

Dewatering Management Plan

Former Corrimal Coke Works, Stage 2a Development

27 Railway Street

Corrimal NSW 2518

Project No. 25234
Version 1

30 April 2026

Reditus Consulting Pty Ltd
ABN: 34 631 168 502



Dewatering Management Plan

Former Corrimal Coke Works, Stage 2a development

DOCUMENT CONTROL

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Executive Summary

Reditus Consulting Pty Ltd (Reditus) were engaged by LegPro 70 Pty Ltd ATF Legpro 70 Unit Trust (the client) to prepare a Dewatering Management Plan (DMP) for the Stage 2a proposed development at the site located at 27 Railway Street, Corrimal NSW 2518, also known as 'Former Corrimal Coke Works'. The Stage 2a forms a smaller area within the Former Corrimal Coke Works (the site).

The Former Corrimal Coke Works has an area of approximately 18.16 ha, of which, the site forms an area of approximately 1.4 ha. Wider site area includes Lots 101, 102 and 103 of DP 1301632 and Lot 126 of DP 598190. The proposed development forms State Significant Development (SSD-83789971) which includes the construction of four mixed use buildings composed of residential and commercial spaces and basement carparking. Each of the four buildings will include a one-storey basement carpark (Basement 2.1, 2.2, 2.3 and 2.4).

Given the proposed SSD excavation will extend into the groundwater table, dewatering will be required. As such, the proposed development is an aquifer inference activity, requiring regulatory authorisation under the Water Management Act (WMA) 2000, within a Water Sharing Plan zone, identified as the Greater Metropolitan Region Groundwater Sources 2023, Sydney Basin South Groundwater Source. To address the mandatory requirements to be granted consent this DMP has been prepared in general accordance with the NSW DPE (2022) *Minimum Requirements for building site groundwater investigations and reporting* guidelines (herein referred to as the minimum requirements).

Results from the numerical groundwater model completed for the site, the predicted long-term steady-state groundwater take was **1.284 ML/year**, across all three basement excavations whilst the predicted groundwater take during the construction phase (year 1) was **2.682 ML/year**. Reditus consider that the predicted groundwater inflows can be effectively managed under a 'drained basement' design, with the estimated inflows and drawdown meeting the relevant impact assessment criteria of 'Minimal Impact' under the AIP 2012 and WMA 2000. In addition, drawdown is predicted to have no effect on the water table at distances greater than 10 m from the excavation footprint.

Baseline groundwater quality testing completed by Reditus (2025) indicates that groundwater at the site contains elevated metals above the adopted Water Quality Objectives. As such, dewatered and treated groundwater is proposed to be discharged to the stormwater network. A Water Quality Monitoring Program has been proposed to confirm groundwater quality prior to discharging (and post treatment) and monitor the groundwater quality throughout the proposed dewatering period to confirm compliance with the adopted Water Quality Objectives.

The **Water Management (General) Regulation 2025**, Schedule 4, Section 19, applies dewatering activities that are taking less than 3 ML/year and where water is not taken from consumption or supply. (i.e., temporary and operational dewatering <3ML/year). Therefore, a water access licence (WAL) will not be required for the proposed dewatering activity at the site.

1 Introduction

Reditus Consulting Pty Ltd (Reditus) were engaged by LegPro 70 Pty Ltd ATF Legpro 70 Unit Trust (Legacy, the client) to prepare a Dewatering Management Plan (DMP) for the Stage 2a redevelopment of the former Corrimal Coke Works site located at 27 Railway Street, Corrimal NSW 2518 (the site).

The Stage 2a built form was declared a State Significant Development (SSD) and forms part of SSD-83789711. The proposed SSD includes the development of four mixed use buildings composed of residential and commercial spaces and basement carparking. Each of the four buildings will include a one-storey basement carpark (Basement 2.1, 2.2, 2.3 and 2.4). This DMP has been prepared for the works relating to the Stage 2a developments located in the south-eastern portion of the wider former Corrimal Coke Works.

The wider area classified as the former Corrimal Coke works occupies an area of approximately 18.16 ha, and includes primarily native and cleared vegetation, with some existing buildings on site that remain from the former operations. Further developments are also being conducted simultaneously, including the Stage 1 built form development and Stage 2-4 Bulk Earthworks (BEW) inclusive of the realignment of North Corrimal Creek, those works have received separate planning consent from Wollongong City Council (WCC) under DA2023/550 and DA2023/823 respectively.

