctly laminated at 0 to 10 degrees, with zones of irregular bedding up to 0.5m wide	FR			100	84		SM, Sandy Clay, 20mm SM, Sandy Clay, 40mm BP BP SM, Clayey Sand, 80mm SM, Sandy Clay, 10mm - JT, 40°, IR, RF, CN BP, 0°, PR, S, CT, Clay BP, 0°, PR, RF, CT, Clay	Defects are BP, 0-15 degrees, PR, CN, S-RF unless otherwise noted
					Exploratory hole terminated at 35.26 m Target depth								

DRILLING

NMLC NMLC Coring — TCR % core run recovered
NQ NQ Coring — RQD % core run > 100mm long (sound rock fraction only measured)
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

▼ = Water level (static)
▶ = Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
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ROCK STRENGTH (Is50 MPa)

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DEFECT ABBREVIATIONS

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CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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INF-BH-103 (1)

Jacobs	**Client:**	Sydney Water		**Title:**	INF-BH-103 (1)
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG/MZ	**Checked:**	PH	**Scale:** NTS **Drawing Number:** 1/3

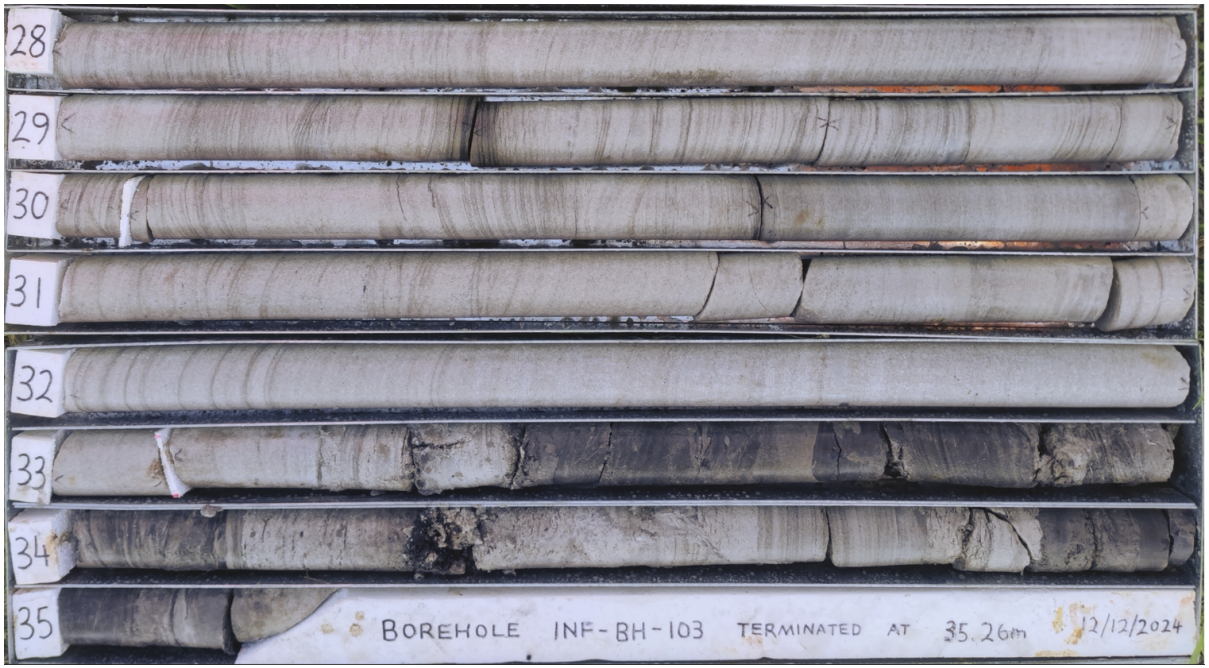
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INF-BH-103 (2)

Jacobs	**Client:**	Sydney Water		**Title:**	INF-BH-103 (2)
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG/MZ	**Checked:** PH	**Scale:** NTS	**Drawing Number:** 2/3

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INF-BH-103 (3)

Jacobs	**Client:**	Sydney Water		**Title:**	INF-BH-103 (3)
	Project:	Greater Parramatta & Olympic Peninsula (GPOP)			
	Drawn:	RG/MZ	**Checked:**	PH	**Scale:** NTS	**Drawing Number:** 3/3

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Jacobs — Engineering Log - Borehole

SPM-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** SP0067, Camellia, NSW **Project No:** IA319500

Contractor:	BG Drilling	**Easting:**	317089.0 m	**Elevation:**	4.20 m	**Started:**	05/08/2024
Plant:	Hanjin D&B 8-D	**Northing:**	6256211.5 m	**Datum:**	AHD	**Finished:**	05/08/2024
Logged By:	RG **Checked By:** PH	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description (SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components)	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/T				4	0		ASPHALT: dark grey, angular aggregrate up to 10mm			ROAD SURFACE
			D				FILL: COBBLES and GRAVEL in a sandy matrix: sandstone cobbles, fine to medium grained, sub-angular to sub-rounded, sandstone and siltstone gravel; dark orange-brown; fine to coarse grained sand	M		BASECOURSE SUB-BASECOURSE
NDD			D		0.5		FILL: Gravelly SAND: fine to coarse grained; dark orange-brown; fine to medium grained, sub-angular to sub-rounded, sandstone and siltstone gravel			FILL
							FILL: Sandy CLAY: low plasticity; orange to red-brown mottled grey; trace fine to medium grained, sub-angular, sandstone and siltstone gravel	M <Wp		
				3	1.0		*1.1m: sub-angular sandstone cobble*			
			D		1.5		Sandy CLAY: low to medium plasticity; brown mottled grey			ALLUVIUM
			SPT N=10 4,4,6				*1.7m: grey with occassional orange-brown and red-brown mottling* *1.8m: trace fine to medium grained, sub-angular ironstone gravel*	M =Wp	F-St	1.60m: HP = 150 kPa 1.70m: HP = 80 kPa 1.80m: HP = 100 kPa
				2	2.0					
					2.5		*2.5m: medium to high plasticity*	M >Wp	St	
			SPT N=14 3,5,9	1	3.0		CLAY: high plasticity; grey mottled red-brown and orange-brown			3.20m: HP = 340 kPa 3.30m: HP = 400 kPa 3.40m: HP = 380 kPa
					3.5			M <Wp		
			D		4.0					4.10m: HP = 350 kPa 4.20m: HP = 340 kPa 4.30m: HP = 400 kPa
AD/V			SPT N=17 4,8,9	0	4.5				VSt	
					5.0					
			D	-1	5.5					
			SPT N=15 4,6,9		6.0			M =Wp		6.10m: HP = 290 kPa 6.20m: HP = 350 kPa 6.30m: HP = 300 kPa 6.40m: Some seepage into the hole
				-2	6.5					
					7.0					
			SPT N=20 4,9,11	-3	7.5					7.60m: HP = 220 kPa 7.70m: HP = 370 kPa
							CLAY: high plasticity; brown mottled orange-brown and brown; trace fine grained, sub-angular ironstone and sandstone gravel		VSt-H	7.80m: HP = 410 kPa RESIDUAL SOIL

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

= Water level (static)
= Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Borehole

SPM-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** SP0067, Camellia, NSW **Project No:** IA319500

Contractor:	BG Drilling	**Easting:**	317089.0 m	**Elevation:**	4.20 m	**Started:**	05/08/2024
Plant:	Hanjin D&B 8-D	**Northing:**	6256211.5 m	**Datum:**	AHD	**Finished:**	05/08/2024
Logged By:	RG **Checked By:** PH	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	Field Test Data & Other Observations
AD/V			SPT N=R 10, 11/50mm	-4	8.5		CLAY: high plasticity; brown mottled orange-brown and brown; trace fine grained, sub-angular ironstone and sandstone gravel	M =Wp	VSt-H	RESIDUAL SOIL
							Sandy CLAY: medium plasticity; grey-white; fine to medium grained sand	M <Wp	H	EXTREMELY WEATHERED MATERIAL
					9.0		*8.9m: dark orange-brown*			8.90m: HP = 480 kPa
				-5			Continued as cored hole from 9.00m			9.00m: HP > 600 kPa
					9.5					
					10.0					
				-6						
					10.5					
					11.0					
				-7						
					11.5					
					12.0					
				-8						
					12.5					
					13.0					
				-9						
					13.5					
					14.0					
				-10						
					14.5					
					15.0					
				-11						
					15.5					

METHOD & SUPPORT

HA Hand Auger
AS Auger
AD/V Auger - V-bit
AD/T Auger - TC-bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
C Casing
PT Push Tube

PENETRATION

No resistance ranging to refusal

GROUNDWATER

▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
N SPT blows per 300mm
HW SPT penetration by hammer weight
RW SPT penetration by rod weight
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs Engineering Log - Cored Borehole

SPM-BH-101

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** SP0067, Camellia, NSW **Project No:** IA319500

Contractor:	BG Drilling	**Easting:**	317089.0 m	**Elevation:**	4.20 m	**Started:**	05/08/2024
Plant:	Hanjin D&B 8-D	**Northing:**	6256211.5 m	**Datum:**	AHD	**Finished:**	05/08/2024
Logged By:	RG **Checked By:** PH	**Grid:**	GDA20	**Inclination:**	-90°	**Orientation:**	000°

DRILLING | MATERIAL SUBSTANCE | ROCK MASS DEFECTS

Method	Groundwater/ Water Loss (%)	RL (m)	Depth (m)	Graphic Log	Description of Strata SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components ROCK TYPE: Grain size, Colour, Structure (texture. fabric, mineral composition, hardness, alteration, cementation)	Weathering	Estimated Strength Is(50) (MPa) □ - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Point Load Strength Index Is(50)/ UCS (MPa)	TCR (%)	RQD (%)	Defect Spacing (mm) 20 60 200 600 2000	Defect descriptions and additional observations (type, inclination, planarity, roughness, coating, thickness, other)
		-4	8.5		Starting coring from 9.00 m							
HQ3	0	-5	9.0		CLAY (XW SANDSTONE): medium to high plasticity; grey-white; trace fine to medium grained, sub-rounded sandstone gravel	XW			100	0		
			9.5		SANDSTONE: medium to coarse grained; iron stained grey-white and orange; indistinctly laminated at 0°	HW		d=0.11 a=0.24				BP, 0°, CU, RF, CT, Sandy Clay
		-6	10.0									JT, 30°, PR, RF, CT, Sandy Clay SM, 0°, Gravelly Clay, 160mm
			10.5					d=0.51 a=0.34				
	0				INTERLAMINATED SANDSTONE (70%) AND SILTSTONE (30%): fine to medium grained sandstone; iron stained grey and orange with dark grey siltstone laminations; indistinctly laminated at 0-10°				100	79		SM, 0°, Clay, 60mm SM, 0°, Clay, 20mm
			11.0									SM, 0°, Clay, 30mm
		-7										SM, 0°, Sandy Clay, 10mm
			11.5			MW		d=1.30 a=1.01				
			12.0					d=0.06 a=0.84				
		-8			SANDSTONE: medium to coarse grained; grey to grey-white with grey to dark grey laminations; indistinctly crossbedded at 0-10° - massive	SW		d=1.15 a=1.75				BP, 10°, PR, RF, CN
			12.5									
			13.0									
		-9										
	0		13.5					d=1.17 a=2.00	100	100		
			14.0			FR						
		-10										
			14.5					d=0.21 a=2.61				BP, 0°, PR, RF, CN
			15.0					d=0.94 a=1.16				
		-11			Exploratory hole terminated at 15.15 m							
			15.5									

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

TCR % core run recovered
RQD % core run > 100mm long (sound rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▶ = Water inflow

WEATHERING

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

ROCK STRENGTH (Is50 MPa)

0.03-0.1	Very Low (VL)
0.1-0.3	Low (L)
0.3-1.0	Medium (M)
1.0-3.0	High (H)
3.0-10	Very High (VH)
> 10	Extremely High (EH)

DEFECT ABBREVIATIONS

TYPE		COATING	PLANARITY	ROUGHNESS
BP Bedding Parting	FZ Fracture Zone	CN Clean	CU Curved	VR Very Rough
JT Joint	VN Vein	CT Coating	IR Irregular	RF Rough
SM Seam	FL Foliation	SN Stain	PR Planar	S Smooth
CS Crushed Seam	VO Void	VNR Veneer	ST Stepped	POL Polished
CZ Crushed Zone	DB Drilling Break	FILLED Filled	UN Undulated	SL Slickensided
SZ Shear Zone	HB Handling Break		DIS Discontinuous	

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Jacobs — Engineering Log - Pavement Hole

SPM-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1
Client: Sydney Water **Location:** SP0067, Camellia, NSW **Project No:** IA319500

Contractor:	BG Drilling	**Easting:**	317123.7 m	**Elevation:**	3.60 m	**Started:**	06/08/2024
Plant:	Hanjin D&B 8-D	**Northing:**	6256264.6 m	**Datum:**	AHD	**Finished:**	06/08/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/T NDD HA AD/V		Not Observed	SPT N=4 1,2,2 SPT N=5 2,3,2 SPT N=2 0,0,2	3 2 1 0 -1 -2 -3 -4	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		ASPHALT: dark grey, angular aggregrate up to 10mm FILL: Sandy GRAVEL: fine to coarse grained, sub-rounded; dark grey; fine to medium grained sand (compacted road base) FILL: Sandy CLAY: low plasticity; grey and brown; fine to medium grained sand; trace fine grained, sub-angular gravel *0.5m: dark brown* CLAY: medium to high plasticity, grey mottled brown and orange-brown Exploratory hole terminated at 3.00 m	D M <Wp M =Wp M >Wp	St-VSt	5 10 15 20	ROAD SURFACE BASECOURSE FILL 0.50m: Hydrocarbon odour 0.60m: DCP started at 0.6m 0.70m: HP 80 kPa 0.80m: HP 90 kPa 0.90m: HP 50 kPa 1.60m: HP 90 kPa 1.70m: HP 100 kPa 1.80m: HP 120 kPa 2.10m: Clay smear on DCP from this depth 2.50m: SPT 380mm penetration due to hammer weight 2.60m: HP 380 kPa ALLUVIUM 2.70m: HP 390 kPa 2.80m: HP 480 kPa 3.30m: DCP terminated at 3.3m, target depth

METHOD & SUPPORT
DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION
No resistance ranging to refusal
VE E F H VH

GROUNDWATER
▼ = Water level (static)
▶ = Water inflow

SAMPLES & FIELD TESTS
D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE
D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Engineering Log - Pavement Hole

SPM-BH-103

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** SP0067, Camellia, NSW **Project No:** IA319500

Contractor:	BG Drilling	**Easting:**	317085.2 m	**Elevation:**	4.23 m	**Started:**	06/08/2024
Plant:	Hanjin D&B 8-D	**Northing:**	6256255.9 m	**Datum:**	AHD	**Finished:**	06/08/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
AD/V		Not Observed	SPT N=6 4,3,3	4	0.5		ASPHALT: dark grey, angular aggregrate up to 10mm				ROAD SURFACE
NDD							FILL: Sandy GRAVEL: fine to medium grained, sub-angular; dark grey; fine to medium grained sand (compacted road base)	D-M			BASECOURSE
							FILL: Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded; brown and yellow brown; fine grained sand	M			FILL
							FILL: Sandy CLAY: low to medium plasticity; brown, grey-white and red; fine grained sand; trace fine to medium grained, sub-angular, sandstone gravel				0.70m: DCP started at 0.7m 0.80m: HP 300 kPa 0.90m: HP 150 kPa 1.00m: HP 130 kPa
				3	1.0						
			SPT N=10 3,4,6		1.5						1.60m: HP 130 kPa 1.70m: HP 100 kPa 1.80m: HP 310 kPa
					2.0		*1.7m: sandy gravel band, 200mm*	M <Wp			
			D	2							
					2.5		*2.4m: fine to medium grained sand*				2.60m: HP 150 kPa 2.70m: HP 140 kPa 2.80m: HP 90 kPa
			SPT N=5 6,4,1		3.0		*1.7m: gravelly sand band, 200mm* *3m: brown*				
			D	1	3.5			M =Wp			3.40m: DCP terminated at 3.4m, target depth 3.50m: SPT 100mm penetration due to hammer weight 3.60m: HP 80 kPa 3.70m: HP 80 kPa 3.80m: HP 90 kPa
			SPT N=3 0,1,2		4.0						
			SPT N=1 2,0,1	0	4.5		*4.7m: sand bands present at this depth* *4.8m: trace medium grained, sub-angular gravel*				4.70m: HP 220 kPa 4.80m: HP 220 kPa 4.90m: HP 120 kPa
				-1	5.0			M >Wp			
			SPT N=0 0,0,0		5.5						5.50m: SPT 450mm penetration due to hammer weight 5.60m: HP 50 kPa 5.70m: HP 60 kPa
					6.0		Exploratory hole terminated at 6.00 m				
				-2	6.5						
					7.0						
				-3	7.5						

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal

VE E F H VH

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Jacobs — Engineering Log - Pavement Hole

SPM-BH-104

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 1

Client: Sydney Water **Location:** SP0067, Camellia, NSW **Project No:** IA319500

Contractor:	BG Drilling	**Easting:**	317068.4 m	**Elevation:**	4.40 m	**Started:**	06/08/2024
Plant:	Hanjin D&B 8-D	**Northing:**	6256251.6 m	**Datum:**	AHD	**Finished:**	06/08/2024
Logged By:	RG **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

EXCAVATION INFORMATION | MATERIAL SUBSTANCE

Method	Penetration	Groundwater Levels	Samples & SPT Data	RL (m)	Depth (m)	Graphic Log	Material Description SOIL TYPE: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture	Consistency Relative Density	DCP (blows/ 100mm)	Field Test Data & Other Observations
DT							ASPHALT: dark grey; angular aggregate up to 10mm				ROAD SURFACE
NDD							FILL: Sandy GRAVEL: fine to medium grained, sub-angular; dark grey; fine to medium grained sand (compacted road base)				BASECOURSE
			D	4	0.5		FILL: Sandy CLAY: low plasticity; grey and brown; trace fine grained, sub-angular gravel				FILL
			SPT N=4 4,2,2				*0.45m: orange-brown*				0.50m: DCP started at 0.5m 0.60m: HP 120 kPa 0.70m: HP 220 kPa 0.80m: HP 230 kPa
					1.0		*1.1m: brown*	M <Wp			
			D	3	1.5						
AD/V		Not Observed	SPT N=10 3,5,5								1.60m: HP 320 kPa 1.70m: HP 400 kPa 1.80m: HP 460 kPa
				2	2.5		CLAY: high plasticity, grey mottled brown and orange-brown	M =Wp	VSt-H		ALLUVIUM 2.60m: HP 400 kPa 2.70m: HP 410 kPa 2.80m: HP 450 kPa
			SPT N=13 4,6,7		3.0						
							Exploratory hole terminated at 3.00 m				3.10m: DCP terminated at 3.1m, target depth
				1	3.5						
					4.0						
				0	4.5						
					5.0						
				-1	5.5						
					6.0						
				-2	6.5						
					7.0						
				-3	7.5						

METHOD & SUPPORT

DT Diatube
NDD Non-destructive digging
AD/V Auger - V-bit
AD/T Auger - TC-bit
PT Push Tube
E Excavator
BH Backhoe Bucket
HA Hand Auger

PENETRATION

No resistance ranging to refusal

VE E F H VH

GROUNDWATER

▼ = Water level (static)

▶ = Water inflow

SAMPLES & FIELD TESTS

D Disturbed Sample
B Bulk Sample
SPT SPT Sample
U Undisturbed Sample
E Enviro Sample
W Water Sample
HP Hand Penetrometer
HV Hand Vane Shear
(P: Peak Su R: Residual Su)

MOISTURE

D = Dry
M = Moist
W = Wet
Wp = Plastic Limit
Wl = Liquid Limit

DENSITY (N-value)

VL	Very Loose	0 - 4
L	Loose	4 - 10
MD	Medium Dense	10 - 30
D	Dense	30 - 50
VD	Very Dense	50 - 100

CONSISTENCY (SU) {N-value}

VS	Very Soft	< 12 kPa {0-2}
S	Soft	12 - 25 {2-4}
F	Firm	25 - 50 {4-8}
St	Stiff	50 - 100 {8-15}
VSt	Very Stiff	100 - 200 {15-30}
H	Hard	> 200 kPa {>30}

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Piezometer Installation Details

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 1 of 3

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : INF-BH-102	Type: Standpipe	Tip Depth & Tip RL : 20.00 m -16.69 m
AD/V	13/12/2024	3 2 1 0 -1 -2 -3 -4	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5		FILL: Clayey SAND: fine to coarse grained; brown mottled grey, orange-brown and white; low plasticity clay; fine to medium grained, sub-angular to sub-rounded, siltstone gravel FILL: CLAY: low plasticity; brown and grey-brown; with fine to coarse grained sand *...becoming grey* Sandy CLAY: low plasticity; brown mottled grey; fine to coarse grained sand *...increasing grey mottling and coarse grained sand* *...fine to medium grained, subrounded, sandstone gravel band* *...trace fine to medium grained, sub-rounded to angular, siltstone and sandstone gravel* Sandy CLAY: high plasticity; brown mottled white and orange-brown; fine to coarse grained sand; with fine to medium grained, sub-angular to sub-rounded, ironstone gravel *...becoming pale grey mottled red-brown; increasing fine grained sand; trace gravel content*	1.50 m 6.50 m 7.00 m	Soil Bentonite and grout Sand Bentonite Sand Bentonite	

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs — Piezometer Installation Details

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 2 of 3

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID :	Type:	Tip Depth & Tip RL :
						INF-BH-102	Standpipe	20.00 m -16.69 m
AD/V					Sandy CLAY: high plasticity; brown mottled white and orange-brown; fine to coarse grained sand; with fine to medium grained, sub-angular to sub-rounded, ironstone gravel			
		-5	8.5		*...increasing siltstone gravel content*			
					NO CORE (280mm)			
			9.0		Interlaminated SANDSTONE (80%) and SILTSTONE (20%): fine grained, dark grey banded grey, distinctly laminated at 0-10 degrees			
		-6	9.5					
			10.0					
		-7	10.5					
			11.0					
		-8	11.5					
HQ3			12.0					
		-9	12.5					
			13.0					
		-10	13.5					Sand
			14.0					
		-11	14.5					
			15.0					
		-12	15.5		SANDSTONE: medium to coarse grained, cross bedded at 0-30 degrees			

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Jacobs — Piezometer Installation Details

INF-BH-102

Project: Greater Parramatta & Olympic Peninsula (GPOP) **Page:** 3 of 3

Client: Sydney Water **Location:** Rosehill Gardens Circus Ground South **Project No:** IA319500

Contractor:	Macquarie Geotechnical Pty Ltd	**Easting:**	316963.6 m	**Elevation:**	3.31 m	**Started:**	13/12/2024
Plant:	FRASTE PL G Multidrill	**Northing:**	6256162.7 m	**Datum:**	AHD	**Finished:**	16/12/2024
Logged By:	RG/MZ **Checked By:** PH	**Grid:**	MGA20 Z56	**Inclination:**	-90°	**Orientation:**	000°

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS		
Method	Groundwater Levels	RL (m)	Depth (m)	Graphic Log	Description of Strata LITHOLOGY: Grain size, Colour, Structure, Other Observations	ID : INF-BH-102	Type: Standpipe	Tip Depth & Tip RL : 20.00 m -16.69 m
HQ3		-13	16.5		SANDSTONE: medium to coarse grained, cross bedded at 0-30 degrees			
			17.0					
		-14	17.5					
			18.0					
		-15	18.5					
			19.0					
		-16	19.5					
			20.0			20.00 m		
		-17	20.5		Exploratory hole terminated at 20.00 m Target depth			
			21.0					
		-18	21.5					
			22.0					
		-19	22.5					
			23.0					
		-20	23.5					

DRILLING METHOD

AS Auger
AD/V Auger V-bit
AD/T Auger TC bit
WB Washbore
RR Rock Roller
SNC Sonic Drilling
AH Air Hammer
NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring

GROUNDWATER SYMBOLS

Water level (static)
Water level (during drilling)

This log was created for Jacobs' client. Jacobs accepts no responsibility for any reliance on this information by third parties.