Reditus has previously prepared a Groundwater Model and Impact Assessment (Reditus 2025) for the Stage 2a component of the development. The report concludes the construction of the basements will be classified as an aquifer interference activity, requiring regulatory authorisation under the Water Management Act 2000. A DMP is required as part of the consent conditions, which was completed against the WaterNSW "Dewatering Checklist for a Water Management Works Approval". The associated assessment was completed in accordance with the NSW DPIE (2022) *Minimum requirements for building site groundwater investigations and reporting* guidelines and the NSW DPIE (2022) *Minimum requirements for building site groundwater investigations and reporting* guidelines.

The site location and site layout is provided in **Figure 1** and **Figure 2, Appendix A**, and site identification details presented in **Table 1-1** below.

Table 1-1 Site Identification Details

ITEM	DETAIL
Street Address	27 Railway Street, Corrimal NSW 2577
Lot and Deposited Plan	Wider site area includes Lots 101, 102 and 103 of DP 1301632 and Lot 126 of DP 598190
Local Government Area	City of Wollongong
Site Coordinates to the approximate centre of the site (GDA2020 MGA Zone 56)	Easting: 307277.348 Northing: 6194039.365
Site Area	Wider site area: 18.16 ha Stage 2a area: 1.4 ha
Site Location and layout	Figure 1 and 2, Appendix A
Water Sharing Plan	Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023
Groundwater Source	Sydney Basin South Groundwater Source ¹

¹ The groundwater source ranges from north of Wollongong to Nerriga in the south. National parks cover much of the southern and western portion of the groundwater source and the bore distribution is concentrated to the north-east around Camden and the south-western areas around Moss Vale.

1.1 Objectives

- Provide details on the hydrogeological setting of the site and a summary of key environmental factors relevant to dewatering with specific focus on aquifer properties and water quality at the site.
- Provide details of the proposed development layout, construction design and dewatering methods.
- Predict dewatering extraction volumes required for the proposed temporary construction activities.
- Determine the potential impacts of the dewatering activities to groundwater dependent ecosystems (GDEs), third-party water supply works and potential for subsidence impacts on nearby structures or infrastructure (through assessment against the 'Minimal Impact' thresholds detailed under the *NSW Aquifer Interference Policy*, WM Act and NSW DPE (2023) *Groundwater impact assessment criteria*.
- Provide details of the proposed dewatering pumping method and proposed water treatment system to ensure compliance with relevant guidelines and regulations.
- Provide management strategies to minimise adverse environmental impacts.
- Establish environmental control procedures, monitoring program, performance criteria and compliance reporting to assess the potential impacts of extracted groundwater on the receiving environment and the effectiveness of implemented controls.

1.2 Scope of Works

To meet the above objectives, the following scope of work was undertaken:

- A desktop site assessment, including review of available previous investigation reports and publicly available information.
- A review of relevant groundwater policy, legislation, regulations and guidelines, including:
 - *NSW Aquifer Interference Policy*
 - Water Management Act 2000 (WM Act) and Part 5 of the Water Act 1912.
 - NSW DPE (2022) *Minimum requirements for building site groundwater investigations and reporting*.
 - NSW DPE (2023) *Groundwater impact assessment criteria*.
- Review of construction plans and methodology relevant to the proposed dewatering activity.
- Development of groundwater elevation contour plan, interpretation of groundwater flow direction and assessment of groundwater fluctuations based on long-term groundwater elevation monitoring completed by Alliance.
- Development of a Hydrogeological Conceptual Site Model (H-CSM) to replicate the hydrogeological stratigraphy, proposed excavation activity and construction development.
- Summarise the findings of the Groundwater Impact Assessment (including groundwater take model predictions, impact assessment against regulatory criteria and water quality) (Reditus 2025). Assessment of model results against the NSW DPI (2012) Aquifer Interference Policy Minimal Impact assessment criteria and the NSW DPI (2023) Groundwater Impact Assessment Criteria.
- Description of dewatering methodology for temporary construction dewatering and long-term drained basement dewatering development.
- Specify the discharge water quality criteria, dewatering methods including details of how dewatering volumes are to be measured (e.g., calibrated flow meter), management requirements, sampling frequency and compliance reporting requirements including a water quality testing program in compliance with Australian and New Zealand (2018) Guidelines for fresh and marine water quality.
- Details of how reporting will occur during and following the dewatering program, to confirm that predicted quantities and quality objectives were met.
- Assessment of the possible impacts of the proposed dewatering activity on other groundwater users/receptors against the minimal impact thresholds detailed in the NSW DPE (2023) *Groundwater impact assessment criteria*.
- Preparation of a Dewatering Management Plan in general accordance with the NSW DPI (October 2022) Minimum requirements for building site groundwater investigations and reporting; and the NSW DP1 (2023) Groundwater Impact Assessment Criteria, so that requirements of integrated development under the NSW Water Management Act 2000 can be met.

1.3 Roles and Responsibilities

The Principal Contractor will be responsible for implementing the appropriate management of the proposed construction dewatering activity as detailed within this document.

It must be noted that this DMP is not inclusive of all conditions of consent in relation to groundwater management, and that the Principal Contractor is responsible for making itself aware of, and complying with, all relevant conditions of any permits, licenses and approvals.

Monitoring, analysis and assessment of groundwater inflow volumes and offsite groundwater levels (offsite drawdown) must be completed by a suitability qualified hydrogeologist. All environmental monitoring, assessment of results and compliance reporting must be completed by a suitably qualified environmental consultant.

Geotechnical and structural engineering advice may be required if offsite groundwater drawdown threshold levels are triggered. Detailed geotechnical considerations are beyond the scope of this document.



If the dewatering activity is extended beyond the anticipated 12-month dewatering period, then this plan should be review by a suitability qualified professional to ensure it is still compliant with relevant legislation and guidelines.

Details of the nominated Principal Contractor, Hydrogeologist and Environmental Consultant are provided in **Table 1-2** below.

Table 1-2. Nominated Roles and Responsibilities

ROLE	COMPANY	CONTACT INFORMATION
Principal Contractor	LegPro Pty Ltd ATF Legpro 70 Unit Trust	Name: TBD Title: TBD Phone: TBD
Hydrogeologist & Environmental Consultant	Reditus Consulting Pty Ltd	Name: Seb McCulloch Title: Senior Hydrogeologist Phone: 0402 823 691

1.4 Limitations

A detailed statement of limitations for this report is provided in **Section 15**.

This report is based on the Scope of Work outlined in **Section 1.2**. Reditus prepared this report in a manner consistent with the normal level of care and expertise exercised by members of the environmental and hydrogeological assessment profession.

This report relates only to the objectives stated and does not relate to any other work undertaken for the Client (LegPro Pty Ltd ATF Legpro 70 Unit Trust). It is a report based on the information reported in previous environmental assessments by others, and data made available to Reditus. These conditions stated in this report may change with time and space.

All conclusions regarding the property area are the professional opinions of Reditus, subject to the qualifications in the report. Whilst normal assessments of data reliability have been made, Reditus assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Reditus, or developments resulting from situations outside the scope of this project. The client acknowledges that this report is for the exclusive use of the client.

All groundwater models include some degree of uncertainty in their predictions as they are, by necessity, simplifications of complex real world systems. Whilst every effort is made to ensure that the primary model reflects the best-case, most-likely case and upper-case understanding of site conditions, this cannot be guaranteed and any model result presented as a single number should be viewed with a degree of caution.

Factors which significantly affect the groundwater model and impact assessment results include dewatering rate, dewatering design, dewatering period, aquifer characteristics and degree of aquifer variability (including hydraulic conductivity, specific yield/ storativity, porosity, recharge, heterogeneity).

2 Document and Data Review

The following documents specific to the site were provided to Reditus to assist with preparation of this plan.

- SDG Pty Ltd (15 August 2025) Ground Level Surveys, 27 Railway Street, Corrimal (ref: 9117)
- DKO Architecture (NSW) Pty Ltd (2025) Architectural Plans for Stages 2-4, Corrimal Coke Works, Corrimal, NSW 2518 (ref: 13687).
- DKO Architecture (NSW) Pty Ltd (August 2020) Staging Plan, Corrimal Coke Works, Corrimal, NSW 2518 (ref:11877).
- Douglas Partners Pty Ltd (May 2023a) Report on Geotechnical Investigation, Proposed Corrimal Coke Works Redevelopment Bulk Earthworks, 27 Railway Street, Corrimal (ref: 78653.13).
- Douglas Partners Pty Ltd (May 2023b) Report on Geotechnical Investigation, Proposed Medium Density Developments, 27 Railway Street, Corrimal (ref: 78653.15).
- Reditus Consulting Pty Ltd (2020) – Data Gap Investigation, 27 Railway Street, Corrimal NSW (ref: 19149RP01).
- Reditus Consulting Pty Ltd (2022) – Consolidated Detailed Site Investigation, Former Corrimal Coke Works, Railway Street, Corrimal NSW (ref:22158RP04).
- Reditus (2025) Groundwater Model and Impact Assessment Stage 2a Development. Former Corrimal Coke Works, Railway Street, Corrimal NSW (ref:24150RP01).
- Reditus (2024b) Remediation Action Plan, Bulk Earthworks - Stage 2-4 Redevelopment - Former Corrimal Coke Works, Railway Street, Corrimal NSW (ref: 22158RP07).
- Reditus (2025) Acid Sulfate Soil Assessment, Stage 2-4 Bulk Earth Works Redevelopment Site, Former Corrimal Coke Works, Railway Street, Corrimal NSW (ref: 24326LTR20_v1).