Appendix B. Groundwater analytical results

B.1 Groundwater analytical results tables

Jacobs

Table H - Groundwater Analytical Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF

	Per- and Poly-fluoroalkyl Substances (PFAS)													(n:2) Fluorotelomer Sulfonic Acids			Metals								
	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluoro-n-pentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanoic acid (PFHpA)	Perfluorobutanesulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	1H,1H,2H,2H-perfluorododecanesulfonic acid (10:2)	Sum (PFHxS + PFOS)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	Sum of US EPA PFAS (PFOS + PFOA)*	Sum of WA DWER PFAS (n=10)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2 FTS)	Arsenic (filtered)	Cadmium (filtered)	Chromium (hexavalent) (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Lead (filtered)	Magnesium (filtered)	Mercury (filtered)	Nickel (filtered)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.1	0.05	0.01	0.01	0.01	0.01	0.05	0.05	0.05	1	0.1	5	1	1	1	1,000	0.1	1
PFAS NEMP (2020) Table 1 Recreational Water		**10**								**2**															
PFAS NEMP (2020) Table 5 Interim Marine 99%	**0.00023**	**19**																							
Table 1A(4) HSLs Groundwater, Commercial Industrial - Clay Soils																									
Dutch Intervention Guideline (RIVM, 2000)																									
NHMRC (2008) Guidelines for Managing Risks in Recreational Water																	**700**	**20**	**500**		**20,000**	**100**		**10**	**200**
ANZG (2018) Marine water 99% toxicant DGVs																		**0.7**[#7]						**0.1**[#8]	**7**[#7]
ANZG (2018) Marine water 95% toxicant DGVs																			**4.4**[#8]	**4.4**	**1.3**[#8]	**4.4**[#9]			

Location Code	Field ID	Date	Time	Lab Report Number	Sample Type																					
WRRF-BH-102	WRRF-BH102_090724	09 Jul 2024	16:30:00	ES2422636	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	**2**	**0.1**	<10	<1	**2**	<1	**216,000**	<0.1	**44**
WRRF-BH-103	WRRF-BH103_080724	08 Jul 2024	16:37:00	ES2422479	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	**1**	**0.1**	<10	<1	**9**	**2**	**278,000**	<0.1	**57**
WRRF-BH-104	WRRF-BH104_110724	11 Jul 2024	10:42:00	ES2422918	Normal	<0.01	**0.02**	<0.02	**0.02**	**0.04**	**0.05**	<0.02	<0.1	<0.05	**0.04**	-	-	**0.13**	<0.05	<0.05	<0.05	<1	<0.1	<10	<1	**1**	<1	**46,000**	<0.1	**10**
WRRF-BH-105	WRRF-BH105_120724	12 Jul 2024	12:55:00	ES2423129	Normal	**0.02**	<0.01	<0.02	<0.02	**0.01**	<0.02	<0.02	<0.1	<0.05	**0.03**	-	-	**0.03**	<0.05	<0.05	<0.05	<1	**0.4**	<10	<1	**3**	<1	**626,000**	<0.1	**68**
WRRF-BH-106	WRRF-BH106_110724	11 Jul 2024	13:12:00	ES2422918	Normal	**0.02**	**0.04**	**0.03**	**0.03**	**0.04**	**0.05**	<0.02	<0.1	<0.05	**0.06**	-	-	**0.21**	<0.05	<0.05	<0.05	**7**	**0.5**	<10	**11**	**11**	**8**	**220,000**	<0.1	**78**
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024	10:20:00	ES2422636	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	<1	**0.1**	<10	**1**	**6**	<1	**229,000**	<0.1	**44**
WRRF-GW-107	WRRF-GW107_120724	12 Jul 2024	8:55:00	ES2423129	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	**4**	**0.1**	<10	<1	**15**	**3**	**318,000**	<0.1	**131**
WRRF-GW-108	WRRF-GW108_090724	09 Jul 2024	13:35:00	ES2422636	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	**2**	**0.1**	<10	<1	**6**	**6**	**504,000**	<0.1	**71**
WRRF-GW-109	WRRF-GW109_090724	09 Jul 2024	14:49:00	ES2422636	Normal	<0.01	**0.01**	**0.02**	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	**0.03**	<0.05	<0.05	<0.05	<1	**0.1**	<10	<1	<1	<1	**123,000**	<0.1	**19**
WRRF-GW-110	WRRF-GW110_080724	08 Jul 2024	15:00:00	ES2422479	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	<1	**0.2**	<10	<1	**2**	<1	**516,000**	<0.1	**43**
WRRF-GW-111	WRRF-GW111_100724	10 Jul 2024	10:25:00	ES2422785	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	**3**	**0.5**	<10	<1	**4**	<1	**494,000**	<0.1	**89**
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	15:22:00	ES2423129	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	**5**	<0.1	<10	**1**	<1	<1	**494,000**	<0.1	**7**
WRRF-GW-113	WRRF-DS1_120724	12 Jul 2024	13:33:00	ES2423129	Field_D	**0.02**	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	**0.02**	-	-	**0.02**	<0.05	<0.05	<0.05	**1**	**0.1**	<10	<1	**10**	<1	-	<0.1	**75**
WRRF-GW-113	WRRF-SR1-120724	12 Jul 2024	13:33:00	1119942	Interlab_D	**0.02**[#14]	<0.01	-	-	0.01#2	-	-	-	-	**0.03**	0.03	0.02	**-**	-	<0.05	-	<1	<0.2	-	**2**	**13**	**1**	-	<0.1	**170**
WRRF-GW-113	WRRF-GW113_120724	12 Jul 2024	13:33:00	ES2423129	Normal	**0.02**	<0.01	<0.02	<0.02	**0.01**	<0.02	<0.02	<0.1	<0.05	**0.03**	-	-	**0.03**	<0.05	<0.05	<0.05	**1**	**0.2**	<10	<1	**9**	<1	**506,000**	<0.1	**75**
WRRF-GW-114	WRRF-GW114_100724	10 Jul 2024	13:25:00	ES2422785, ES2423953	Normal	**0.86**	**1.64**	**1.65**	**1.80**	**2.83**	**2.67**	**0.31**	**0.5**	<0.05	**3.69**	-	-	**13.5**	<0.05	**1.28**	<0.05	**2**	<0.1	<10	<1	<1	<1	**21,000**	<0.1	**2**
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	15:43:00	ES2422785	Field_D	**0.08**	**0.03**	<0.02	<0.02	**0.04**	<0.02	<0.02	<0.1	<0.05	**0.12**	-	-	**0.15**	<0.05	<0.05	<0.05	<1	**0.2**	<10	<1	<1	<1	-	<0.1	**55**
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	15:43:00	ES2422785	Normal	**0.08**	**0.03**	<0.02	<0.02	**0.04**	**0.02**	<0.02	<0.1	<0.05	**0.12**	-	-	**0.17**	<0.05	<0.05	<0.05	<1	**0.2**	<10	<1	<1	<1	**480,000**	<0.1	**54**
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	15:43:00	1117805	Interlab_D	**0.07**[#14]	**0.03**[#14]	-	-	**0.05**[#14]	-	-	-	-	**0.12**	**0.15**	**0.1**	-	-	<0.05	-	<1	**0.3**	**14**	<1	<1	<1	-	<0.1	**50**
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	14:58:00	ES2422918	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	**1**	**0.7**	<10	<1	**9**	**7**	**467,000**	<0.1	**56**
WRRF-GW-117	WRRF-GW117_090724	09 Jul 2024	12:35:00	ES2422636	Normal	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	<1	**0.1**	<10	<1	**3**	<1	**232,000**	<0.1	**54**
WRRF-GW-118	WRRF-GW118_100724	10 Jul 2024	10:50:00	ES2422785	Normal	**0.02**	**0.01**	<0.02	<0.02	**0.02**	<0.02	<0.02	<0.1	<0.05	**0.04**	-	-	**0.05**	<0.05	<0.05	<0.05	<1	**0.4**	<10	<1	<1	<1	**356,000**	<0.1	**22**
WRRF-TP-105	WRRF-TP105-W	14 Jun 2024		ES2419619	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments

#1 Values calculated using hardness of 30 mg/L CaCO3. Chemical for which possible bioaccumulation and secondary poisoning effects should be considered.

#2 Values calculated using hardness of 30 mg/L CaCO3. Refer ANZECC & ARMCANZ (2000) for site specific hardness guidance

#3 Chemical for which possible bioaccumulation and secondary poisoning effects should be considered, refer to ANZECC & ARMCANZ (2000) for further guidance.

#4 Values calculated using hardness of 30 mg/L CaCO3. Figure may not protect key species from chronic toxicity. Refer ANZECC & ARMCANZ (2000) for guidance

#5 Figure may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance.

#6 refer to guideline

#7 High reliability

#8 Very high reliability

#9 Low reliability

#10 Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

#11 Moderate reliability. Ammonia as total ammonia, measured as [NH3-N] at pH 8.

#12 High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

#13 Reported Analyte LOR is higher than Requested Analyte LOR

#14 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#15 Stabilised pH reading taken during groundwater purging prior to sampling.

		BTEX							Polycyclic aromatic hydrocarbons (PAHs)																
	Zinc (filtered)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Benzo(a)pyrene TEQ calc (zero)	Benzo[b+j]fluoranthene	Naphthalene (value used in F2 calc)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	5	1	1	1	2	1	2	1	0.5	1	0.005	1	1	1	1	0.5	1	1	1	1	1	1	1	1	1
PFAS NEMP (2020) Table 1 Recreational Water																									
PFAS NEMP (2020) Table 5 Interim Marine 99%																									
Table 1A(4) HSLs Groundwater, Commercial Industrial - Clay Soils		**30,000**	**NL**	**NL**			**NL**																		
Dutch Intervention Guideline (RIVM, 2000)																									
NHMRC (2008) Guidelines for Managing Risks in Recreational Water		**10**	**3,000**	**8,000**			**6000**																		
ANZG (2018) Marine water 99% toxicant DGVs														**0.01**		**0.1**								**50**[#10]	**0.6**
ANZG (2018) Marine water 95% toxicant DGVs	**15**[#8]	**700**[#10]	**80**	**180**																					

Location Code	Field ID	Date	Time	Lab Report Number	Sample Type																						
WRRF-BH-102	WRRF-BH102_090724	09 Jul 2024	16:30:00	ES2422636	Normal	**439**	<1	<2	**10**	<2	<2	<2	**10**	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-BH-103	WRRF-BH103_080724	08 Jul 2024	16:37:00	ES2422479	Normal	**194**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-BH-104	WRRF-BH104_110724	11 Jul 2024	10:42:00	ES2422918	Normal	**84**	<10[#13]	**17**	<10[#13]	<20[#13]	**41**	**41**	**58**	<2.4[#13]	<4.8[#13]	**1.35**	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	**14.5**	<4.8[#13]	**348**	**31.9**
WRRF-BH-105	WRRF-BH105_120724	12 Jul 2024	12:55:00	ES2423129	Normal	**126**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-BH-106	WRRF-BH106_110724	11 Jul 2024	13:12:00	ES2422918	Normal	**1,600**	**4**	**7**	**3**	**30**	**2**	**32**	**46**	<0.5	<1.0	**0.027**	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**15.5**	<1.0
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024	10:20:00	ES2422636	Normal	**258**	<1	<2	**290**	<2	<2	<2	**290**	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-107	WRRF-GW107_120724	12 Jul 2024	8:55:00	ES2423129	Normal	**314**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-108	WRRF-GW108_090724	09 Jul 2024	13:35:00	ES2422636	Normal	**245**	<1	**2**	<2	<2	<2	<2	**2**	<0.5	<1.0	**0.005**	**1.1**	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	**1.8**	<1.0	<1.0	**2.3**
WRRF-GW-109	WRRF-GW109_090724	09 Jul 2024	14:49:00	ES2422636	Normal	**229**	<1	<2	**5**	<2	<2	<2	**5**	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-110	WRRF-GW110_080724	08 Jul 2024	15:00:00	ES2422479	Normal	**133**	<1	<2	**7**	<2	<2	<2	**7**	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-111	WRRF-GW111_100724	10 Jul 2024	10:25:00	ES2422785	Normal	**301**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	15:22:00	ES2423129	Normal	**31**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	**0.024**	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	**2.3**	<1.0	**4.0**	**1.5**
WRRF-GW-113	WRRF-DS1_120724	12 Jul 2024	13:33:00	ES2423129	Field_D	**132**	**19**	**50**	<2	**30**	**64**	**94**	**163**	<2.4[#13]	<4.8[#13]	**0.343**	**5.1**	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	**18.7**	<4.8[#13]	**298**	**36.7**
WRRF-GW-113	WRRF-SR1-120724	12 Jul 2024	13:33:00	1119942	Interlab_D	**140**	**19**	**51**	<1	**35**	**69**	**100**	-	-	<1	**0.67**	**8**	**1**	**4**	**1**	<1	<1	<1	**1**	<1	**1**	**36**	<1	**710**	**58**
WRRF-GW-113	WRRF-GW113_120724	12 Jul 2024	13:33:00	ES2423129	Normal	**139**	**19**	**47**	<2	**28**	**61**	**89**	**155**	<2.4[#13]	<4.8[#13]	**0.36**	**5.2**	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	<4.8[#13]	**19.1**	<4.8[#13]	**307**	**37.2**
WRRF-GW-114	WRRF-GW114_100724	10 Jul 2024	13:25:00	ES2422785, ES2423953	Normal	**30**	**389**	**111**	**1,510**	**606**	**264**	**870**	**2,880**	<0.5	<1.0	**0.01**	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**2.7**	<1.0
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	15:43:00	ES2422785	Field_D	**395**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	15:43:00	ES2422785	Normal	**394**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	15:43:00	1117805	Interlab_D	**400**	<1	<1	<1	<2	<1	<3	-	-	<1	<0.01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	14:58:00	ES2422918	Normal	**501**	**1**	**25**	<2	<2	<2	<2	**26**	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-117	WRRF-GW117_090724	09 Jul 2024	12:35:00	ES2422636	Normal	**286**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	**2.4**	<1.0	<1.0	<1.0
WRRF-GW-118	WRRF-GW118_100724	10 Jul 2024	10:50:00	ES2422785	Normal	**86**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-TP-105	WRRF-TP105-W	14 Jun 2024		ES2419619	Normal	-	<1	<2	**4**	<2	<2	<2	**4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.006**	

Comments

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#2 Values calculated using hardness of 30 mg/L CaCO3. Refer ANZECC & ARMCANZ (2000) for site specific hardness guidance

#3 Chemical for which possible bioaccumulation and secondary poisoning effects should be considered, refer to ANZECC & ARMCANZ (2000) for further guidance.

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#6 refer to guideline

#7 High reliability

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#13 Reported Analyte LOR is higher than Requested Analyte LOR

#14 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#15 Stabilised pH reading taken during groundwater purging prior to sampling.

					TRH - NEPM 2013 Fractions							TPH - NEPM 1999 Fractions					Nutrients										
					Pyrene	PAHs (Sum of total)	TRH >C6 - C10	TRH >C10 - C16	TRH >C16 - C34	TRH >C34 - C40	TRH >C10 - C40 (Sum of total)	TRH >C6 - C10 less BTEX (F1)	TRH >C10 - C16 less Naphthalene (F2)	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C36 (Sum of total)	Phosphorus total (as P)	Soluble Carbonate as CaCO3*	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Ammonia as N	Anions Total	Bicarbonate Alkalinity as CaCO3	Calcium (filtered)	Cations Total	Chloride	pH (field)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	mg/L	meq/L	mg/L	pH Units
EQL					1	0.5	20	50	100	100	100	20	50	20	50	100	50	50	0.01	1	1	1	0.01	0.01	1	1	0.01	1	0.01
PFAS NEMP (2020) Table 1 Recreational Water																												
PFAS NEMP (2020) Table 5 Interim Marine 99%																												
Table 1A(4) HSLs Groundwater, Commercial Industrial - Clay Soils							NL	NL				NL	NL															
Dutch Intervention Guideline (RIVM, 2000)																		600										
NHMRC (2008) Guidelines for Managing Risks in Recreational Water																												6.5-8.5
ANZG (2018) Marine water 99% toxicant DGVs																												
ANZG (2018) Marine water 95% toxicant DGVs																												
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**																							
WRRF-BH-102	WRRF-BH102_090724	09 Jul 2024	16:30:00	ES2422636	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	46	-	143	46	42	128	4,130	4.64#15
WRRF-BH-103	WRRF-BH103_080724	08 Jul 2024	16:37:00	ES2422479	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	3	-	152	3	39	144	4,810	4.18#15
WRRF-BH-104	WRRF-BH104_110724	11 Jul 2024	10:42:00	ES2422918	Normal	<4.8#13	394	210	3,110	1,360	<100	4,470	<200#13	1,760	<200#13	2,460	2,070	<50	4,530	-	<1	<1	44	-	39.3	44	34	38.5	1,140	5.01#15
WRRF-BH-105	WRRF-BH105_120724	12 Jul 2024	12:55:00	ES2423129	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	74	-	243	74	135	232	7,930	5.67#15
WRRF-BH-106	WRRF-BH106_110724	13 Jul 2024	13:12:00	ES2422918	Normal	<1.0	15.5	330	730	360	<100	1,090	280	700	260	620	520	<50	1,140	-	<1	<1	<1	-	112	<1	172	92.6	2,370	4.17 #15
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024	10:20:00	ES2422636	Normal	<1.0	<0.5	590	<100	<100	<100	<100	300	<100	590	50	<100	<50	50	-	<1	<1	<1	-	130	<1	42	127	3,980	4.64#15
WRRF-GW-107	WRRF-GW107_120724	12 Jul 2024	8:55:00	ES2423129	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	6	-	175	6	31	158	5,500	4.91#15
WRRF-GW-108	WRRF-GW108_090724	09 Jul 2024	13:35:00	ES2422636	Normal	<1.0	5.2	30	300	160	<100	460	30	300	<20	150	310	<50	460	-	<1	<1	6	-	248	6	52	231	8,090	4.78 #15
WRRF-GW-109	WRRF-GW109_090724	09 Jul 2024	14:49:00	ES2422636	Normal	<1.0	<0.5	<20	100	<100	<100	100	<20	100	<20	90	<100	<50	90	-	<1	<1	62	-	91.3	62	70	78.6	2,850	5.59 #15
WRRF-GW-110	WRRF-GW110_080724	08 Jul 2024	15:00:00	ES2422479	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	54	-	225	54	95	220	7,280	5.36#15
WRRF-GW-111	WRRF-GW111_100724	10 Jul 2024	10:25:00	ES2422785	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	28	-	211	28	110	226	6,910	5.14#15
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	15:22:00	ES2423129	Normal	<1.0	7.8	30	440	630	<100	1,070	30	420	20	210	760	<50	970	-	<1	<1	177	-	121	177	119	106	4,050	6.11#15
WRRF-GW-113	WRRF-DS1_120724	12 Jul 2024	13:33:00	ES2423129	Field_D	<4.8#13	358	450	3,160	900	<100	4,060	290	2,820	320	2,860	1,380	<50	4,240	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-SR1-120724	12 Jul 2024	13:33:00	1119942	Interlab_D	2	820	680	3,400	1,000	<100	4,400	510	2,730	310	3,500	1,500	100	5,100	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-GW113_120724	12 Jul 2024	13:33:00	ES2423129	Normal	<4.8#13	368	440	3,460	810	<100	4,270	280	3,100	310	2,960	1,650	<50	4,610	-	<1	<1	63	-	226	63	158	212	7,350	5.45#15
WRRF-GW-114	WRRF-GW114_100724	10 Jul 2024	13:25:00	ES2422785, ES2423953	Normal	<1.0	2.7	6,340	420	<100	<100	420	3,460	410	6,380	670	<100	<50	670	-	<1	<1	68	-	26.5	68	13	27.8	505	5.25 #15
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	15:43:00	ES2422785	Field_D	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	-	-	-	-	-	-	-	-	-	5.25 #15
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	15:43:00	ES2422785	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	140	-	217	140	409	215	6,980	6.1#15
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	15:43:00	1117805	Interlab_D	<1	<1	<20	<50	<100	<100	<100	<20	<50	<20	<50	<100	<100	<100	0.02	-	-	-	1.3	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	14:58:00	ES2422918	Normal	<1.0	<0.5	300	320	<100	<100	320	270	320	220	310	190	<50	500	-	<1	<1	1	-	214	1	89	208	7,020	4.43 #15
WRRF-GW-117	WRRF-GW117_090724	09 Jul 2024	12:35:00	ES2422636	Normal	<1.0	2.4	<20	300	170	<100	470	<20	300	<20	180	310	<50	490	-	<1	<1	8	-	135	8	39	117	3,410	4.78#15
WRRF-GW-118	WRRF-GW118_100724	10 Jul 2024	10:50:00	ES2422785	Normal	<1.0	<0.5	<20	<100	<100	<100	<100	<20	<100	<20	<50	<100	<50	<50	-	<1	<1	187	-	191	187	187	189	5,690	6.34#15
WRRF-TP-105	WRRF-TP105-W	14 Jun 2024		ES2419619	Normal	-	-	30	1,600	2,020	<100	3,620	30	1,590	<20	950	2,600	<50	3,550	-	-	-	-	-	-	-	-	-	-	-

Comments

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#13 Reported Analyte LOR is higher than Requested Analyte LOR

#14 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#15 Stabilised pH reading taken during groundwater purging prior to sampling.