2.1.1 PUBLICLY AVAILABLE DATA SOURCES

A list of publicly available data sources used for the desktop review as part of this assessment is provided in **Table 2-1** below.

Table 2-1 Summary of Publicly Available Data Sources

DATA DESCRIPTION	SOURCE
Groundwater users including Water Access Licence (WAL) holders including stock and domestic users	WaterNSW Water Register website (https://waterregister.watarnsw.com.au/water-register-frame)
	WaterNSW real time data website (https://realtimedata.watarnsw.com.au/water.stm)
Registered bore data	Bureau of Meteorology Australian Groundwater Explorer (http://www.bom.gov.au/water/groundwater/explorer/)
Groundwater dependent ecosystem's location and data	Bureau of Meteorology Groundwater Dependent Ecosystems Atlas (http://www.bom.gov.au/water/groundwater/gde/)
Surrounding contaminated site locations	The NSW Environmental Protection Authority (EPA) list of contaminated sites (https://www.epa.nsw.gov.au/your-environment/contaminated-land/notified-and-regulated-contaminated-land/list-of-notified-sites)



DATA DESCRIPTION	SOURCE
	The NSW Environmental Protection Authority (EPA) contaminated land record website (https://app.epa.nsw.gov.au/prclmapp/searchregister.aspx)
	The NSW Environmental Protection Authority (EPA) Protection of the Environment Operations Act (POEO) public register website (https://app.epa.nsw.gov.au/prpoeoapp/)
Regional geology data and mapping	Wollongong 1:250,000 Geological Series Sheet SI 56-9 (Second Edition, 1966)

3 Proposed Development

3.1 Development Details

Architectural plans for the Stage 2a development show the proposed development includes the following:

- Stage 2a development:
 - Four apartment buildings (2.1 – 2.4)
 - Two separate lots made up of 16 medium-density townhouses each
 - A park area
 - Roads and related infrastructure
 - 1 level basement carparking areas

The approximate layout of the proposed basement footprints at the site are presented in **Figure 2, Appendix A**.

Stage 2a will include the construction of four basements, basement 2.1, 2.2, 2.3 and 2.4. Basement 2.2, 2.3 and 2.4 will be constructed adjacent to each other, and basement 2.1 is located west of these basements. The Bulk Excavation Level (BEL) and Finished Floor Level (FFL) of each basement is presented in **Table 3-1** below.

Table 3-1 Summary of Proposed Excavation Parameters

LOCATION	BASEMENT EXCAVATION FOOTPRINT AREA ¹ (m ²)	FINISHED FLOOR LEVEL (mAHD*)	BULK EXCAVATION LEVEL (BEL mAHD)
Building 2.1	1,656	11.70	11.30
Building 2.2	2,002	11.20	10.78
Building 2.3	3,723	10.00	9.60
Building 2.4	3,325	10.00	9.60

*mAHD - Meters Australian Height Datum

3.2 Basement Construction Methodology

The proposed construction methodology is of a “drained basement” design, which is typically constructed consisting of a sub-slab drainage system. The basement floor is understood to consist of slab-on-grade, strip, or pad footings on the underlying sandstone bedrock.

3.3 Dewatering Extraction Rate and Duration

Dewatering is proposed to commence following the competition of shoring walls and during excavation. Groundwater is proposed to be extracted using internal drainage sump and pump dewatering system during construction (refer to **Figure 3-1** below).

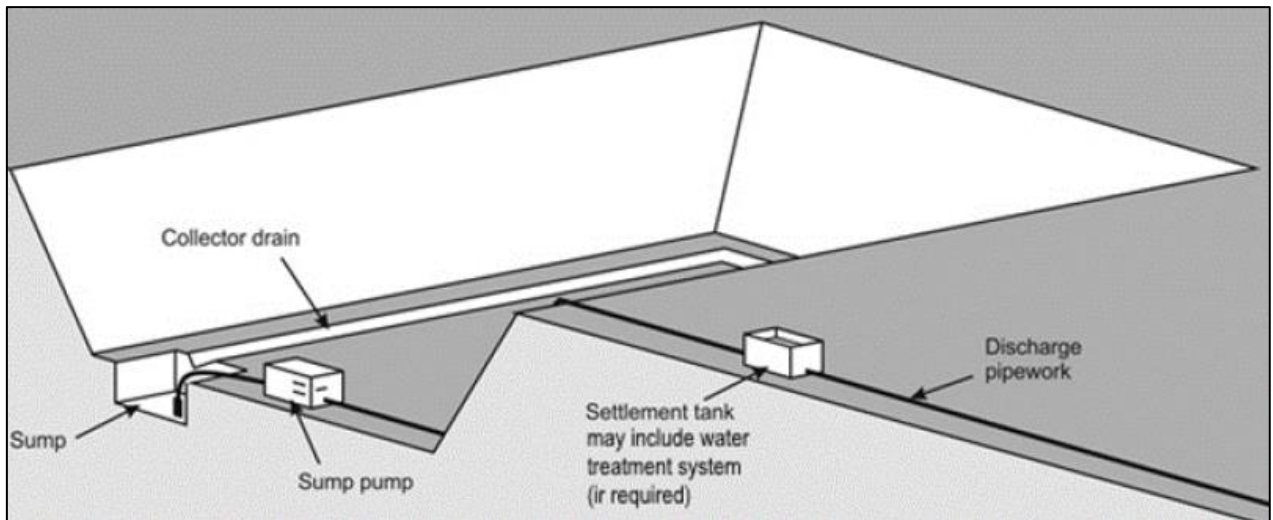


Figure 3-1 Conceptual layout of a sump and pump dewatering system

From an environmental perspective, construction methods to minimise the ingress of groundwater are recommended (such as grout injection into water bearing fractures), as it is effective in:

- Mitigating the risk of environmental impacts associated with drawdown of the water table, and the potential settlement of unconsolidated soils.
- Reducing the volume of extracted groundwater to be discharged (typically) off-site, which often requires treatment and has the potential to adversely impact the receiving environment.

Irrespective of the method, the dewatering depth shall be minimised to the extent practicable to reduce the volume of water to be extracted and to limit groundwater drawdown.

The duration to complete the necessary excavation works and basement construction is assumed to be approximately 12 months. Dewatering is likely to be required to operate 24 hours a day / seven days a week to maintain the water table at operational levels during construction and operation of the drained basement.

To minimise interruptions to the project and unnecessary expenditure, it is recommended that extraction pumps that can cater for low to high flow rates rather than mobilising multiple pumps that may not be required if lower flows are encountered.

3.4 Discharge Methods

The water will be discharged directly into North Corrimal Creek via the stormwater discharge line both of which are owned by the developer. The discharge point into North Corrimal Creek is located wholly within private land and as such does not require the prior approval of Wollongong City Council (WCC) to direct dewatered and treated groundwater into the Creek.

This does not prevent Council's Compliance and Enforcement of relevant provisions under the legislation such as the Protection of the Environment Operations Act 1997 and Contaminated Lands Act 1997. Given Council are not the asset or owner of the land they are not required to approve or permit the discharge. All water discharges and monitoring results are to be documented and kept on site. Copies of all records shall be provided to the appropriate regulatory authority, including Council, upon request.

Appropriate and ongoing treatment of extracted groundwater will be required during the proposed dewatering program to improve the water quality and minimise potential impacts to the receiving waters, relevant details are provided in **Section 11 and 13**.

4 Site Characterisation

4.1 Topography and Drainage

Development Application drawings including survey height are included in **Appendix B**.

The site shows significant undulations with numerous peaks and troughs across the wider site area. The northern portion of the site (Stage 1 development) has a maximum elevation of 16 m Australian Height Datum (AHD), whilst the southern portion of the site (wider site area) sits at the lowest site elevation of 4 m AHD. The development was graded across the northern and eastern portions of the site. The grade is non-uniform across the site area, with grades varying between 20% and 40%.

Two dams are located in the southern extent of the Stage 2a area, which will be drained and filled prior to the Stage 2a development. It is noted that these works are part of a separate package of work (Stage 2 – 4 Bulk Earth Works) and are not discussed further. The dams currently flow into North Corrimal Creek, which flow into Towradgi Creek. Tributaries of Towradgi Creek are located along the southern boundary of the site as well as in a north-south direction through the central portion and along the western boundary of the site. The tributaries of Towradgi Creek (North and South Corrimal Creeks) have a confluence at the south-eastern corner of the site before flowing out to the east towards Corrimal Beach and the Pacific Ocean.