						Inorganics				
						Electrical conductivity (lab)	Ionic Balance	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrate (as N)
						µS/cm	%	mg/L	mg/L	mg/L
EQL						1	0.01	0.2	0.05	0.02
PFAS NEMP (2020) Table 1 Recreational Water										
PFAS NEMP (2020) Table 5 Interim Marine 99%										
Table 1A(4) HSLs Groundwater, Commercial Industrial - Clay Soils										
Dutch Intervention Guideline (RIVM, 2000)										
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ANZG (2018) Marine water 99% toxicant DGVs										
ANZG (2018) Marine water 95% toxicant DGVs										
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**					
WRRF-BH-102	WRRF-BH102_090724	09 Jul 2024	16:30:00	ES2422636	Normal	**13,600**	**5.74**	-	-	-
WRRF-BH-103	WRRF-BH103_080724	08 Jul 2024	16:37:00	ES2422479	Normal	-	**2.81**	-	-	-
WRRF-BH-104	WRRF-BH104_110724	11 Jul 2024	10:42:00	ES2422918	Normal	**4,380**	**1.08**	-	-	-
WRRF-BH-105	WRRF-BH105_120724	12 Jul 2024	12:55:00	ES2423129	Normal	-	**2.27**	-	-	-
WRRF-BH-106	WRRF-BH106_110724	11 Jul 2024	13:12:00	ES2422918	Normal	-	**9.42**	-	-	-
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024	10:20:00	ES2422636	Normal	**13,100**	**1.12**	-	-	-
WRRF-GW-107	WRRF-GW107_120724	12 Jul 2024	8:55:00	ES2423129	Normal	-	**5.24**	-	-	-
WRRF-GW-108	WRRF-GW108_090724	09 Jul 2024	13:35:00	ES2422636	Normal	-	**3.61**	-	-	-
WRRF-GW-109	WRRF-GW109_090724	09 Jul 2024	14:49:00	ES2422636	Normal	-	**7.48**	-	-	-
WRRF-GW-110	WRRF-GW110_080724	08 Jul 2024	15:00:00	ES2422479	Normal	-	**1.11**	-	-	-
WRRF-GW-111	WRRF-GW111_100724	10 Jul 2024	10:25:00	ES2422785	Normal	-	**3.34**	-	-	-
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	15:22:00	ES2423129	Normal	-	**6.69**	-	-	-
WRRF-GW-113	WRRF-DS1_120724	12 Jul 2024	13:33:00	ES2423129	Field_D	-	-	-	-	-
WRRF-GW-113	WRRF-SR1-120724	12 Jul 2024	13:33:00	1119942	Interlab_D	-	-	-	-	-
WRRF-GW-113	WRRF-GW113_120724	12 Jul 2024	13:33:00	ES2423129	Normal	-	**3.25**	-	-	-
WRRF-GW-114	WRRF-GW114_100724	10 Jul 2024	13:25:00	ES2422785, ES2423953	Normal	-	**2.37**	-	-	-
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	15:43:00	ES2422785	Field_D	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	15:43:00	ES2422785	Normal	-	**0.48**	-	-	-
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	15:43:00	1117805	Interlab_D	-	-	**0.9**	<0.05	<0.02
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	14:58:00	ES2422918	Normal	-	**1.28**	-	-	-
WRRF-GW-117	WRRF-GW117_090724	09 Jul 2024	12:35:00	ES2422636	Normal	**12,500**	**7.16**	-	-	-
WRRF-GW-118	WRRF-GW118_100724	10 Jul 2024	10:50:00	ES2422785	Normal	-	**0.41**	-	-	-
WRRF-TP-105	WRRF-TP105-W	14 Jun 2024		ES2419619	Normal	-	-	-	-	-

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#15 Stabilised pH reading taken during groundwater purging prior to sampling.

								Monocyclic Aromatic Hydrocarbons (MAHs)																			
	Nitrite (as N)	Nitrogen (Organic)	Nitrogen (Total)	Potassium (filtered)	Sodium (filtered)	Sulfate as SO4 - Turbidimetric (filtered)	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	tert-butylbenzene	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,2,3-trichloropropane	1,2-dibromo-3-chloropropane	1,2-dichloroethane	1,2-dichloropropane	1,3-dichloropropane
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.02	0.2	0.2	1	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
PFAS NEMP (2020) Table 1 Recreational Water																									
PFAS NEMP (2020) Table 5 Interim Marine 99%																									
Table 1A(4) HSLs Groundwater, Commercial Industrial - Clay Soils																									
Dutch Intervention Guideline (RIVM, 2000)																									
NHMRC (2008) Guidelines for Managing Risks in Recreational Water																									
ANZG (2018) Marine water 99% toxicant DGVs																									
ANZG (2018) Marine water 95% toxicant DGVs									**30**							**270**		**1900**	**900**	**1,100**					
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**																						
WRRF-BH-102	WRRF-BH102_090724	09 Jul 2024	16:30:00	ES2422636	Normal	-	-	-	**5**	**2,480**	**1,250**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-103	WRRF-BH103_080724	08 Jul 2024	16:37:00	ES2422479	Normal	-	-	-	**5**	**2,730**	**782**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-104	WRRF-BH104_110724	11 Jul 2024	10:42:00	ES2422918	Normal	-	-	-	**2**	**758**	**303**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-105	WRRF-BH105_120724	12 Jul 2024	12:55:00	ES2423129	Normal	-	-	-	**18**	**3,980**	**838**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-106	WRRF-BH106_110724	11 Jul 2024	13:12:00	ES2422918	Normal	-	-	-	**8**	**1,510**	**2,160**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024	10:20:00	ES2422636	Normal	-	-	-	**6**	**2,430**	**835**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-107	WRRF-GW107_120724	12 Jul 2024	8:55:00	ES2423129	Normal	-	-	-	**7**	**2,990**	**968**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-108	WRRF-GW108_090724	09 Jul 2024	13:35:00	ES2422636	Normal	-	-	-	**5**	**4,290**	**949**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-109	WRRF-GW109_090724	09 Jul 2024	14:49:00	ES2422636	Normal	-	-	-	**6**	**1,490**	**464**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-110	WRRF-GW110_080724	08 Jul 2024	15:00:00	ES2422479	Normal	-	-	-	**10**	**3,970**	**896**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-111	WRRF-GW111_100724	10 Jul 2024	10:25:00	ES2422785	Normal	-	-	-	**8**	**4,120**	**745**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	15:22:00	ES2423129	Normal	-	-	-	**34**	**1,820**	**140**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-DS1_120724	12 Jul 2024	13:33:00	ES2423129	Field_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-SR1-120724	12 Jul 2024	13:33:00	1119942	Interlab_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-GW113_120724	12 Jul 2024	13:33:00	ES2423129	Normal	-	-	-	**13**	**3,720**	**831**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-114	WRRF-GW114_100724	10 Jul 2024	13:25:00	ES2422785, ES2423953	Normal	-	-	-	<1	**585**	**525**	**82**	**54**	**10**	<5	**6**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	15:43:00	ES2422785	Field_D	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	15:43:00	ES2422785	Normal	-	-	-	**29**	**3,540**	**818**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	15:43:00	1117805	Interlab_D	<0.02	<0.2	**0.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	14:58:00	ES2422918	Normal	-	-	-	**13**	**3,800**	**763**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-117	WRRF-GW117_090724	09 Jul 2024	12:35:00	ES2422636	Normal	-	-	-	**4**	**2,200**	**1,850**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-118	WRRF-GW118_100724	10 Jul 2024	10:50:00	ES2422785	Normal	-	-	-	**8**	**3,460**	**1,280**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-TP-105	WRRF-TP105-W	14 Jun 2024		ES2419619	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments

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#13 Reported Analyte LOR is higher than Requested Analyte LOR

#14 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#15 Stabilised pH reading taken during groundwater purging prior to sampling.

	Chlorinated Hydrocarbons																	Volatile Organic Compounds (VOCs)							
	2,2-dichloropropane	Bromodichloromethane	Bromoform	Carbon tetrachloride	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	Dibromomethane	Hexachlorobutadiene	Trichloroethene (TCE)	Tetrachloroethene (PCE)	trans-1,2-dichloroethene	trans-1,3-dichloropropene	Vinyl chloride	1,1-dichloropropene	cis-1,4-Dichloro-2-butene	Pentachloroethane	Styrene	trans-1,4-Dichloro-2-butene	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	5	5	5	5	5	50	5	50	5	5	5	5	5	5	5	5	50	5	5	5	5	5	5	5	5
PFAS NEMP (2020) Table 1 Recreational Water																									
PFAS NEMP (2020) Table 5 Interim Marine 99%																									
Table 1A(4) HSLs Groundwater, Commercial Industrial - Clay Soils																									
Dutch Intervention Guideline (RIVM, 2000)																									
NHMRC (2008) Guidelines for Managing Risks in Recreational Water																									
ANZG (2018) Marine water 99% toxicant DGVs							**370**																	**20**	
ANZG (2018) Marine water 95% toxicant DGVs													**330**	**70**			**100**			**80**					

Location Code	Field ID	Date	Time	Lab Report Number	Sample Type																						
WRRF-BH-102	WRRF-BH102_090724	09 Jul 2024	16:30:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-103	WRRF-BH103_080724	08 Jul 2024	16:37:00	ES2422479	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-104	WRRF-BH104_110724	11 Jul 2024	10:42:00	ES2422918	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-105	WRRF-BH105_120724	12 Jul 2024	12:55:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-106	WRRF-BH106_110724	11 Jul 2024	13:12:00	ES2422918	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024	10:20:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-107	WRRF-GW107_120724	12 Jul 2024	8:55:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-108	WRRF-GW108_090724	09 Jul 2024	13:35:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-109	WRRF-GW109_090724	09 Jul 2024	14:49:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-110	WRRF-GW110_080724	08 Jul 2024	15:00:00	ES2422479	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-111	WRRF-GW111_100724	10 Jul 2024	10:25:00	ES2422785	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	15:22:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-DS1_120724	12 Jul 2024	13:33:00	ES2423129	Field_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-SR1-120724	12 Jul 2024	13:33:00	1119942	Interlab_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-GW113_120724	12 Jul 2024	13:33:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-114	WRRF-GW114_100724	10 Jul 2024	13:25:00	ES2422785, ES2423953	Normal	<5	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	<5	<5	<5	<50	<5	<5	<5	<5	<5	<5	<5	<5
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	15:43:00	ES2422785	Field_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	15:43:00	ES2422785	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	15:43:00	1117805	Interlab_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	14:58:00	ES2422918	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-117	WRRF-GW117_090724	09 Jul 2024	12:35:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-118	WRRF-GW118_100724	10 Jul 2024	10:50:00	ES2422785	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-TP-105	WRRF-TP105-W	14 Jun 2024		ES2419619	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments

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#14 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#15 Stabilised pH reading taken during groundwater purging prior to sampling.

						Halogenated Benzenes						Halogenated Hydrocarbons					Solvents				
						1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene	Bromobenzene	Chlorobenzene	1,2-dibromoethane	Bromomethane	Dichlorodifluoromethane	Iodomethane	Trichlorofluoromethane	Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Carbon disulfide	Vinyl acetate
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						5	5	5	5	5	5	5	50	50	5	50	50	50	50	5	50
PFAS NEMP (2020) Table 1 Recreational Water																					
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Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**																
WRRF-BH-102	WRRF-BH102_090724	09 Jul 2024	16:30:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-103	WRRF-BH103_080724	08 Jul 2024	16:37:00	ES2422479	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-104	WRRF-BH104_110724	11 Jul 2024	10:42:00	ES2422918	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-105	WRRF-BH105_120724	12 Jul 2024	12:55:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-BH-106	WRRF-BH106_110724	11 Jul 2024	13:12:00	ES2422918	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024	10:20:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-107	WRRF-GW107_120724	12 Jul 2024	8:55:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-108	WRRF-GW108_090724	09 Jul 2024	13:35:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-109	WRRF-GW109_090724	09 Jul 2024	14:49:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-110	WRRF-GW110_080724	08 Jul 2024	15:00:00	ES2422479	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-111	WRRF-GW111_100724	10 Jul 2024	10:25:00	ES2422785	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	15:22:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-DS1_120724	12 Jul 2024	13:33:00	ES2423129	Field_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-SR1-120724	12 Jul 2024	13:33:00	1119942	Interlab_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-113	WRRF-GW113_120724	12 Jul 2024	13:33:00	ES2423129	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-114	WRRF-GW114_100724	10 Jul 2024	13:25:00	ES2422785, ES2423953	Normal	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	<5	<50
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	15:43:00	ES2422785	Field_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	15:43:00	ES2422785	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	15:43:00	1117805	Interlab_D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	14:58:00	ES2422918	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-117	WRRF-GW117_090724	09 Jul 2024	12:35:00	ES2422636	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-118	WRRF-GW118_100724	10 Jul 2024	10:50:00	ES2422785	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-TP-105	WRRF-TP105-W	14 Jun 2024		ES2419619	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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#10 Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

#11 Moderate reliability. Ammonia as total ammonia, measured as [NH3-N] at pH 8.

#12 High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

#13 Reported Analyte LOR is higher than Requested Analyte LOR

#14 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#15 Stabilised pH reading taken during groundwater purging prior to sampling.

Data Table E - Groundwater Analytical Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, River Release Pipeline