4.2 Climate

Rainfall data was obtained from the Bureau of Meteorology weather stations at Bellambi AWS (068228) to create a monthly rainfall data set representative of the Site.

The Bellambi AWS is located approximately 2.0 km from east of the Site, with a rainfall record spanning from 1997 to 2025 (current), which is considered suitable to provide long-term average rainfall data for the Site. A summary of the long-term monthly average rainfall is presented on **Table 4-1** below.

Table 4-1 Average Rainfall

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Rainfall	86.7	150.5	123.5	103.5	85.0	111.0	87.1	88.5	59.5	79.5	99.9	76.8

4.3 Geology and Soil Landscape

The Wollongong – Port Hacking 1:100 000 Geological Series Sheet (Department of Mines, 1985) indicates that the site is underlain by the Erin Vale Formation (mapping unit P_{ie} , comprising fine to medium grained lithic sandstone) and Pheasants Nest Formation (mapping unit P_{ipcr} , comprising interbedded lithic sandstone, coal, carbonaceous claystone, siltstone and claystone). Both rock units belong to the Illawarra Coal Measures of Permian age, which cover almost all of the site are mantled by alluvium (mapping unit Q_{al} , comprising quartz and lithic “fluvial” sand, silt and clay) associated with North Corrimal Creek and Towradgi Creek.

The soil landscape likely to be found on the site is Gwynneville. The Gwynneville residual soil landscape typically comprises shallow brown podzolic soils and xanthozems on upper slopes, lithosols on simple slopes and shallow brown earths on midslopes and lower slopes (Department of Planning, Industry and Environment, 2020, soil landscapes of central and eastern NSW v2.1).

4.3.1 SITE-SPECIFIC GEOLOGY

A series of investigation works have been completed at the site by various consultants in association with the proposed development. At the time of writing this data is not available to Reditus in full. The generalised site stratigraphy based on the investigations by Reditus in 2025 (GIA) and summarised in **Table 4-2** below. Full well installation details are found in **Table 5-1**.

A site walk over identified carbonaceous fill present across the site which overlies alluvium deposits.

Table 4-2 Site-specific geology summary

STRATIGRAPHIC LAYER	GENERALISED DESCRIPTION	THICKNESS (M)
Unconsolidated Fill	Fill. Gravelly SAND, very loose, black/grey, fine grained, fine to coarse sized gravel, moist, carbonaceous material (coal, coke fine and gravel). Sandy to silty CLAY, medium to high plasticity, soft, grey/brown, coarse grained sand, with medium sized gravel organic, wet to moist. Sandy GRAVEL, dense, coarse grained sand, carbonaceous material (coal and gravel).	1.3 - 5
Alluvial	Alluvial. Silty CLAY, soft medium to high plasticity, grey/brown, trace fine sized gravel, organic, wet to moist.	0.4 -1.5
Residual Clay	Residual CLAY very stiff, high plasticity, grey/brown and orange, organic, wet, ironstone gravels. Sandy CLAY, stiff, low plasticity, white, medium grained sand, organic wet.	7
Residual Sand	Gravelly to Clayey SAND; low plasticity clay, red, coarse grained, coarse sized gravel, dry.	2.7

4.3.2 ACID SULFATE SOILS

Acid sulfate soils (ASS) occur predominantly on coastal land with elevations generally below 5 mAHD. These soils also occur further inland in saline seepage areas, rivers, lake beds and irrigation channels. Where present, drawdown of the local water table can expose ASS to oxidising conditions creating acidity and mobilising metals at potentially harmful concentrations.

Review of the Wollongong Local Environmental Plan (2009) maps much of the wider site including the Stage 2-4 development as Acid Sulphate Soils Class 5 with approximately 3% of the wider site is mapped as Class 3 land. The Class 3 land which is located along the southern boundary of the wider site adjacent to Towradgi Creek and is not proposed to be disturbed by the Stage 2a development. The Class 3 land is mapped at an RL of less than 4m AHD, while the deepest invert of the Stage 2a basement excavation levels is 6.6m AHD, as such it is not possible for the future dewatering activities to drawdown water within the Class 3 zone since it is 2.6m above the ground level of the Class 3 zone.

The Wollongong Local Environmental Plan (2009) defines Class 5 ASS as:

- Development consent is required for the carrying out of works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the water table is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.

Reditus completed additional assessment works relating to the potential for Acid Sulfate Soils to be present within the Stage 2a area. These were reported in *Acid Sulfate Soil Assessment. Proposed New Creek Alignment, Stage 2-4 Bulk Earth Works Redevelopment Site. Former Corrimal Coke Works, Railway Street, Corrimal NSW* dated 23 September 2025.

Based on the additional field observations and soil analytical results, it was concluded that:

- The field and analytical results of the ASS assessment did not identify indicators of AASS (Actual Acid Sulfate Soils) at the site for the soil sampling locations assessed to date.

- The sulfur trail is not indicative of RIS (Reduced Inorganic Sulfur) and PASS (Potential Acid Sulfate Soils) requiring management. Therefore, the soils proposed for excavation as part of the proposed development are not considered to present a potential ASS risk.

Even though the recent investigations did not identify the presence of any ASS/PASS requiring management, an Acid Sulfate Soil Management Plan (ASSMP), a precautionary approach was recommended and an ASSMP (Reditus, 2025) was prepared for the site.

4.4 Surface Water – Groundwater interaction

The GIA (Reditus 2026) includes an assessment of the surface water and groundwater interaction at North Corrimal Creek to determine if it is a gaining or losing stream (i.e. if it discharges water to groundwater or if it gains water from groundwater). This was assessed by determining the long-term trends of surface water (in North Corrimal Creek) and groundwater (in monitoring wells RED_MW09 and RED_MW10) elevations. The assessment concludes that the North Corrimal Creek loses water to the surrounding aquifer as the creek water elevation was greater than the groundwater elevation during the monitoring period between 22 August and 20 November 2025.

5 Hydrogeological Setting

The site is located within the Sydney Basin South Groundwater Source, which is managed under the WMA 2000 through the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023.

The groundwater system within the development extent on the site is described as:

- **Semi-Confined/Confined Weathered and Fractured Sandstone Aquifer:** Semi-confined/confined groundwater system within weathered and fractured sandstone/shale/siltstone of the Pheasants Nest Formation.

The depth to the bedrock in the Stage 1 area of the proposed development (north of Stages 2-4) has been mapped at between 6 m and 8 m bgl with some areas at greater than 10 metres bgl. Monitoring wells installed near the basement footprints of the Stage 2a development to depths of <5 m below ground level (bgl) did not reach depth of bedrock. Shallow perched groundwater was observed in two monitoring wells which were screened within fill material (coal wash material) and alluvium. It is expected that the depth to bedrock in the Stage 2-4 development areas would be at similar depths (6-10 mbgl) to the Stage 1 area. Groundwater storage within the bedrock sequence would be dominated by secondary porosity within the open bedding planes and fractures. The intensity, connectivity and orientation of the fracture network would determine the groundwater flow direction and velocity.

A review of Hydrogeology map of Australia (Geoscience Australia) indicates that site aquifers are fractured or fissured, extensive aquifers of low to moderate productivity.

5.1 Groundwater Monitoring Wells

Several groundwater investigations have been completed at the wider site area. Groundwater monitoring wells installed at the site as part of the Stage 1 development are summarised as follows:

- MW1 to MW5 were installed by Environmental Strategies in 2014 during the DSI. It is noted that these monitoring wells have been lost/destroyed.
- MW12 to MW14 were installed by Arcadis in 2018 during further additional groundwater investigations at the site.
- RCMW01 to RCMW03 were installed by Reditus in 2020 during the DGI. It is noted that RCMW01 and RCMW02 have been destroyed.
- Groundwater monitoring wells MW501, MW503 and MW507 were installed by Douglas Partners in March 2023 during the Geotechnical Investigation. These groundwater wells were utilised by Reditus for hydrogeological assessment purposes at the site.

- Groundwater monitoring wells RW01 through to RW06 (inclusive) were installed by Reditus in April 2024 to confirm the hydrogeological model of the shallow water bearing zone and were also utilised for hydrogeological assessment purposes for the Stage 1 development.
- Groundwater monitoring test pits were constructed on the 17th February within the Stage 1 basement footprint and then surveyed and the water levels determined within those pits on the 18th February 2025.
- The Stage 1 monitoring wells have been installed to depths ranging between RL 6.4 mAHD to 12.0 mAHD.