		Nutrients	Metals										Inorganics																Physiochemical parameters				TRH - NEP		
		Phosphorus total (as P)	Arsenic (filtered)	Cadmium (filtered)	Chromium (hexavalent) (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Lead (filtered)	Magnesium (filtered)	Mercury (filtered)	Nickel (filtered)	Zinc (filtered)	Soluble Carbonate as CaCO3*	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Ammonia as N	Anions Total	Bicarbonate Alkalinity as CaCO3	Calcium (filtered)	Cations Total	Chloride	Ionic Balance	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Nitrogen (Organic)	Nitrogen (Total)	Potassium (filtered)	Sodium (filtered)	Sulfate as SO4 - Turbidimetric (filtered)	pH (Lab)	pH (Final)	pH (Initial)	pH (after HCL)	TRH >C6 - C10	TRH >C10 - C16	TRH >C16 - C34
		mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	mg/L	meq/L	mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH Units	pH Units	pH Units	pH Units	µg/L	µg/L	µg/L
EQL		0.01	1	0.1	5	1	1	1	1,000	0.1	1	5	1	1	1	0.01	0.01	1	1	0.01	1	0.01	0.2	0.01	0.01	0.01	0.2	0.2	1	1	1	0.01	0.1	0.1	0.1	20	50	100
Dutch Intervention (2000)			**60**	**6**		**30**	**75**	**75**		**0.3**	**75**	**800**																										
PFAS NEMP 2020 Table 1 Recreational Water																																					
PFAS NEMP 2020 Table 5 Freshwater 99%																																					
NHMRC Guidelines for Managing Risks in Recreational Water 2008			**7**	**2**	**50**		**2,000**	**10**		**1**	**20**																				**6.5-8.5**						
NEPM 2013 Table 1A(4) HSL C GW, Clay for Vapour Intrusion																																					
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																																					
ANZG (2018) Marine water 99% toxicant DGVs				**0.7**	**0.14**		**0.3**	**2.2**		**0.1**	**7**	**7**				**0.5**																						
ANZG (2018) Marine water 95% toxicant DGVs				**5.5**	**4.4**		**1.3**	**4.4**		**0.4**	**70**	**15**				**0.91**																						
Location Code	**Field ID**	**Date**	**Lab Report Number**	**Sample Type**	**Sample Code**																																
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	-	**1**	**11.0**	<10	**2**	**63**	**1**	**39,000**	<0.1	**1,880**	**209**	<1	<1	<1	**0.08**	**21.1**	<1	**10**	**18.9**	**550**	**5.45**	-	<0.01	<0.01	<0.01	-	-	**1**	**349**	**268**	-	-	-	-	<20	**230**	<100
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RRP-BH-108	RRP-BH-108_250228	28 Feb 2025	ES2505870	Normal	ES2505870005	-	<1	**0.4**	<10	<1	<1	<1	**316,000**	<0.1	**12**	**31**	<1	<1	**317**	**0.22**	**210**	**317**	**108**	**199**	**6,680**	**2.76**	-	**0.18**	**0.17**	**0.01**	-	-	**67**	**3,820**	**760**	-	-	-	-	<20	<100	<100
RRP-BH-119	RRP-BH-119_250227	27 Feb 2025	ES2505698	Normal	ES2505698002	-	<10[#1]	<1.0[#1]	<10	<10[#1]	<10[#1]	<10[#1]	**1,960,000**	<0.1	**15**	<50[#1]	<1	<1	**847**	**32.0**	**814**	**847**	**852**	**868**	**25,500**	**3.24**	-	<0.01	<0.01	<0.01	-	-	**475**	**15,000**	**3,730**	-	-	-	-	<20	<100	<100
RRP-BH-119	RRP-QC01_250227	27 Feb 2025	ES2505698	Field_D	ES2505698001	-	<10[#1]	<1.0[#1]	<10	<10[#1]	<10[#1]	<10[#1]	-	<0.1	**17**	<50[#1]	-	-	-	**5.37**	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	<20	<100	<100
RRP-BH-119	RRP-QC02_250227	27 Feb 2025	1194412	Interlab_D	S25-Ma0007746	**0.11**	<10	<2	<5	<10	<10	<10	-	<1	**15**	<50	-	-	-	**4.6**	-	-	-	-	-	-	**6.7**	<0.05	<0.02	<0.02	**2.1**	**6.7**	-	-	-	-	-	-	<20	**50**	<100
RRP-BH-124	RRP-BH-124_250227	27 Feb 2025	ES2505698	Normal	ES2505698004	-	**3**	<0.1	<10	<1	<1	<1	**358,000**	<0.1	**3**	**6**	<1	<1	**1,420**	**20.5**	**212**	**1,420**	**489**	**194**	**6,430**	**4.25**	-	<0.01	<0.01	<0.01	-	-	**102**	**3,170**	**90**	-	-	-	-	<20	<100	<100
RRP-BH-128	RRP-BH-128_250227	27 Feb 2025	ES2505698	Normal	ES2505698003	-	<10[#1]	<1.0[#1]	<10	<10[#1]	<10[#1]	<10[#1]	**1,050,000**	<0.1	<10[#1]	<50[#1]	<1	<1	**470**	**1.41**	**504**	**470**	**480**	**481**	**15,400**	**2.32**	-	**0.02**	**0.02**	<0.01	-	-	**262**	**8,360**	**2,870**	-	-	-	-	<20	<100	<100
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	ES2423129	Normal	ES2423129003	-	**5**	<0.1	<10	**1**	<1	<1	**238,000**	<0.1	**7**	**31**	<1	<1	**177**	-	**121**	**177**	**119**	**106**	**4,050**	**6.69**	-	-	-	-	-	-	**34**	**1,820**	**140**	**6.34**	-	-	-	**30**	**440**	**630**
WRRF-GW-112	WRRF-GW-112_241211	11 Dec 2024	ES2440620	Normal	ES2440620001	-	**7**	<0.1	<10	<1	<1	<1	**68,000**	<0.1	**1**	**6**	<1	<1	**187**	-	**39.6**	**187**	**126**	**37.1**	**760**	**3.34**	-	-	-	-	-	-	**15**	**570**	**694**	-	-	-	-	<20	**340**	**1,040**
WRRF-GW-112	WRRF-GW-112_250218	18 Feb 2025	ES2504633	Normal	ES2504633006	-	**9**	<0.1	<10	**1**	<1	<1	**100,000**	<0.1	<1	<5	<1	<1	**273**	-	**50.7**	**273**	**117**	**52.9**	**1,350**	**2.19**	-	-	-	-	-	-	**20**	**882**	**343**	-	-	-	-	<20	**890**	**3,000**
WRRF-GW-112	WRRF-GW-112_270924	27 Sep 2024	ES2431767	Normal	ES2431767002	-	**1**	<0.1	<10	<1	<1	<1	**37,000**	<0.1	**1**	**5**	<1	<1	**96**	-	**24.9**	**96**	**126**	**23.4**	**360**	**3.17**	-	-	-	-	-	-	**8**	**318**	**616**	-	-	-	-	<20	**130**	**590**
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	ES2422785	Field_D	ES2422785005	-	<1	**0.2**	<10	<1	<1	<1	-	<0.1	**55**	**395**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<100	<100
WRRF-GW-115	WRRF-GW115_2.0-2.45	26 Jun 2024	ES2423649	Normal	ES2423649013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5.0**	**7.4**	**1.5**	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	ES2422785	Normal	ES2422785004	-	<1	**0.2**	<10	<1	<1	<1	**480,000**	<0.1	**54**	**394**	<1	<1	**140**	-	**217**	**140**	**409**	**215**	**6,980**	**0.48**	-	-	-	-	-	-	**29**	**3,540**	**818**	**6.38**	-	-	-	<20	<100	<100
WRRF-GW-115	WRRF-GW-115_241213	13 Dec 2024	ES2440990	Normal	ES2440990006	-	**6**	<0.1	<10	<1	<1	<1	**519,000**	<0.1	**92**	**281**	<1	<1	**33**	-	**228**	**33**	**258**	**204**	**7,140**	**5.57**	-	-	-	-	-	-	**24**	**3,390**	**1,230**	-	-	-	-	<20	<100	<100
WRRF-GW-115	WRRF-GW-115_250220	20 Feb 2025	ES2504948	Normal	ES2504948006	-	**5**	<0.1	<10	<1	<1	<1	**540,000**	<0.1	**91**	**67**	<1	<1	**67**	-	**217**	**67**	**233**	**206**	**6,980**	**2.54**	-	-	-	-	-	-	**23**	**3,440**	**903**	-	-	-	-	<20	<100	<100
WRRF-GW-115	WRRF-GW-115_270924	27 Sep 2024	ES2431767	Normal	ES2431767003	-	**2**	<0.1	<10	<1	<1	<1	**540,000**	<0.1	**80**	**179**	<1	<1	**112**	-	**204**	**112**	**269**	**213**	**6,490**	**2.13**	-	-	-	-	-	-	**27**	**3,560**	**922**	-	-	-	-	<20	<100	<100
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	1117805	Interlab_D	S24-Jl0035985	**0.02**	<1	**0.3**	**14**	<1	<1	<1	-	<0.1	**50**	**400**	-	-	-	**1.3**	-	-	-	-	-	-	**0.9**	<0.05	<0.02	<0.02	<0.2	**0.9**	-	-	-	-	-	-	<20	<50	<100
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	ES2422918	Normal	ES2422918006	-	**1**	**0.7**	<10	<1	**9**	**7**	**467,000**	<0.1	**56**	**501**	<1	<1	**1**	-	**214**	**1**	**89**	**208**	**7,020**	**1.28**	-	-	-	-	-	-	**13**	**3,800**	**763**	-	-	-	-	**300**	**320**	<100
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405001	-	**3**	**0.4**	<10	**2**	**8**	**12**	**410,000**	<0.1	**70**	**481**	<1	<1	**3**	-	**230**	**3**	**65**	**188**	**7,520**	**9.97**	-	-	-	-	-	-	**9**	**3,470**	**847**	-	-	-	-	**360**	**450**	<100
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_250219	19 Feb 2025	ES2504806	Normal	ES2504806005	-	**2**	**0.2**	<10	**2**	**8**	**10**	**415,000**	<0.1	**59**	**421**	<1	<1	**4**	-	**178**	**4**	**62**	**189**	**5,780**	**2.98**	-	-	-	-	-	-	**9**	**3,490**	**731**	-	-	-	-	**440**	**1,040**	**220**
WRRF-GW-116	WRRF-GW-116_270924	27 Sep 2024	ES2431767	Normal	ES2431767005	-	**2**	**0.3**	<10	<1	**10**	**14**	**462,000**	<0.1	**83**	**490**	<1	<1	<1	-	**209**	<1	**56**	**200**	**6,770**	**2.07**	-	-	-	-	-	-	**10**	**3,660**	**854**	-	-	-	-	**290**	**140**	<100

Comments
#1 Reported Analyte LOR is higher than Requested Analyte LOR
#2 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.
#3 Moderate
#4 Severe

Data Table E - Groundwater Analytical Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, River Release Pipeline

	M 2013 Fractions				TPH - NEPM 1999 Fractions					Polycyclic aromatic hydrocarbons (PAHs)																		Monocyclic Aromatic Hydrocarbons (MAHs)															
	TRH >C34 - C40	TRH >C10 - C40 (Sum of total)	TRH >C6 - C10 less BTEX (F1)	TRH >C10 - C16 less Naphthalene (F2)	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C36 (Sum of total)	Naphthalene (value used in F2 calc)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(k)fluoranthene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(a) pyrene	Benzo(a)pyrene TEQ calc (zero)	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	Naphthalene	PAHs (Sum of total)	PAHs (Vic EPA List)	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	tert-butylbenzene	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	100	100	20	50	20	50	100	50	50	5	1	1	1	1	1	1	1	0.5	0.5	1	1	1	1	1	1	1	0.5	1	1	1	1	5	5	5	5	1	1	1	2	1	2
Dutch Intervention (2000)													**5**	**0.5**	**0.05**		**0.05**	**0.05**		**0.2**		**1**		**0.05**	**5**		**70**										**30**	**1,000**	**150**			**70**
PFAS NEMP 2020 Table 1 Recreational Water																																										
PFAS NEMP 2020 Table 5 Freshwater 99%																																										
NHMRC Guidelines for Managing Risks in Recreational Water 2008																		**0.01**																			**1**	**800**	**300**			**600**
NEPM 2013 Table 1A(4) HSL C GW, Clay for Vapour Intrusion																																										
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																																					**30,000 | 30,000 | 35,000**					
ANZG (2018) Marine water 99% toxicant DGVs																											**50**										**500**					
ANZG (2018) Marine water 95% toxicant DGVs																											**70**										**700**					
Location Code	**Field ID**	**Date**	**Lab Report Number**	**Sample Type**	**Sample Code**																																						
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	<100	**230**	<20	**220**	<20	**100**	**240**	<50	**340**	**13**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	**8.2**	**8.2**	-	**5**	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	**3**	**3**
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	-	-	-	-	-	-	-	-	-	**14**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RRP-BH-108	RRP-BH-108_250228	28 Feb 2025	ES2505870	Normal	ES2505870005	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	<2	<2
RRP-BH-119	RRP-BH-119_250227	27 Feb 2025	ES2505698	Normal	ES2505698002	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	<2	<2
RRP-BH-119	RRP-QC01_250227	27 Feb 2025	ES2505698	Field_D	ES2505698001	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	**3**	<2	<2	<2	<2
RRP-BH-119	RRP-QC02_250227	27 Feb 2025	1194412	Interlab_D	S25-Ma0007746	<100	<100	<20	**50**	<20	<50	<100	<100	<100	<10	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	**1**	-	**1**	<1	<1	<1	-	-	-	<1	**3**	<1	<2	<1	<3
RRP-BH-124	RRP-BH-124_250227	27 Feb 2025	ES2505698	Normal	ES2505698004	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	<2	<2
RRP-BH-128	RRP-BH-128_250227	27 Feb 2025	ES2505698	Normal	ES2505698003	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	<2	<2
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	ES2423129	Normal	ES2423129003	<100	**1,070**	**30**	**420**	**20**	**210**	**760**	<50	**970**	**24**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	**2.3**	<1.0	**1.5**	<1.0	**4.0**	**7.8**	-	-	-	-	-	-	-	-	<1	<2	<2	<2	<2	<2
WRRF-GW-112	WRRF-GW-112_241211	11 Dec 2024	ES2440620	Normal	ES2440620001	<100	**1,380**	<20	**340**	<20	**180**	**1,160**	**60**	**1,400**	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	**2.1**	<1.0	<1.0	<1.0	<1.0	**2.1**	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	<2	<2
WRRF-GW-112	WRRF-GW-112_250218	18 Feb 2025	ES2504633	Normal	ES2504633006	<100	**3,890**	<20	**890**	<20	**520**	**3,000**	**420**	**3,940**	<5	<1.0	<1.0	**1.2**	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	**3.6**	<1.0	**3.8**	<1.0	<1.0	**8.6**	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	<2	<2
WRRF-GW-112	WRRF-GW-112_270924	27 Sep 2024	ES2431767	Normal	ES2431767002	<100	**720**	<20	**130**	<20	**90**	**670**	<50	**760**	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**1.4**	**1.4**	-	-	-	-	-	-	-	-	-	<1	<2	<2	<2	<2	<2
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	ES2422785	Field_D	ES2422785005	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	-	-	-	-	-	-	-	-	<1	<2	<2	<2	<2	<2
WRRF-GW-115	WRRF-GW115_2.0-2.45	26 Jun 2024	ES2423649	Normal	ES2423649013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	ES2422785	Normal	ES2422785004	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	-	-	-	-	-	-	-	-	<1	<2	<2	<2	<2	<2
WRRF-GW-115	WRRF-GW-115_241213	13 Dec 2024	ES2440990	Normal	ES2440990006	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	**2**	<2	<2	<2	<2
WRRF-GW-115	WRRF-GW-115_250220	20 Feb 2025	ES2504948	Normal	ES2504948006	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	<5	<5	<5	<5	<5	<5	<5	<5	<1	<2	<2	<2	<2	<2
WRRF-GW-115	WRRF-GW-115_270924	27 Sep 2024	ES2431767	Normal	ES2431767003	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	-	-	-	-	-	-	-	-	<1	<2	<2	<2	<2	<2
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	1117805	Interlab_D	S24-Jl0035985	<100	<100	<20	<50	<20	<50	<100	<100	<100	<10	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<3
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	ES2422918	Normal	ES2422918006	<100	**320**	**270**	**320**	**220**	**310**	**190**	<50	**500**	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	-	-	-	-	-	-	-	-	-	**1**	<2	**25**	<2	<2	<2
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405001	<100	**450**	**180**	**430**	**350**	**410**	**170**	<50	**580**	**16**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**9.4**	**9.4**	-	**20**	**14**	**6**	<5	<5	<5	<5	<5	**135**	<2	**34**	**9**	**6**	**15**
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**139**	-	**37**	**10**	**7**	-
WRRF-GW-116	WRRF-GW-116_250219	19 Feb 2025	ES2504806	Normal	ES2504806005	<100	**1,260**	**240**	**1,020**	**390**	**920**	**460**	<50	**1,380**	**25**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**17.9**	**17.9**	-	**33**	**28**	**9**	<5	**5**	<5	<5	<5	**121**	<2	**49**	**24**	**8**	**32**
WRRF-GW-116	WRRF-GW-116_270924	27 Sep 2024	ES2431767	Normal	ES2431767005	<100	**140**	**150**	**130**	**270**	**160**	<100	<50	**160**	**10**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**6.7**	**6.7**	-	-	-	-	-	-	-	-	-	**104**	<2	**26**	**6**	**5**	**11**

Comments
#1 Reported Analyte LOR is higher than Requested Analyte LOR
#2 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the
#3 Moderate
#4 Severe

Data Table E - Groundwater Analytical Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, River Release Pipeline

| | | |

Data Table E - Groundwater Analytical Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, River Release Pipeline

					Solvents							Volatile Organic Compounds (VOCs)						Per- and Poly-fluoroalkyl Substances (PFAS)											(n:2) Fluorotelomer Sulfonic Acids									
					Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Acetone	Allyl chloride	Carbon disulfide	Vinyl acetate	1,1-dichloropropene	cis-1,4-Dichloro-2-butene	Pentachloroethane	Styrene	trans-1,4-Dichloro-2-butene	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluoro-n-pentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanoic acid (PFHpA)	Perfluorobutanesulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	Sum (PFHxS + PFOS)	Sum of PFAS (enHealth) (PFHxS + PFOS + PFOA)	Sum of US EPA PFAS (PFOS + PFOA)	Sum of WA DWER PFAS (n=10)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	3- & 4-Methylphenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,4-dimethylphenol	2,4-dinitrophenol	2,6-dichlorophenol	2-chlorophenol	2-methylphenol
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					5	50	5	5	1	1	50	5	5	5	1	5	0.0001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.002	0.0002	0.001	0.001	0.0002	0.001	0.001	0.001	0.001	6	1	1	1	1	30	1	1	1
Dutch Intervention (2000)															**300**																								
PFAS NEMP 2020 Table 1 Recreational Water																		**10**							**2**														
PFAS NEMP 2020 Table 5 Freshwater 99%																	**0.00023**	**19**																					
NHMRC Guidelines for Managing Risks in Recreational Water 2008															**30**																								
NEPM 2013 Table 1A(4) HSL C GW, Clay for Vapour Intrusion																																							
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																																							
ANZG (2018) Marine water 99% toxicant DGVs																																							
ANZG (2018) Marine water 95% toxicant DGVs																																							
Location Code	**Field ID**	**Date**	**Lab Report Number**	**Sample Type**	**Sample Code**																																			
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**1.91**	**0.362**	**0.122**	**0.489**	**1.90**	**0.130**	**0.362**	**0.176**	**3.81**	-	-	**5.45**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RRP-BH-108	RRP-BH-108_250228	28 Feb 2025	ES2505870	Normal	ES2505870005	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0078**	**0.0086**	**0.0236**	**0.0130**	**0.0064**	**0.0016**	<0.0005	**0.0118**	**0.0142**	-	-	**0.0748**	<0.001	**0.002**	<0.001	<0.001	-	-	-	-	-	-	-	-
RRP-BH-119	RRP-BH-119_250227	27 Feb 2025	ES2505698	Normal	ES2505698002	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0106**	**0.0047**	<0.0005	**0.0110**	**0.0041**	**0.0014**	<0.0005	<0.0020	**0.0147**	-	-	**0.0328**	<0.001	**0.001**	<0.001	<0.001	-	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0
RRP-BH-119	RRP-QC01_250227	27 Feb 2025	ES2505698	Field_D	ES2505698001	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0065**	**0.0022**	<0.0005	**0.0064**	**0.0027**	**0.0007**	<0.0005	<0.0020	**0.0092**	-	-	**0.0185**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
RRP-BH-119	RRP-QC02_250227	27 Feb 2025	1194412	Interlab_D	S25-Ma0007746	<5	-	<5	<5	<1	<1	-	-	-	<1	-	**0.0096**[#2]	**0.003**[#2]	-	-	**0.003**[#2]	-	-	-	**0.0126**	**0.0156**	**0.0126**	-	-	<0.005	-	-	<6	<10	<10	<3	<3	<30	<3	<3	<3
RRP-BH-124	RRP-BH-124_250227	27 Feb 2025	ES2505698	Normal	ES2505698004	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0003**	<0.0005	**0.0014**	**0.0017**	<0.0005	<0.0005	**0.0013**	<0.0020	**0.0003**	-	-	**0.0047**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
RRP-BH-128	RRP-BH-128_250227	27 Feb 2025	ES2505698	Normal	ES2505698003	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0060**	**0.0007**	<0.0005	<0.0005	**0.0011**	<0.0005	<0.0005	<0.0020	**0.0071**	-	-	**0.0078**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	ES2423129	Normal	ES2423129003	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW-112_241211	11 Dec 2024	ES2440620	Normal	ES2440620001	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0284**	**0.0457**	<0.0005	**0.0212**	**0.0476**	**0.0287**	<0.0005	<0.0020	**0.0760**	-	-	**0.179**	<0.001	**0.003**	**0.004**	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW-112_250218	18 Feb 2025	ES2504633	Normal	ES2504633006	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0152**	**0.0103**	<0.0016[#1]	**0.0134**	**0.0770**	**0.0212**	<0.0016[#1]	<0.0080[#1]	**0.0922**	-	-	**0.137**	<0.002[#1]	<0.002[#1]	<0.002[#1]	<0.002[#1]	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW-112_270924	27 Sep 2024	ES2431767	Normal	ES2431767002	-	-	-	-	-	-	-	-	-	-	-	**0.0482**	**0.0285**	**0.0574**	**0.0488**	**0.0650**	**0.0314**	<0.0005	<0.0020	**0.113**	-	-	**0.288**	<0.001	**0.003**	**0.006**	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	ES2422785	Field_D	ES2422785005	-	-	-	-	-	-	-	-	-	-	-	**0.08**	**0.03**	<0.02	<0.02	**0.04**	<0.02	<0.02	<0.1	**0.12**	-	-	**0.15**	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_2.0-2.45	26 Jun 2024	ES2423649	Normal	ES2423649013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	ES2422785	Normal	ES2422785004	-	-	-	-	-	-	-	-	-	-	-	**0.08**	**0.03**	<0.02	<0.02	**0.04**	**0.02**	<0.02	<0.1	**0.12**	-	-	**0.17**	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW-115_241213	13 Dec 2024	ES2440990	Normal	ES2440990006	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0911**	**0.0278**	<0.0005	**0.0404**	**0.0514**	**0.0210**	**0.0128**	**0.0061**	**0.142**	-	-	**0.264**	<0.001	**0.004**	**0.009**	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW-115_250220	20 Feb 2025	ES2504948	Normal	ES2504948006	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0824**	**0.0198**	**0.0127**	**0.0315**	**0.0368**	**0.0153**	**0.0062**	**0.0072**	**0.119**	-	-	**0.220**	<0.001	**0.002**	**0.006**	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW-115_270924	27 Sep 2024	ES2431767	Normal	ES2431767003	-	-	-	-	-	-	-	-	-	-	-	**0.0454**	**0.0165**	**0.0082**	**0.0171**	**0.0269**	**0.0112**	**0.0047**	<0.0020	**0.0723**	-	-	**0.135**	<0.001	**0.002**	**0.003**	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	1117805	Interlab_D	S24-Jl0035985	-	-	-	-	-	-	-	-	-	-	-	**0.07**[#2]	**0.03**[#2]	-	-	**0.05**[#2]	-	-	-	**0.12**	**0.15**	**0.1**	-	-	<0.05	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	ES2422918	Normal	ES2422918006	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405001	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0073**	**0.0033**	**0.0097**	**0.0130**	**0.0159**	**0.0029**	**0.0025**	<0.0020	**0.0232**	-	-	**0.0596**	<0.001	**0.005**	<0.001	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_250219	19 Feb 2025	ES2504806	Normal	ES2504806005	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	**0.0219**	**0.0169**	**0.0550**	**0.0596**	**0.0682**	**0.0199**	**0.0130**	**0.0214**	**0.0901**	-	-	**0.278**	<0.001	**0.002**	<0.001	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_270924	27 Sep 2024	ES2431767	Normal	ES2431767005	-	-	-	-	-	-	-	-	-	-	-	**0.0053**	**0.0010**	<0.0005	**0.0008**	**0.0022**	**0.0005**	<0.0005	<0.0020	**0.0075**	-	-	**0.0098**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-

Comments
#1 Reported Analyte LOR is higher than Requested Analyte LOR
#2 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the
#3 Moderate
#4 Severe

Data Table E - Groundwater Analytical Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, River Release Pipeline

	Phenols															Leach Preparation	Exposure Classification		EPA 621 Classification of Wastes	
	2-nitrophenol	4,6-Dinitro-2-methylphenol	4,6-Dinitro-o-cyclohexyl phenol	4-chloro-3-methylphenol	4-nitrophenol	3&4-Methylphenol (m&p-cresol)	Cresol Total	Dinoseb	Pentachlorophenol	Phenol	Phenolics Total	Tetrachlorophenols	Phenols (Total Halogenated)	Phenols (Total Non Halogenated)	TCLP Fluid	Concrete Piles	Steel Piles	Vic EPA IWRG 621 CHC (Total)*	Vic EPA IWRG 621 Other CHC (Total)*
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	-	-	-	µg/L	µg/L
EQL	1	30	100	1	30	2	10	100	2	1	50	30	10	100	1			5	5
Dutch Intervention (2000)							**200**		**3**	**2,000**		**10**							
PFAS NEMP 2020 Table 1 Recreational Water																			
PFAS NEMP 2020 Table 5 Freshwater 99%																			
NHMRC Guidelines for Managing Risks in Recreational Water 2008									**10**										
NEPM 2013 Table 1A(4) HSL C GW, Clay for Vapour Intrusion																			
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																			
ANZG (2018) Marine water 99% toxicant DGVs									**11**	**270**									
ANZG (2018) Marine water 95% toxicant DGVs									**22**	**400**									

Location Code	Field ID	Date	Lab Report Number	Sample Type	Sample Code																	
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-
RRP-BH-102	RRP-BH-102_250228	28 Feb 2025	ES2505870	Normal	ES2505870004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RRP-BH-108	RRP-BH-108_250228	28 Feb 2025	ES2505870	Normal	ES2505870005	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-
RRP-BH-119	RRP-BH-119_250227	27 Feb 2025	ES2505698	Normal	ES2505698002	<1.0	-	-	<1.0	-	<2.0	-	-	<2.0	<1.0	-	-	-	-	-	-	-	-	-
RRP-BH-119	RRP-QC01_250227	27 Feb 2025	ES2505698	Field_D	ES2505698001	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-
RRP-BH-119	RRP-QC02_250227	27 Feb 2025	1194412	Interlab_D	S25-Ma0007746	<10	<30	<100	<10	<30	-	<10	<100	<10	<3	-	<30	<10	<100	-	-	-	<5	<5
RRP-BH-124	RRP-BH-124_250227	27 Feb 2025	ES2505698	Normal	ES2505698004	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-
RRP-BH-128	RRP-BH-128_250227	27 Feb 2025	ES2505698	Normal	ES2505698003	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW112_120724	12 Jul 2024	ES2423129	Normal	ES2423129003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**[#3]	**1**[#4]	-	-
WRRF-GW-112	WRRF-GW-112_241211	11 Dec 2024	ES2440620	Normal	ES2440620001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW-112_250218	18 Feb 2025	ES2504633	Normal	ES2504633006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-112	WRRF-GW-112_270924	27 Sep 2024	ES2431767	Normal	ES2431767002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-DS1_100724	10 Jul 2024	ES2422785	Field_D	ES2422785005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW115_2.0-2.45	26 Jun 2024	ES2423649	Normal	ES2423649013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**	-	-	-	-
WRRF-GW-115	WRRF-GW115_100724	10 Jul 2024	ES2422785	Normal	ES2422785004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**[#3]	**1**[#4]	-	-
WRRF-GW-115	WRRF-GW-115_241213	13 Dec 2024	ES2440990	Normal	ES2440990006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW-115_250220	20 Feb 2025	ES2504948	Normal	ES2504948006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-GW-115_270924	27 Sep 2024	ES2431767	Normal	ES2431767003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-115	WRRF-SR1_1007274	10 Jul 2024	1117805	Interlab_D	S24-Jl0035985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW116_110724	11 Jul 2024	ES2422918	Normal	ES2422918006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_241210	10 Dec 2024	ES2440405	Normal	ES2440405001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_250219	19 Feb 2025	ES2504806	Normal	ES2504806005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-116	WRRF-GW-116_270924	27 Sep 2024	ES2431767	Normal	ES2431767005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments
#1 Reported Analyte LOR is higher than Requested Analyte LOR
#2 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the c
#3 Moderate
#4 Severe

Jacobs

Table E - Groundwater Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, Brine

| | | | | | | | | | Nutrients | Metals | | | | | | | | | | | | | | | | | Inorganics | | | | | | | | | | | | | | | | |

																	Physiochemical parameters		Field Parameters												

Jacobs

Table E - Groundwater Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, Brine

							TRH - NEPM 2013 Fractions				TPH - NEPM 1999 Fractions					Polycyclic aromatic hydrocarbons (PAHs)															
							TRH >C34 - C40	TRH >C10 - C40 (Sum of total)	TRH >C6 - C10 less BTEX (F1)	TRH >C10 - C16 less Naphthalene (F2)	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C36 (Sum of total)	Naphthalene (value used in F2 calc)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(k)fluoranthene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(a) pyrene	Benzo(a)pyrene TEQ calc (zero)	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene
							µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL							100	100	20	50	20	50	100	50	50	5	1	1	1	1	1	1	1	0.5	0.5	1	1	1	1	1	1
Dutch Intervention (2000)																			5	0.5	0.05		0.05	0.05		0.2		1		0.05	5
PFAS NEMP 2020 Table 5 Interim Marine 99%																															
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion									**NL | NL | NL [#1]**	**NL | NL | NL [#2]**																				
ANZG (2018) Marine water 99% toxicant DGVs																															
ANZG (2018) Marine water 95% toxicant DGVs																															
Location Code	**Field ID**	**Date**	**Depth**	**Lab Report Number**	**Sample Type**	**Sample Code**																									
INF-BH-102	BIP-DS_250314	14 Mar 2025		ES2507235	Field_D	ES2507235004	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	BIP-SR_250314	14 Mar 2025		1198761	Interlab_D	S25-Ma0038211	<100	<100	<20	<50	<20	<50	<100	<100	<100	<10	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1
	INF-BH-102_250314	14 Mar 2025		ES2507235	Normal	ES2507235003	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024		ES2422636	Normal	ES2422636001	<100	<100	**300**	<100	**590**	**50**	<100	<50	**50**	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	WRRF-GW-101	21 Feb 2025	3.6		Normal	WRRF-GW-101_3.6_202502210157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_240924	24 Sep 2024		ES2431290	Normal	ES2431290004	<100	<100	<20	<100	**100**	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
			3.67		Normal	WRRF-GW-101_3.67_202409240403	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_241211	11 Dec 2024		ES2440620	Normal	ES2440620003	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
			3.7		Normal	WRRF-GW-101__202412110230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250128	28 Jan 2025	3.6		Normal	WRRF-GW-101__202501280828	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250221	21 Feb 2025		ES2505097	Normal	ES2505097007	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WRRF-GW-110	WRRF-GW110	24 Sep 2024	6.8		Normal	WRRF-GW-110_6.8_202409240414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW110_080724	08 Jul 2024		ES2422479	Normal	ES2422479003	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	WRRF-GW-110	18 Feb 2025	6.6		Normal	WRRF-GW-110_6.6_202502181036	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_240924	24 Sep 2024		ES2431290	Normal	ES2431290006	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	WRRF-GW-110_241212	12 Dec 2024		ES2440791	Normal	ES2440791011	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
			5		Normal	WRRF-GW-110_5_202412120230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_250218	18 Feb 2025		ES2504633	Normal	ES2504633001	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	WRRF-QC01_250218	18 Feb 2025		ES2504633	Field_D	ES2504633007	<100	<100	<20	<100	<20	<50	<100	<50	<50	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	WRRF-QC02_250218	18 Feb 2025		1189594	Interlab_D	S25-Fe0047869	<100	<100	<20	<50	<20	<50	<100	<100	<100	<10	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1

Comments
#1 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#2 To obtain F2 subtract naphthalene from the >C10 - C16 fraction.
#3 High reliability
#4 Very high reliability
#5 Low reliability
#6 Moderate reliability. Ammonia as total ammonia, measured as [NH3-N] at pH 8.
#7 Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for sp
#8 Very Low reliability
#9 Moderate reliability
#10 To account for the bioaccumulating nature of this toxicant, it is recommended that the 99% species protection level DGV is used for slightly to moc
#11 High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for specie
#12 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the correspondi
#13 Severe
#14 Moderate

Environmental Standards
Rijkswaterstaat Environment, February 2000, Dutch Intervention (2000)
HEPA, January 2020, PFAS NEMP 2020 Table 5 Interim Marine 99%
NEPM, April 2013, NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion
ANZG, 2018, ANZG (2018) Marine water 99% toxicant DGVs
ANZG, 2018, ANZG (2018) Marine water 95% toxicant DGVs

| | | |

									Chlorinated Hydrocarbons																								
									1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,2,3-trichloropropane	1,2-dibromo-3-chloropropane	1,2-dichloroethane	1,2-dichloropropane	1,3-dichloropropane	2,2-dichloropropane	Bromochloromethane	Bromodichloromethane	Bromoform	Carbon tetrachloride	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	trans-1,2-dichloroethene	trans-1,3-dichloropropene	Dibromomethane	Dichloromethane	Hexachlorobutadiene	Trichloroethene (TCE)	Tetrachloroethene (PCE)
									µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL									1	1	1	1	1	1	5	1	1	1	5	1	1	5	1	1	1	5	5	1	1	1	1	1	5	5	1	1
Dutch Intervention (2000)									300		130	900	10			400						630	10			400						1,000		500	40
PFAS NEMP 2020 Table 5 Interim Marine 99%																																			
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																																			
ANZG (2018) Marine water 99% toxicant DGVs											140[#8]																								
ANZG (2018) Marine water 95% toxicant DGVs											**1,900[#8]**																								
Location Code	**Field ID**	**Date**	**Depth**	**Lab Report Number**	**Sample Type**	**Sample Code**																													
INF-BH-102	BIP-DS_250314	14 Mar 2025		ES2507235	Field_D	ES2507235004	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	-	<5	<5	<5
	BIP-SR_250314	14 Mar 2025		1198761	Interlab_D	S25-Ma0038211	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<5	<5	<5	<1	<1	<1	<1	<1	<5	-	<1	<1
	INF-BH-102_250314	14 Mar 2025		ES2507235	Normal	ES2507235003	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	-	<5	<5	<5
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024		ES2422636	Normal	ES2422636001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101	21 Feb 2025	3.6		Normal	WRRF-GW-101_3.6_202502210157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_240924	24 Sep 2024		ES2431290	Normal	ES2431290004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3.67		Normal	WRRF-GW-101_3.67_202409240403	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_241211	11 Dec 2024		ES2440620	Normal	ES2440620003	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	-	<5	<5	<5
			3.7		Normal	WRRF-GW-101__202412110230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250128	28 Jan 2025	3.6		Normal	WRRF-GW-101__202501280828	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250221	21 Feb 2025		ES2505097	Normal	ES2505097007	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	-	<5	<5	<5
WRRF-GW-110	WRRF-GW110	24 Sep 2024	6.8		Normal	WRRF-GW-110_6.8_202409240414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW110_080724	08 Jul 2024		ES2422479	Normal	ES2422479003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110	18 Feb 2025	6.6		Normal	WRRF-GW-110_6.6_202502181036	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_240924	24 Sep 2024		ES2431290	Normal	ES2431290006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_241212	12 Dec 2024		ES2440791	Normal	ES2440791011	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	-	<5	<5	<5
			5		Normal	WRRF-GW-110_5_202412120230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_250218	18 Feb 2025		ES2504633	Normal	ES2504633001	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	-	<5	<5	<5
	WRRF-QC01_250218	18 Feb 2025		ES2504633	Field_D	ES2504633007	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5	<50	<5	<50	<5	<5	<5	<5	<5	-	<5	<5	<5
	WRRF-QC02_250218	18 Feb 2025		1189594	Interlab_D	S25-Fe0047869	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1	<5	<5	<5	<1	<1	<1	<1	<1	<5	-	<1	<1

Comments

#1 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#2 To obtain F2 subtract naphthalene from the >C10 - C16 fraction.
#3 High reliability
#4 Very high reliability
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#14 Moderate

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ANZG, 2018, ANZG (2018) Marine water 99% toxicant DGVs
ANZG, 2018, ANZG (2018) Marine water 95% toxicant DGVs

Jacobs

Table E - Groundwater Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, Brine

						Halogenated Benzenes									Halogenated Hydrocarbons					Solvents							Volatile Organic Compounds (VOCs)								
						Vinyl chloride	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene	Bromobenzene	Chlorobenzene	1,2-dibromoethane	Bromomethane	Dichlorodifluoromethane	Iodomethane	Trichlorofluoromethane	Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Acetone	Allyl chloride	Carbon disulfide	Vinyl acetate	1,1-dichloropropene	cis-1,4-Dichloro-2-butene	Pentachloroethane	Styrene	trans-1,4-Dichloro-2-butene	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						5	5	5	1	1	1	5	1	1	1	1	5	5	1	5	5	50	5	5	1	1	50	5	5	5	1	5	0.0001	0.0005
Dutch Intervention (2000)						5									180																300			
PFAS NEMP 2020 Table 5 Interim Marine 99%																																	0.00023	19
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																																				
ANZG (2018) Marine water 99% toxicant DGVs								20[#9]																												
ANZG (2018) Marine water 95% toxicant DGVs								**80[#9]**																												
Location Code	**Field ID**	**Date**	**Depth**	**Lab Report Number**	**Sample Type**	**Sample Code**																														
INF-BH-102	BIP-DS_250314	14 Mar 2025		ES2507235	Field_D	ES2507235004	<50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	<0.0002	**0.0026**
	BIP-SR_250314	14 Mar 2025		1198761	Interlab_D	S25-Ma0038211	<5	-	-	<1	<1	<1	-	<1	<1	<1	<1	<5	<5	<1	<5	<5	-	<5	<5	<1	<1	-	-	-	-	<1	-	**0.0004**	**0.003[#12]**
	INF-BH-102_250314	14 Mar 2025		ES2507235	Normal	ES2507235003	<50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	<0.0002	**0.0020**
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024		ES2422636	Normal	ES2422636001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01
	WRRF-GW-101	21 Feb 2025	3.6		Normal	WRRF-GW-101_3.6_202502210157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_240924	24 Sep 2024		ES2431290	Normal	ES2431290004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0002	<0.0005
			3.67		Normal	WRRF-GW-101_3.67_202409240403	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_241211	11 Dec 2024		ES2440620	Normal	ES2440620003	<50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	<0.0002	<0.0005
			3.7		Normal	WRRF-GW-101__202412110230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250128	28 Jan 2025	3.6		Normal	WRRF-GW-101__202501280828	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250221	21 Feb 2025		ES2505097	Normal	ES2505097007	<50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	<0.0002	<0.0005
WRRF-GW-110	WRRF-GW110	24 Sep 2024	6.8		Normal	WRRF-GW-110_6.8_202409240414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW110_080724	08 Jul 2024		ES2422479	Normal	ES2422479003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01
	WRRF-GW-110	18 Feb 2025	6.6		Normal	WRRF-GW-110_6.6_202502181036	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_240924	24 Sep 2024		ES2431290	Normal	ES2431290006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0002	**0.0013**
	WRRF-GW-110_241212	12 Dec 2024		ES2440791	Normal	ES2440791011	<50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	<0.0002	**0.0009**
			5		Normal	WRRF-GW-110_5_202412120230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_250218	18 Feb 2025		ES2504633	Normal	ES2504633001	<50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	<0.0002	<0.0005
	WRRF-QC01_250218	18 Feb 2025		ES2504633	Field_D	ES2504633007	<50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<50	<50	<5	<50	<50	<50	<50	-	-	<5	<50	<5	<5	<5	<5	<5	<0.0002	<0.0005
	WRRF-QC02_250218	18 Feb 2025		1189594	Interlab_D	S25-Fe0047869	<5	-	-	<1	<1	<1	-	<1	<1	<1	<1	<5	<5	<1	<5	<5	-	<5	<5	<1	<1	-	-	-	-	<1	-	**0.0013[#12]**	**0.004[#12]**

Comments
#1 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
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#3 High reliability
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Table E - Groundwater Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF, Brine

								Per- and Poly-fluoroalkyl Substances (PFAS)										(n:2) Fluorotelomer Sulfonic Acids											
								Perfluoro-n-pentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanoic acid (PFHpA)	Perfluorobutanesulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	Sum (PFHxS + PFOS)	Sum of PFAS (enHealth) (PFHxS + PFOS + PFOA)	Sum of US EPA PFAS (PFOS + PFOA)	Sum of WA DWER PFAS (n=10)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	3- & 4-Methylphenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,4-dimethylphenol	2,4-dinitrophenol	2,6-dichlorophenol	2-chlorophenol
								µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								0.0005	0.0005	0.0005	0.0005	0.0005	0.002	0.0002	0.001	0.001	0.0002	0.001	0.001	0.001	0.001	6	10	10	3	3	30	3	3
Dutch Intervention (2000)																													
PFAS NEMP 2020 Table 5 Interim Marine 99%																													
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																													
ANZG (2018) Marine water 99% toxicant DGVs																													
ANZG (2018) Marine water 95% toxicant DGVs																													
Location Code	**Field ID**	**Date**	**Depth**	**Lab Report Number**	**Sample Type**	**Sample Code**																							
INF-BH-102	BIP-DS_250314	14 Mar 2025		ES2507235	Field_D	ES2507235004		<0.0005	**0.0023**	**0.0015**	**0.0013**	<0.0005	<0.0020	**0.0015**	-	-	**0.0077**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
	BIP-SR_250314	14 Mar 2025		1198761	Interlab_D	S25-Ma0038211		-	-	**0.001**[#12]	-	-	-	**0.0014**	**0.0044**	**0.0034**	-	-	<0.005	-	-	<6	<10	<10	<3	<3	<30	<3	<3
	INF-BH-102_250314	14 Mar 2025		ES2507235	Normal	ES2507235003		<0.0005	**0.0021**	**0.0017**	**0.0015**	<0.0005	<0.0020	**0.0017**	-	-	**0.0073**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024		ES2422636	Normal	ES2422636001		<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
	WRRF-GW-101	21 Feb 2025	3.6		Normal	WRRF-GW-101_3.6_202502210157		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_240924	24 Sep 2024		ES2431290	Normal	ES2431290004		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0020	<0.0002	-	-	<0.0002	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
			3.67		Normal	WRRF-GW-101_3.67_202409240403		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_241211	11 Dec 2024		ES2440620	Normal	ES2440620003		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0020	<0.0002	-	-	<0.0002	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
			3.7		Normal	WRRF-GW-101__202412110230		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250128	28 Jan 2025	3.6		Normal	WRRF-GW-101__202501280828		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250221	21 Feb 2025		ES2505097	Normal	ES2505097007		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0020	<0.0002	-	-	<0.0002	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
WRRF-GW-110	WRRF-GW110	24 Sep 2024	6.8		Normal	WRRF-GW-110_6.8_202409240414		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW110_080724	08 Jul 2024		ES2422479	Normal	ES2422479003		<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.01	-	-	<0.01	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
	WRRF-GW-110	18 Feb 2025	6.6		Normal	WRRF-GW-110_6.6_202502181036		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_240924	24 Sep 2024		ES2431290	Normal	ES2431290006		**0.0022**	**0.0022**	**0.0030**	<0.0005	<0.0005	<0.0020	**0.0030**	-	-	**0.0087**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
	WRRF-GW-110_241212	12 Dec 2024		ES2440791	Normal	ES2440791011		**0.0030**	**0.0024**	**0.0064**	**0.0008**	<0.0005	<0.0020	**0.0064**	-	-	**0.0145**	<0.001	**0.001**	<0.001	<0.001	-	-	-	-	-	-	-	-
			5		Normal	WRRF-GW-110_5_202412120230		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_250218	18 Feb 2025		ES2504633	Normal	ES2504633001		**0.0025**	**0.0018**	**0.0044**	**0.0006**	<0.0005	<0.0020	**0.0044**	-	-	**0.0093**	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
	WRRF-QC01_250218	18 Feb 2025		ES2504633	Field_D	ES2504633007		**0.0028**	**0.0032**	**0.0064**	**0.0010**	<0.0005	<0.0020	**0.0064**	-	-	**0.0144**	<0.001	**0.001**	<0.001	<0.001	-	-	-	-	-	-	-	-
	WRRF-QC02_250218	18 Feb 2025		1189594	Interlab_D	S25-Fe0047869		-	-	**0.054**[#12]	-	-	-	**0.0553**	**0.0593**	**0.0053**	-	-	**0.031**	-	-	-	-	-	-	-	-	-	-

Comments

#1 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
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ANZG, 2018, ANZG (2018) Marine water 95% toxicant DGVs

												Phenols														Exposure Classificat		EPA 621 Classification	
												2-methylphenol	2-nitrophenol	4,6-Dinitro-2-methylphenol	4,6-Dinitro-o-cyclohexyl phenol	4-chloro-3-methylphenol	4-nitrophenol	Cresol Total	Dinoseb	Pentachlorophenol	Phenol	Phenolics Total	Tetrachlorophenols	Phenols (Total Halogenated)	Phenols (Total Non Halogenated)	Concrete Piles	Steel Piles	Vic EPA IWRG 621 CHC (Total)*	Vic EPA IWRG 621 Other CHC (Total)*
												µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	-	-	µg/L	µg/L
EQL												3	10	30	100	10	30	10	100	10	3	50	30	10	100			5	5
Dutch Intervention (2000)																		200		3	2,000		10						
PFAS NEMP 2020 Table 5 Interim Marine 99%																													
NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion																													
ANZG (2018) Marine water 99% toxicant DGVs																				11[#10]	270[#5]								
ANZG (2018) Marine water 95% toxicant DGVs																				**22**	**400[#5]**								
Location Code	**Field ID**	**Date**	**Depth**	**Lab Report Number**	**Sample Type**	**Sample Code**																							
INF-BH-102	BIP-DS_250314	14 Mar 2025		ES2507235	Field_D	ES2507235004	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-
	BIP-SR_250314	14 Mar 2025		1198761	Interlab_D	S25-Ma0038211	<3	<10	<30	<100	<10	<30	<10	<100	<10	<3	-	<30	<10	<100	-	-	<5	<5
	INF-BH-102_250314	14 Mar 2025		ES2507235	Normal	ES2507235003	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-
WRRF-GW-101	WRRF-GW101_090724	09 Jul 2024		ES2422636	Normal	ES2422636001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1[#13]	1[#13]	-	-
	WRRF-GW-101	21 Feb 2025	3.6		Normal	WRRF-GW-101_3.6_202502210157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_240924	24 Sep 2024		ES2431290	Normal	ES2431290004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3.67		Normal	WRRF-GW-101_3.67_202409240403	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_241211	11 Dec 2024		ES2440620	Normal	ES2440620003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			3.7		Normal	WRRF-GW-101__202412110230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250128	28 Jan 2025	3.6		Normal	WRRF-GW-101__202501280828	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-101_250221	21 Feb 2025		ES2505097	Normal	ES2505097007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WRRF-GW-110	WRRF-GW110	24 Sep 2024	6.8		Normal	WRRF-GW-110_6.8_202409240414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW110_080724	08 Jul 2024		ES2422479	Normal	ES2422479003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1[#14]	1[#14]	-	-
	WRRF-GW-110	18 Feb 2025	6.6		Normal	WRRF-GW-110_6.6_202502181036	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_240924	24 Sep 2024		ES2431290	Normal	ES2431290006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_241212	12 Dec 2024		ES2440791	Normal	ES2440791011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			5		Normal	WRRF-GW-110_5_202412120230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-GW-110_250218	18 Feb 2025		ES2504633	Normal	ES2504633001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-QC01_250218	18 Feb 2025		ES2504633	Field_D	ES2504633007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WRRF-QC02_250218	18 Feb 2025		1189594	Interlab_D	S25-Fe0047869	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	<5

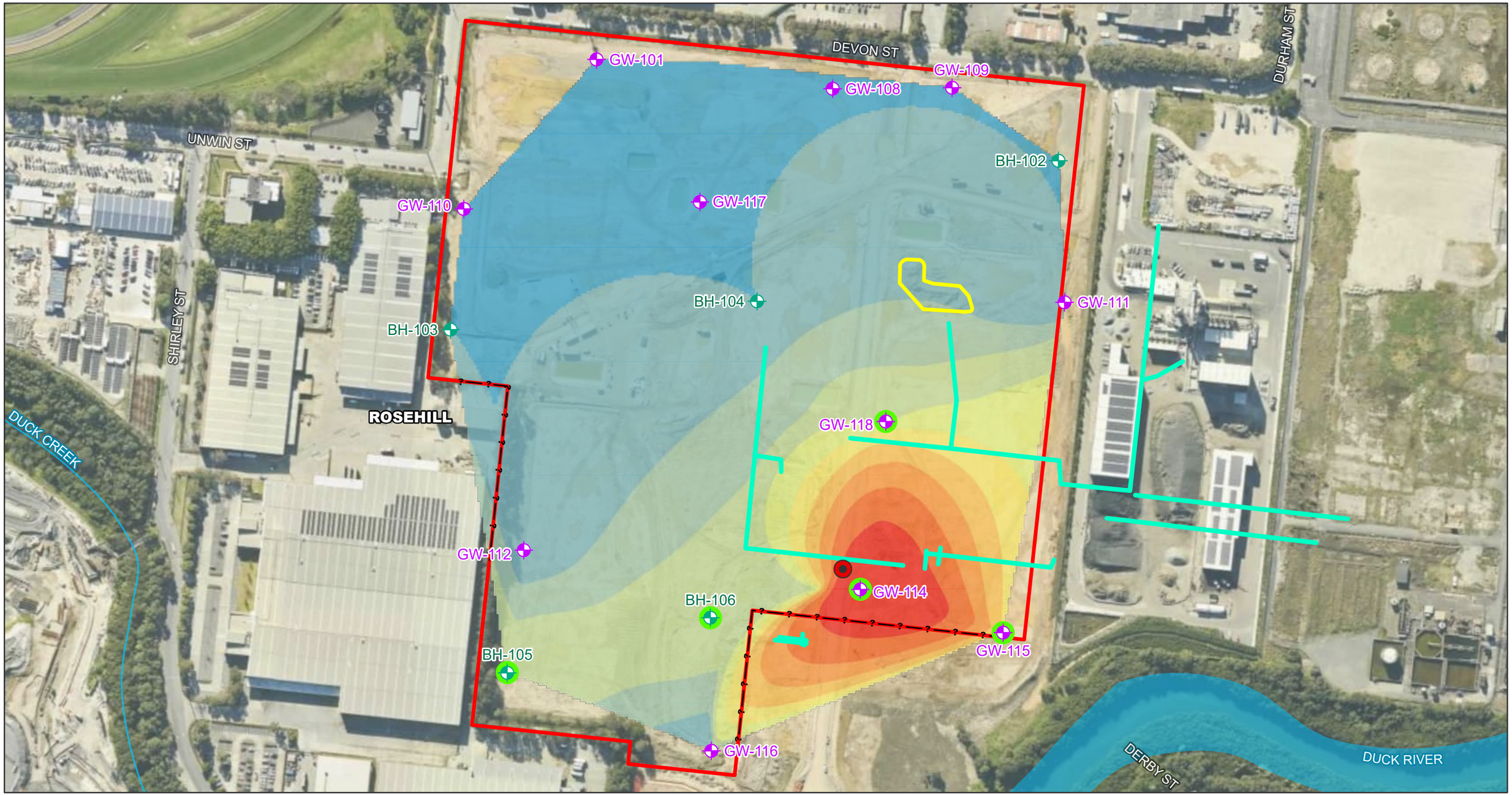
Comments

#1 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#2 To obtain F2 subtract naphthalene from the >C10 - C16 fraction.
#3 High reliability
#4 Very high reliability
#5 Low reliability
#6 Moderate reliability. Ammonia as total ammonia, measured as [NH3-N] at pH 8.
#7 Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for sp
#8 Very Low reliability
#9 Moderate reliability
#10 To account for the bioaccumulating nature of this toxicant, it is recommended that the 99% species protection level DGV is used for slightly to moc
#11 High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for specie
#12 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the correspondi
#13 Severe
#14 Moderate

Environmental Standards

Rijkswaterstaat Environment, February 2000, Dutch Intervention (2000)
HEPA, January 2020, PFAS NEMP 2020 Table 5 Interim Marine 99%
NEPM, April 2013, NEPM 2013 Table 1A(4) HSL D GW, Clay for Vapour Intrusion
ANZG, 2018, ANZG (2018) Marine water 99% toxicant DGVs
ANZG, 2018, ANZG (2018) Marine water 95% toxicant DGVs

B.2 Shallow groundwater contaminant heat maps



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

- Exceeds ecological site assessment criteria (0.00023 µg/L)

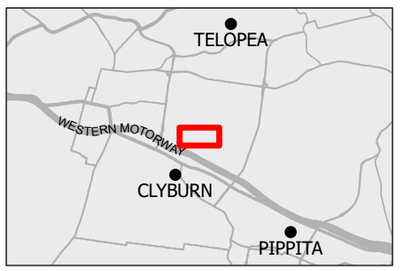
PFOS (µg/L)

- 0.86
- 0.43
- <0.01

? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



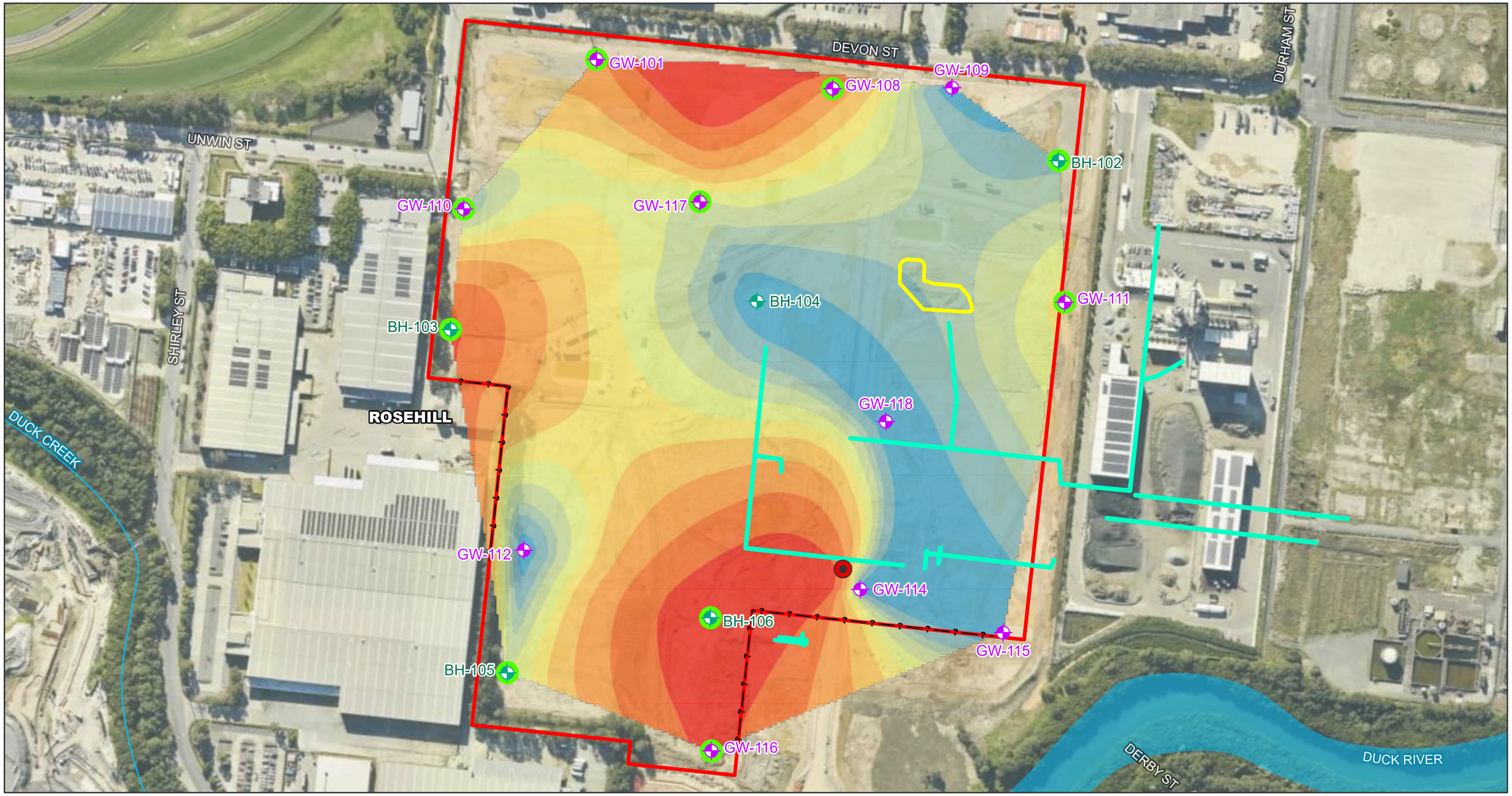
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024

Figure 10a: Shallow groundwater - PFOS concentrations



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

- Exceeds ecological site assessment criteria (1.3 µg/L)

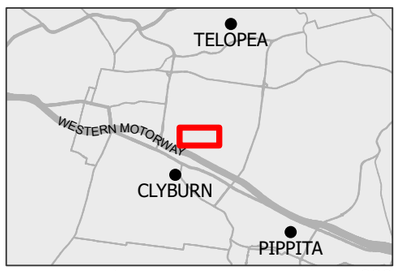
Copper (dissolved) (µg/L)

- 15
- 8
- <1

? — ?- Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



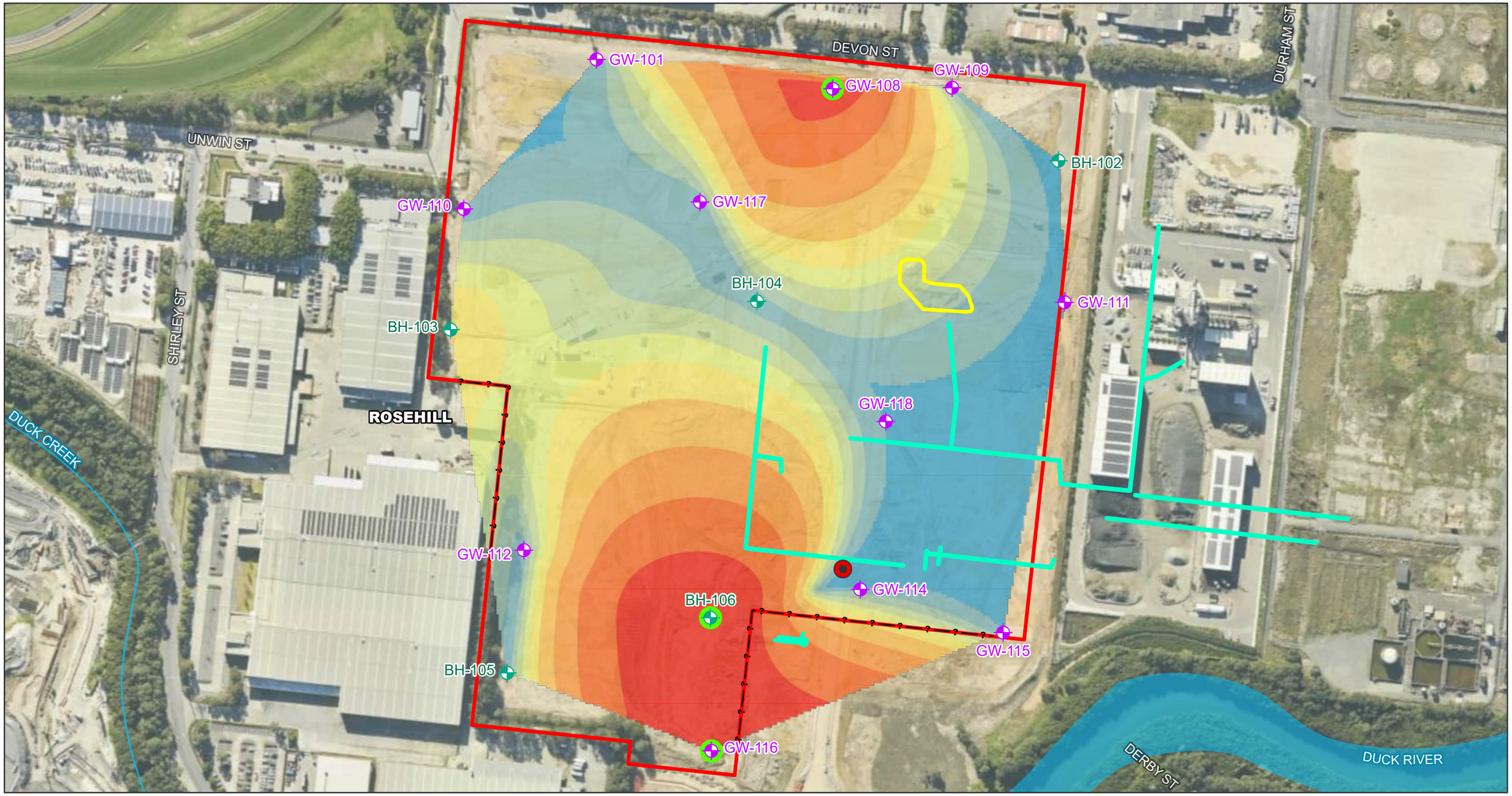
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024

Figure 10b: Shallow groundwater - Copper (dissolved) concentrations



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

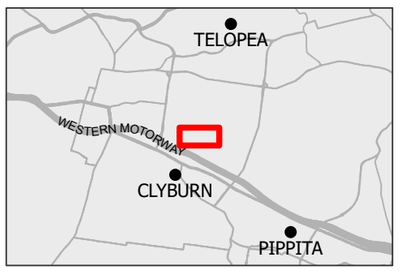
- Exceeds ecological site assessment criteria (4.4 µg/L)

Lead (dissolved) (µg/L)

- 8
- 4
- <1
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



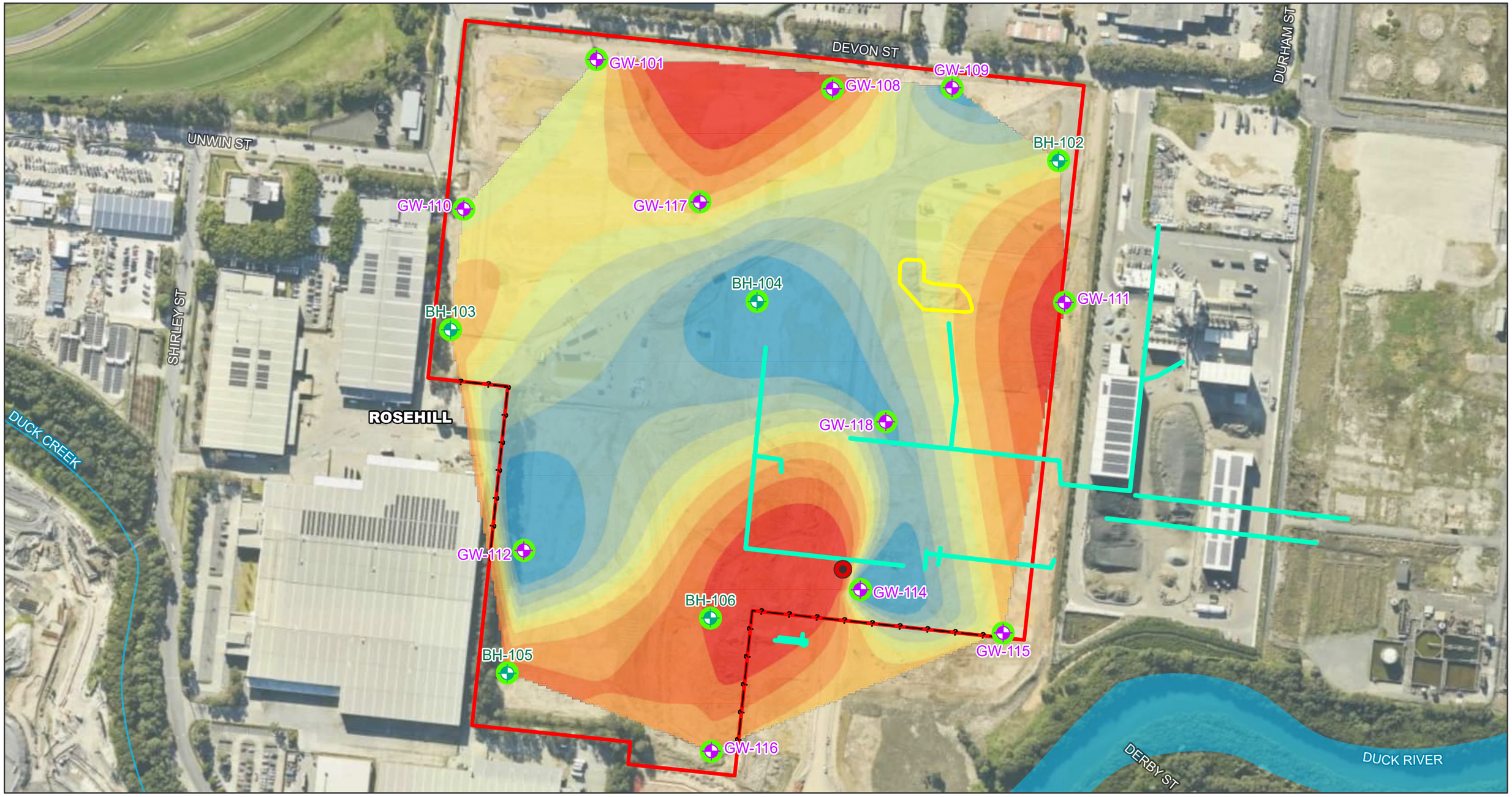
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024

Figure 10c: Shallow groundwater - Lead (dissolved) concentrations



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

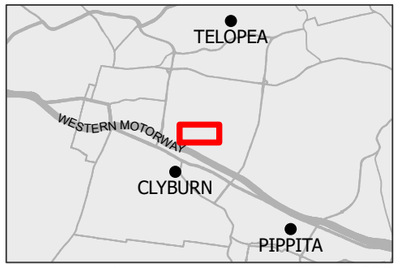
- Exceeds ecological site assessment criteria (7 µg/L)

Nickel (dissolved) (µg/L)

- 170
- 86
- 2
- Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



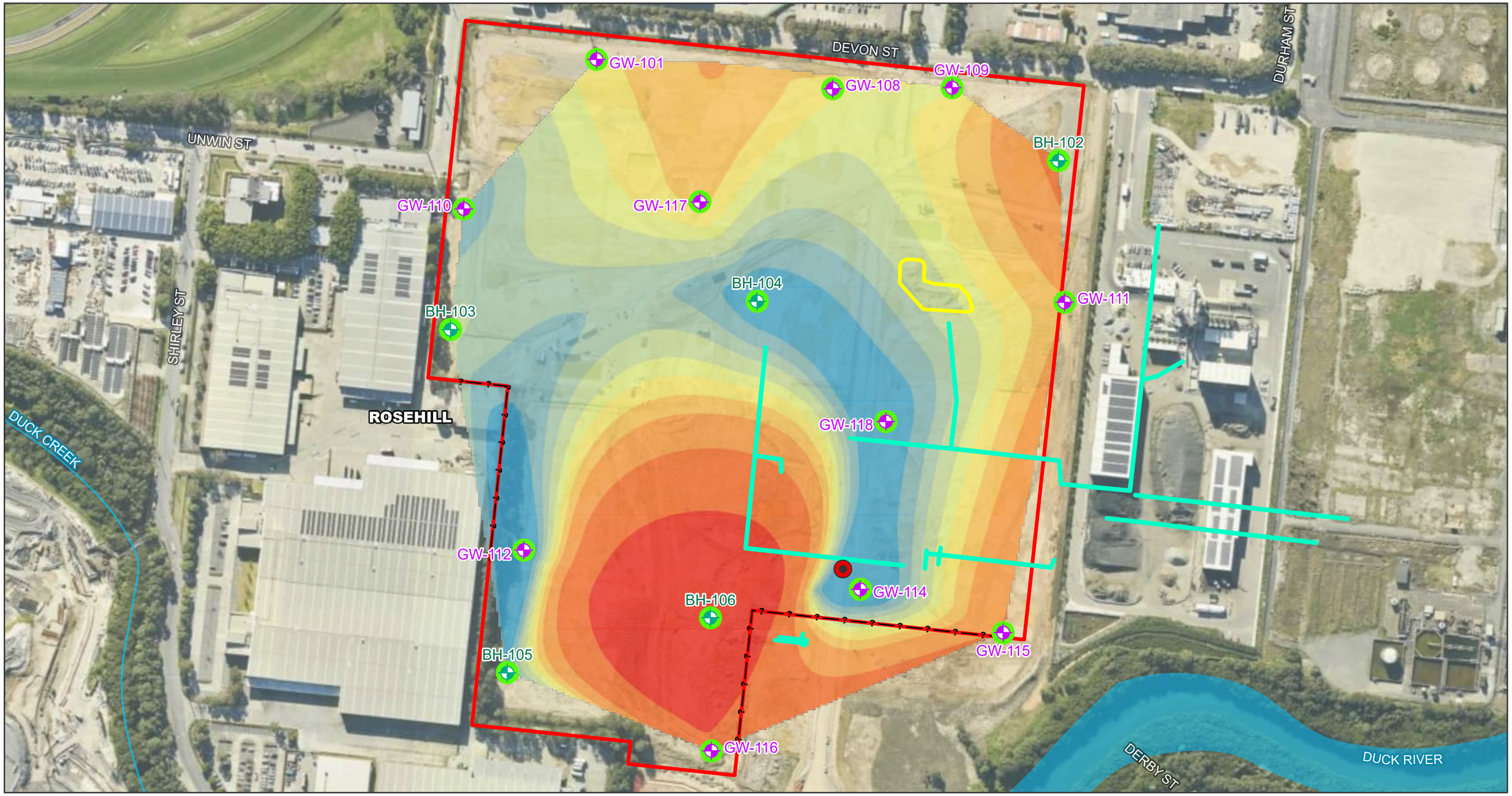
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Figure 10d: Shallow groundwater - Nickel (dissolved) concentrations

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

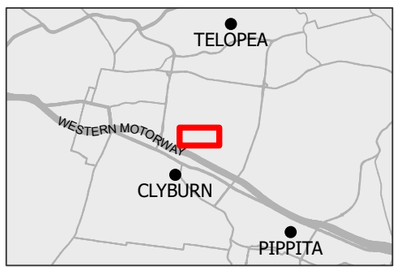
- Exceeds ecological site assessment criteria (15 µg/L)

Zinc (dissolved) (µg/L)

- 1600
- 812
- 30
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



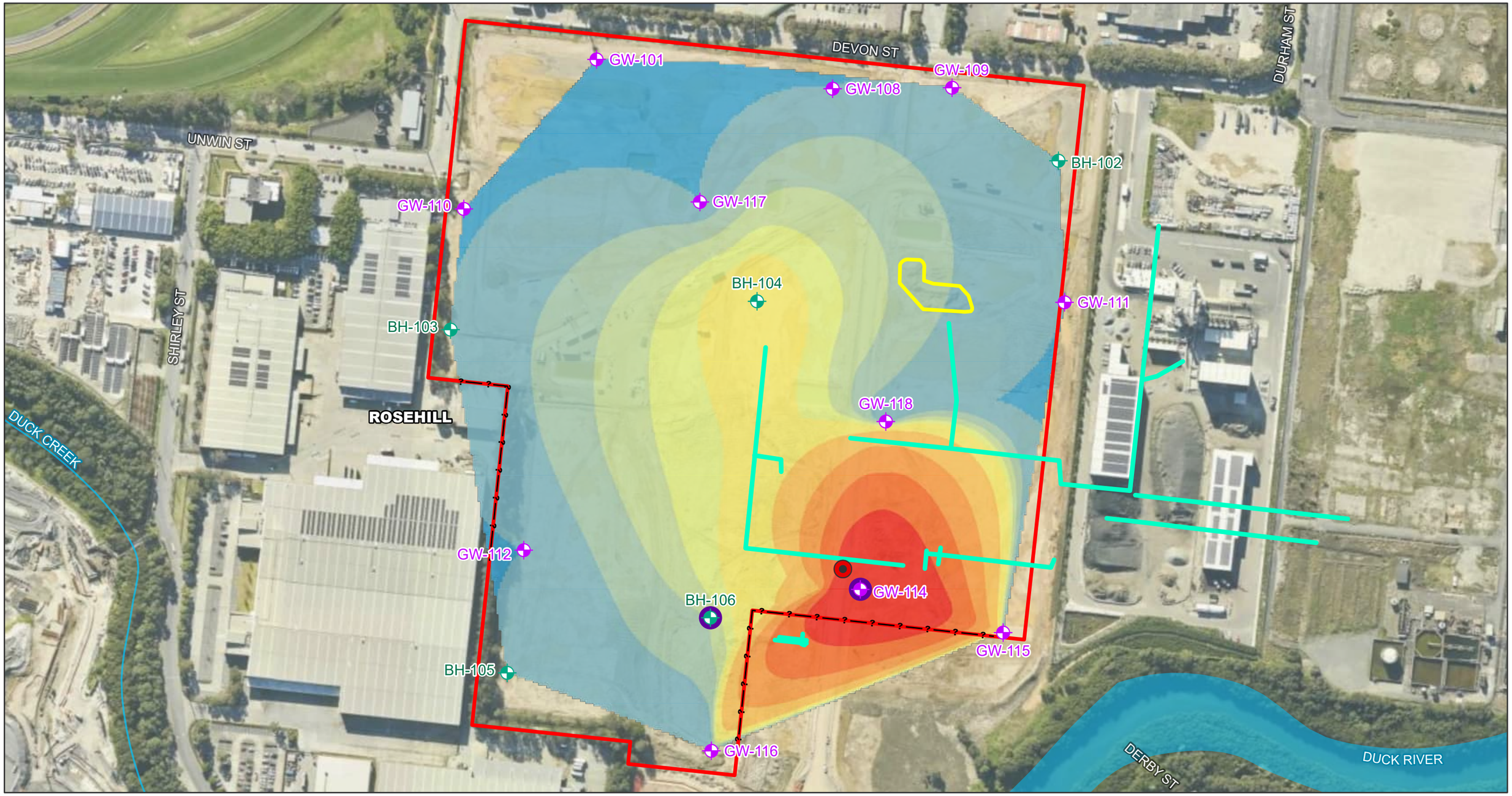
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Figure 10e: Shallow groundwater - Zinc (dissolved) concentrations

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

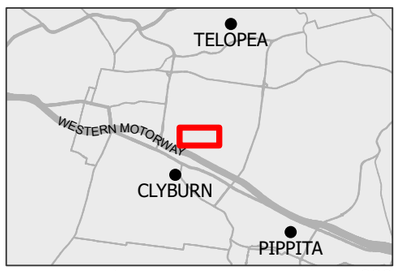
- Exceeds human health site assessment criteria (10 µg/L)

Benzene (µg/L)

- 389
- 196
- <1
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



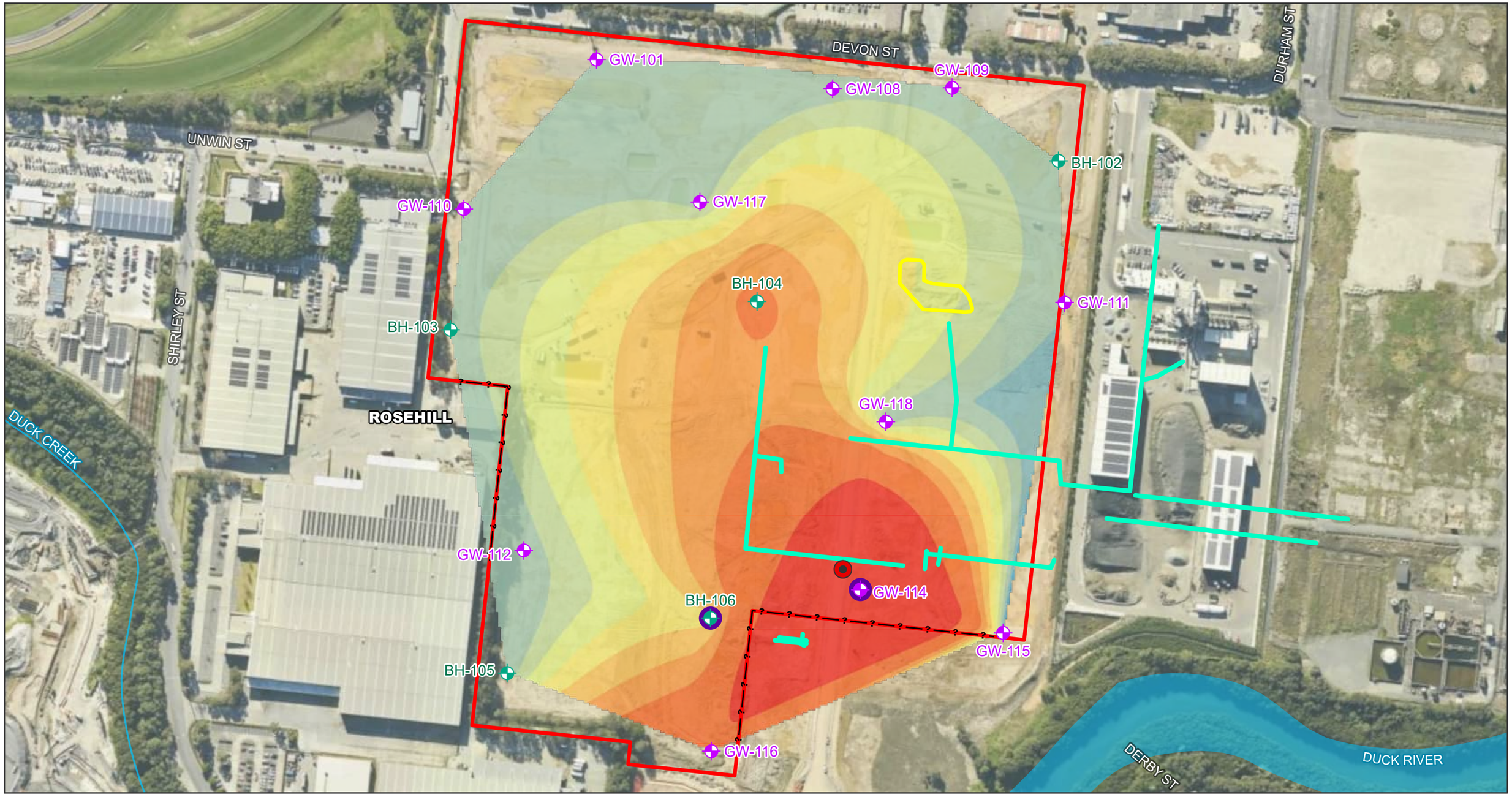
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024

Figure 10f: Shallow groundwater - Benzene concentrations



LEGEND

- Site boundary
- Residual sludge within pipe network (ERM, 2022)
- Potential PFAS source - Tank 24 (Pre-demolition)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

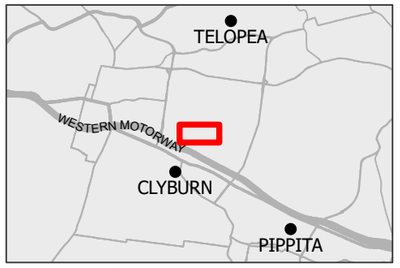
- Exceeds human health site assessment criteria (80 µg/L)

Ethylbenzene (µg/L)

- 111
- 56
- <2
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



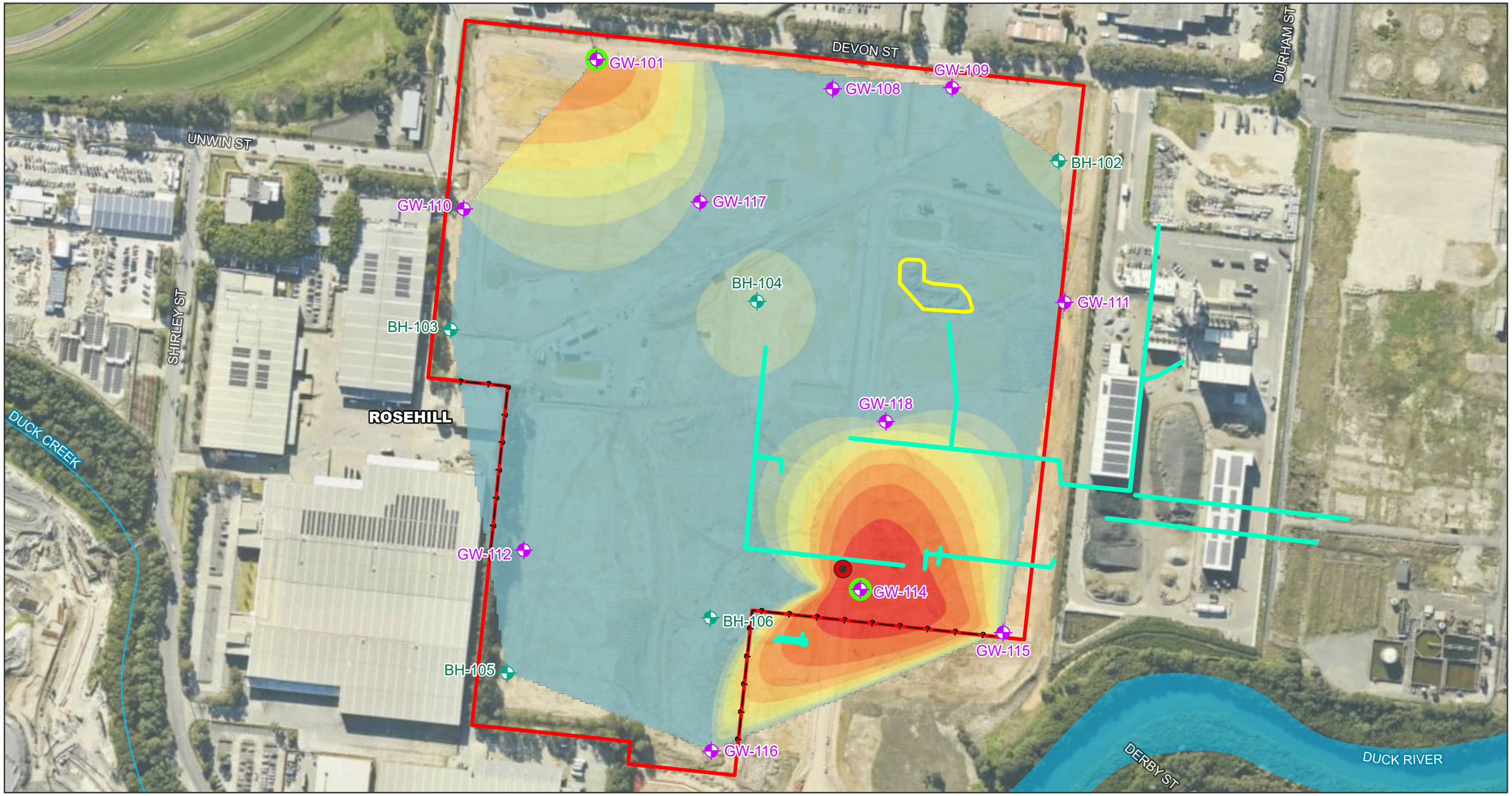
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Figure 10g: Shallow groundwater - Ethylbenzene concentrations

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 20/09/2024



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

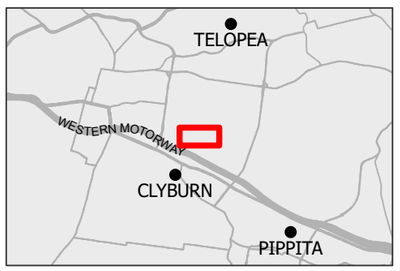
- Exceeds ecological site assessment criteria (180 µg/L)

Toluene (µg/L)

- 1510
- 759
- <2
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



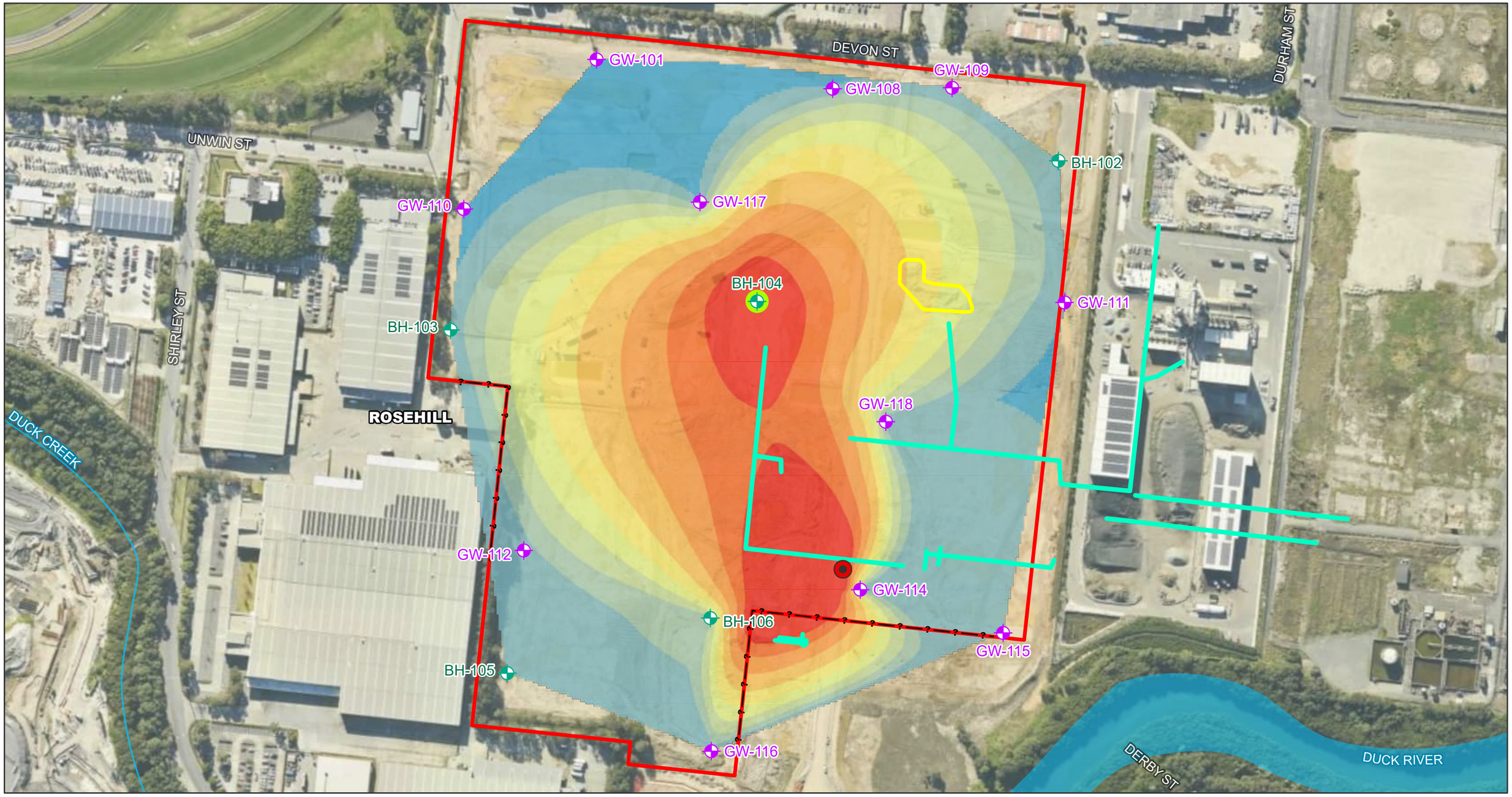
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Figure 10h: Shallow groundwater - Toluene concentrations

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

- Exceeds ecologicalsite site assessment criteria (50 µg/L)

Napthalene (µg/L)

- 348
- 175
- <1
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



N

A4 1:4,000

GDA2020 MGA Zone 56

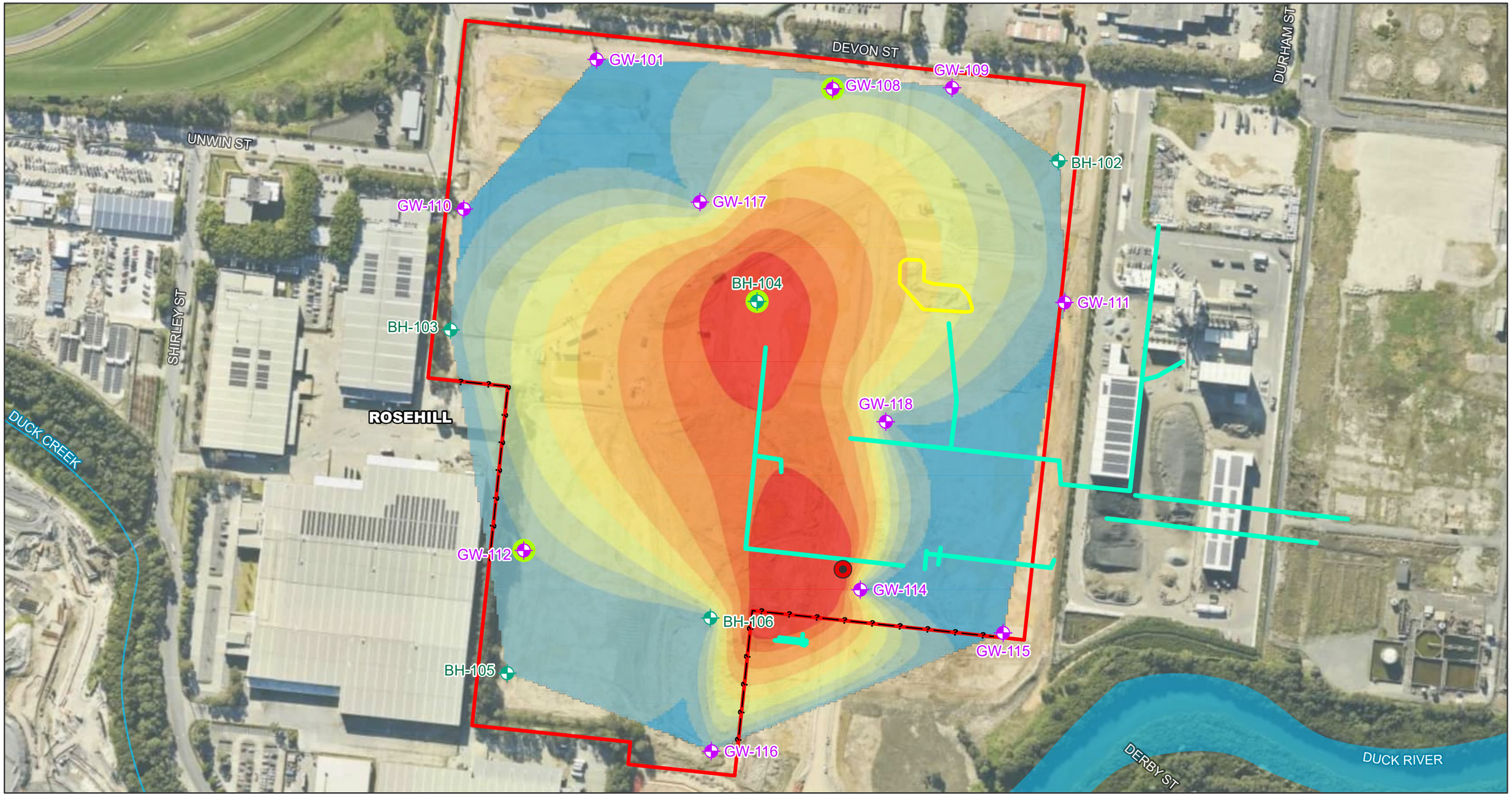
0 50 100

Meters

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024

\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024

Figure 10i: Shallow groundwater - Naphthalene concentrations



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

Site Assessment Criteria (SAC)

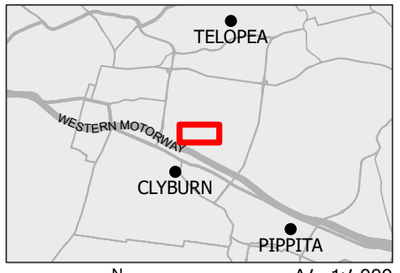
- Exceeds ecological site asssessment criteria (0.6 µg/L)

Phenanthrene (µg/L)

- 31.9
- 16.51
- <1.0
- Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



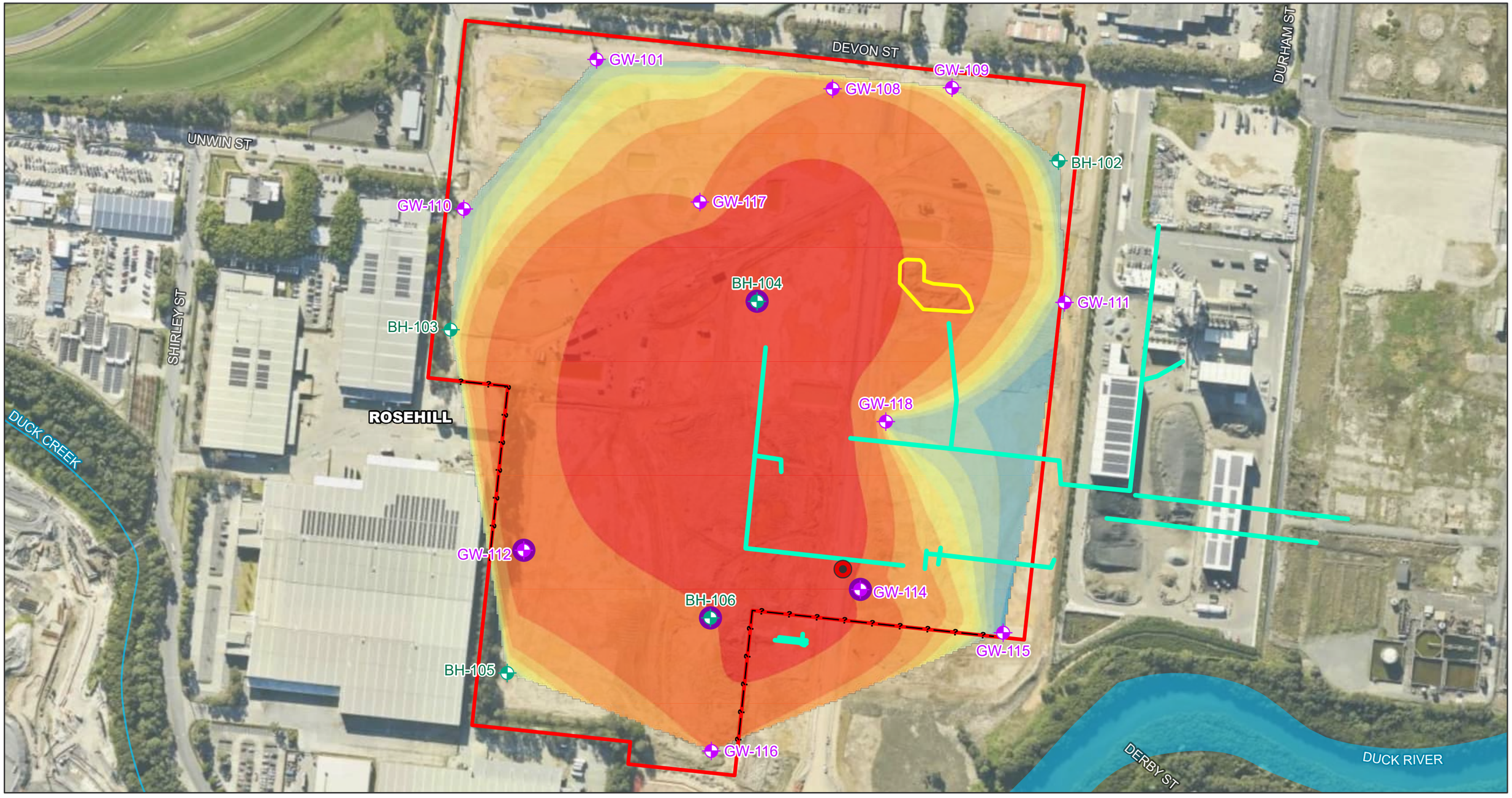
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024

Figure 10j: Shallow groundwater - Phenanthrene concentrations



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

- Borehole / Shallow groundwater well
- Shallow groundwater well

ShallowGWTPH_SAC

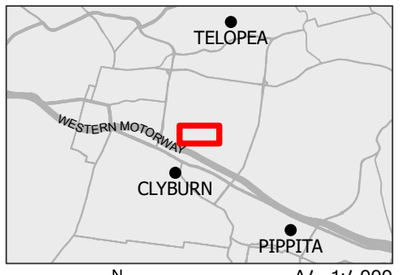
- Exceeds human health site assessment criteria (600 µg/L)

TPH C10 - C36 (sum of total) (µg/L)

- 4530
- 2299
- <50
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



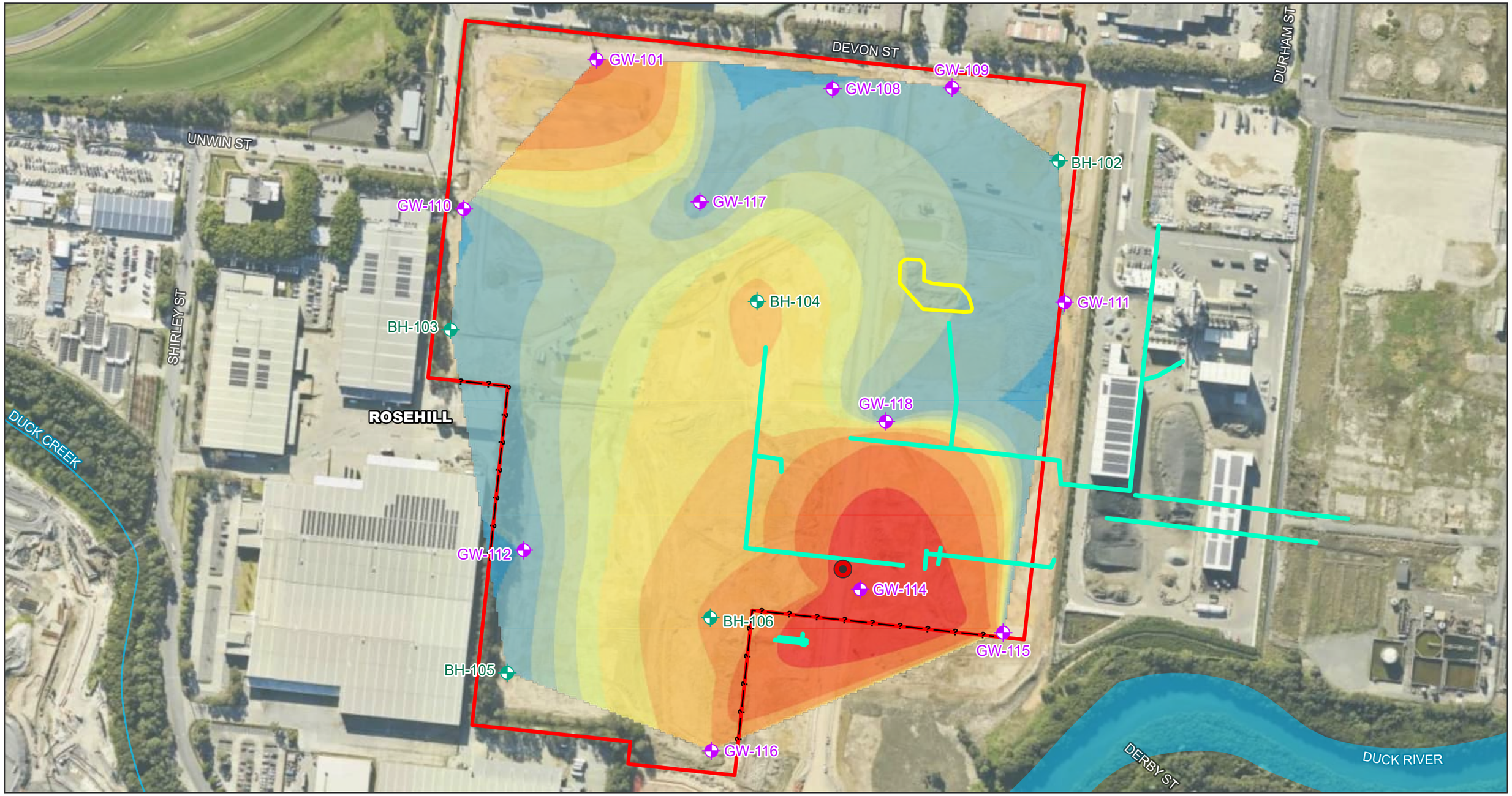
N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Figure 10k: Shallow groundwater - TPH C10 - C36 (sum of total) concentrations

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024



LEGEND

- Site boundary
- Potential PFAS source - Tank 24 (Pre-demolition)
- Residual sludge within pipe network (ERM, 2022)
- Stockpile

Sampling locations

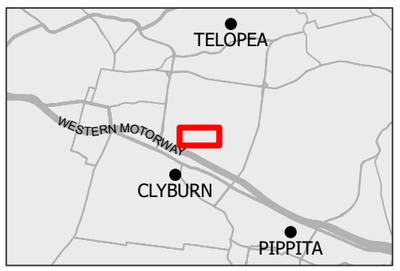
- Borehole / Shallow groundwater well
- Shallow groundwater well

TPH C6-C9 (µg/L)

- 6380
- 3212
- <20
- ? — ? Unknown concentration extent

- Watercourse
- Water body

All results displayed in ug/L.



N

A4 1:4,000
GDA2020 MGA Zone 56

0 50 100
Meters

Figure 10l: Shallow groundwater - TPH C10 - C36 (sum of total) concentrations

Data Sources: Department of Customer Service (2024); Imagery Sources: Aerometrex 2024
\\AUSYD0VS01\GISProj\NSW_IA319500_GPOP\Apps\Figures\IA319500_DSI_HeatMaps.aprx | Date: 19/09/2024

Appendix C. Surface water analytical results tables

Jacobs

Table I - Surface Water Analytical Results

Greater Parramatta and Olympic Peninsula
Camellia WRRF

							Per- and Poly-fluoroalkyl Substances (PFAS)											(n:2) Fluorotelomer Sulfonic Acids						
							Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluoro-n-pentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanoic acid (PFHpA)	Perfluorobutanesulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2)	Sum (PFHxS + PFOS)	Sum of WA DWER PFAS (n=10)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	Arsenic	Cadmium	Chromium (hexavalent)	Chromium (III+VI)
							µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL							0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.1	0.05	0.01	0.01	0.05	0.05	0.05	1	0.1	10	1
PFAS NEMP 2020 Table 1 Recreational Water								**10**								**2**								
PFAS NEMP 2020 Table 5 Interim Marine 99%							**0.00023**																	
Dutch Intervention Guideline (RIVM, 2000)																								
NHMRC Guidelines for Managing Risks in Recreational Water 2008																				**<0.05**	**700**	**20**	**500**	
ANZG (2018) Marine water 99% toxicant DGVs																						**0.7**[#1]		
ANZG (2018) Marine water 95% toxicant DGVs																				**<0.05**			**4.4**[#2]	**4.4**
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**																			
WRRF-SW-101	WRRF-SW101_100724	10 Jul 2024	12:00:00	ES2422785	Normal		**0.01**	<0.01	<0.02	<0.02	<0.01	<0.02	<0.02	<0.1	<0.05	**0.01**	**0.01**	<0.05	<0.05	<0.05	<1	<0.1	<10	<1
WRRF-SW-102	WRRF-SW102_100724	10 Jul 2024	12:50:00	ES2422785	Normal		**0.03**	**0.01**	<0.02	<0.02	**0.02**	<0.02	<0.02	<0.1	<0.05	**0.05**	**0.06**	<0.05	<0.05	<0.05	**1**	<0.1	<10	**1**

Comments

#1 High reliability

#2 Very high reliability

#3 Low reliability

#4 Moderate reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its

#5 Moderate reliability. Ammonia as total ammonia, measured as [NH3-N] at pH 8.

#6 High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.

						Metals						BTEX												
						Copper	Lead	Magnesium (filtered)	Mercury	Nickel	Zinc	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Benzo(a)pyrene TEQ calc (zero)	Benzo[b+j]fluoranthene	Naphthalene (value used in F2 calc)	Acenaphthene	Acenaphthylene
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L
EQL						1	1	1,000	0.1	1	5	1	2	2	2	2	2	1	0.5	1	0.005	1	1
PFAS NEMP 2020 Table 1 Recreational Water																							
PFAS NEMP 2020 Table 5 Interim Marine 99%																							
Dutch Intervention Guideline (RIVM, 2000)																							
NHMRC Guidelines for Managing Risks in Recreational Water 2008						**20,000**	**100**		**10**	**200**		**10**	**3,000**	**8,000**			**6000**							
ANZG (2018) Marine water 99% toxicant DGVs									**0.1**[#2]	**7**[#1]													
ANZG (2018) Marine water 95% toxicant DGVs						**1.3**[#2]	**4.4**[#3]				**15**[#2]	**700**[#4]	**80**	**180**										
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**																			
WRRF-SW-101	WRRF-SW101_100724	10 Jul 2024	12:00:00	ES2422785	Normal	<1	<1	**554,000**	<0.1	<1	**14**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0
WRRF-SW-102	WRRF-SW102_100724	10 Jul 2024	12:50:00	ES2422785	Normal	**2**	**3**	**212,000**	<0.1	<1	**29**	<1	<2	<2	<2	<2	<2	<1	<0.5	<1.0	<0.005	<1.0	<1.0

Comments
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						Polycyclic aromatic hydrocarbons (PAHs)														TRH - NEPM 2013 Fr			
						Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total)	TRH >C6 - C10	TRH >C10 - C16	TRH >C16 - C34	TRH >C34 - C40
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						1	1	0.5	1	1	1	1	1	1	1	1	1	1	0.5	20	100	100	100
PFAS NEMP 2020 Table 1 Recreational Water																							
PFAS NEMP 2020 Table 5 Interim Marine 99%																							
Dutch Intervention Guideline (RIVM, 2000)																							
NHMRC Guidelines for Managing Risks in Recreational Water 2008								**0.01**															
ANZG (2018) Marine water 99% toxicant DGVs						**0.01**		**0.1**								**50**[#4]	**0.6**						
ANZG (2018) Marine water 95% toxicant DGVs																							
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**																		
WRRF-SW-101	WRRF-SW101_100724	10 Jul 2024	12:00:00	ES2422785	Normal	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<20	<100	<100	<100
WRRF-SW-102	WRRF-SW102_100724	10 Jul 2024	12:50:00	ES2422785	Normal	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<20	<100	<100	<100

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						actions			TPH - NEPM 1999 Fractions					Nutrients									
						TRH >C10 - C40 (Sum of total)	TRH >C6 - C10 less BTEX (F1)	TRH >C10 - C16 less Naphthalene (F2)	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C36 (Sum of total)	Phosphorus total (as P)	Soluble Carbonate as CaCO3*	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Ammonia as N	Anions Total	Bicarbonate Alkalinity as CaCO3	Calcium (filtered)	Cations Total
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	MG/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	mg/L	meq/L
EQL						100	20	100	20	50	100	50	50	0.01	1	1	1	0.01	0.01	1	1	0.01
PFAS NEMP 2020 Table 1 Recreational Water																						
PFAS NEMP 2020 Table 5 Interim Marine 99%																						
Dutch Intervention Guideline (RIVM, 2000)													600									
NHMRC Guidelines for Managing Risks in Recreational Water 2008																						
ANZG (2018) Marine water 99% toxicant DGVs																						
ANZG (2018) Marine water 95% toxicant DGVs																		**0.91**[#5]				
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**																	
WRRF-SW-101	WRRF-SW101_100724	10 Jul 2024	12:00:00	ES2422785	Normal	<100	<20	<100	<20	<50	<100	<50	<50	**0.07**	<1	<1	**99**	**0.17**	**251**	**99**	**219**	**273**
WRRF-SW-102	WRRF-SW102_100724	10 Jul 2024	12:50:00	ES2422785	Normal	<100	<20	<100	<20	<50	<100	<50	<50	**0.09**	<1	<1	**109**	**0.17**	**101**	**109**	**100**	**102**

Comments
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						Inorganics										Physiochemical parameters	TPH
						Chloride	Ionic Balance	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total)	Potassium (filtered)	Sodium (filtered)	Sulfate as SO4 - Turbidimetric (filtered)	Turbidity (Lab)	Oil and Grease
						mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	µg/L
EQL						1	0.01	0.1	0.01	0.01	0.01	0.1	1	1	1	0.1	5,000
PFAS NEMP 2020 Table 1 Recreational Water																	
PFAS NEMP 2020 Table 5 Interim Marine 99%																	
Dutch Intervention Guideline (RIVM, 2000)																	
NHMRC Guidelines for Managing Risks in Recreational Water 2008																	
ANZG (2018) Marine water 99% toxicant DGVs																	
ANZG (2018) Marine water 95% toxicant DGVs																	
Location Code	**Field ID**	**Date**	**Time**	**Lab Report Number**	**Sample Type**												
WRRF-SW-101	WRRF-SW101_100724	10 Jul 2024	12:00:00	ES2422785	Normal	**7,900**	**4.29**	**0.4**	**0.29**	**0.27**	**0.02**	**0.7**	**170**	**4,880**	**1,240**	**5.8**	<5,000
WRRF-SW-102	WRRF-SW102_100724	10 Jul 2024	12:50:00	ES2422785	Normal	**3,160**	**0.82**	**0.6**	**0.52**	**0.49**	**0.03**	**1.1**	**65**	**1,800**	**452**	**13.0**	<5,000

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