The groundwater monitoring wells (RED_MW01-RED_MW08) were installed as part of the Stage 2a development, whilst monitoring wells RED_MW09 and RED_MW10 were installed as part of the surface water / groundwater interaction purposes by Reditus in August 2025. Monitoring wells RED_MW01 to RED_MW08 were installed to approximately 0.5m below the bulk excavation levels (BELs) of the Stage 2a basement excavations. A summary of the well install details are presented in Table 5-1 below

The groundwater monitoring well locations are provided in **Figure 3, Appendix A**. Copies of borehole drilling logs and well construction logs are provided in **Appendix C**.

Table 5-1 Well installation Summary

WELL ID	SURFACE ELEVATION		WELL DEPTH		SCREEN DEPTH	SCREENED LITHOLOGY
	mAHD	mBGL	mAHD	mBGL	mAHD	
RED_MW01	12.12	2.47	9.65	0.47-2.47	11.65-9.65	Carbonaceous material and alluvial silty clay
RED_MW02	11.54	1.96	9.58	0.46-1.96	11.08-9.58	Carbonaceous material and alluvial silty clay
RED_MW03	13.03	3.0	10.03	2-3	11.03-10.03	Alluvial silty clay
RED_MW04	12.99	2.27	10.72	0.77-2.27	12.22-10.72	Carbonaceous material and alluvial silty clay
RED_MW05	13.08	2.35	10.73	0.35-2.35	12.73-10.73	Carbonaceous material
RED_MW06	14.44	3.22	11.22	2.42-3.22	12.02-11.22	Alluvial silty clay
RED_MW07	12.49	4.79	11.42	3.79-4.79	12.42-11.42	Carbonaceous material
RED_MW08	16.21	2.28	11.29	0.28-2.28	13.29-11.29	Carbonaceous material
RED_MW09	-	3.0	-	0.2-3.0	-	Alluvial silty clay and residual clay
RED_MW10	-	6.0	-	3.0-6.0	-	Residual silty clay

5.2 Groundwater Elevation and Inferred groundwater flow direction

5.2.1 MANUAL MEASUREMENTS

The Groundwater Model and Impact Assessment (Reditus 2025) reports the groundwater elevation and flow direction. The groundwater elevations measured as a part of this report are summarised in **Table 5-2**.

It is noted that monitoring wells RED_MW06-RED_MW08 were dry during the groundwater gauging event.

Table 5-2 Manual Groundwater Elevation Measurements

WELL ID	DATE	GROUND ELEVATION (RL mAHD)	DEPTH TO WATER (mBGL)	GROUNDWATER LEVEL (RL mAHD)
RED_MW01	26 Aug 25	12.12	2.37	9.75
RED_MW02	26 Aug 25	11.54	1.22	10.32
RED_MW03	26 Aug 25	13.03	2.96	10.07
RED_MW04	26 Aug 25	12.99	2.137	10.853
RED_MW05	26 Aug 25	13.08	0.62	12.46
RED_MW06	26 Aug 25	14.44	DRY	-
RED_MW07	26 Aug 25	16.21	DRY	-
RED_MW08	26 Aug 25	13.57	DRY	-
RED_MW09	26 Aug 25	10.5 *	1.135	10.065 *
RED_MW10	26 Aug 25	12.5 *	5.735	7.405 *

TOC – top of casing

RL mAHD – Reduced level metres Australian Height Datum

mbTOC – metres below top of casing

mbgl – metres below ground level

5.2.2 INFERRED GROUNDWATER FLOW DIRECTION

Based on the groundwater level measurements, groundwater within the shallow aquifer in the Stage 2a development is inferred to flow to the west and south-west towards the surface water lake and tributaries of Towradgi Creek in the centre of the wider site area.

The hydraulic gradient in the Stage 2a area slopes to the west towards North Corrimal Creek and Towradgi Creek located in the central portion of the site. The GIA (Reditus 2025) reports that the groundwater is directly influenced by rainfall. Shallow clay-rich alluvial deposits near the surface infiltrate less rainfall and indicate areas of lower permeability across site. The groundwater elevation and contour maps are shown in **Figure 3, Appendix A**.

5.2.3 GROUNDWATER ELEVATION MONITORING

Daily groundwater elevations were recorded at eight (8) monitoring well locations (RED_MW01 to RED_MW08) from 28 August 2025 to 21 November 2025, approximately 12 weeks. Four of the eight monitoring wells were noted as being dry for the duration of the monitoring period. A hydrograph was created for the recorded monitoring data at locations RED_MW01, RED_MW02, RED_MW03 and RED_MW05 and is presented on **Figure 5-1** below.

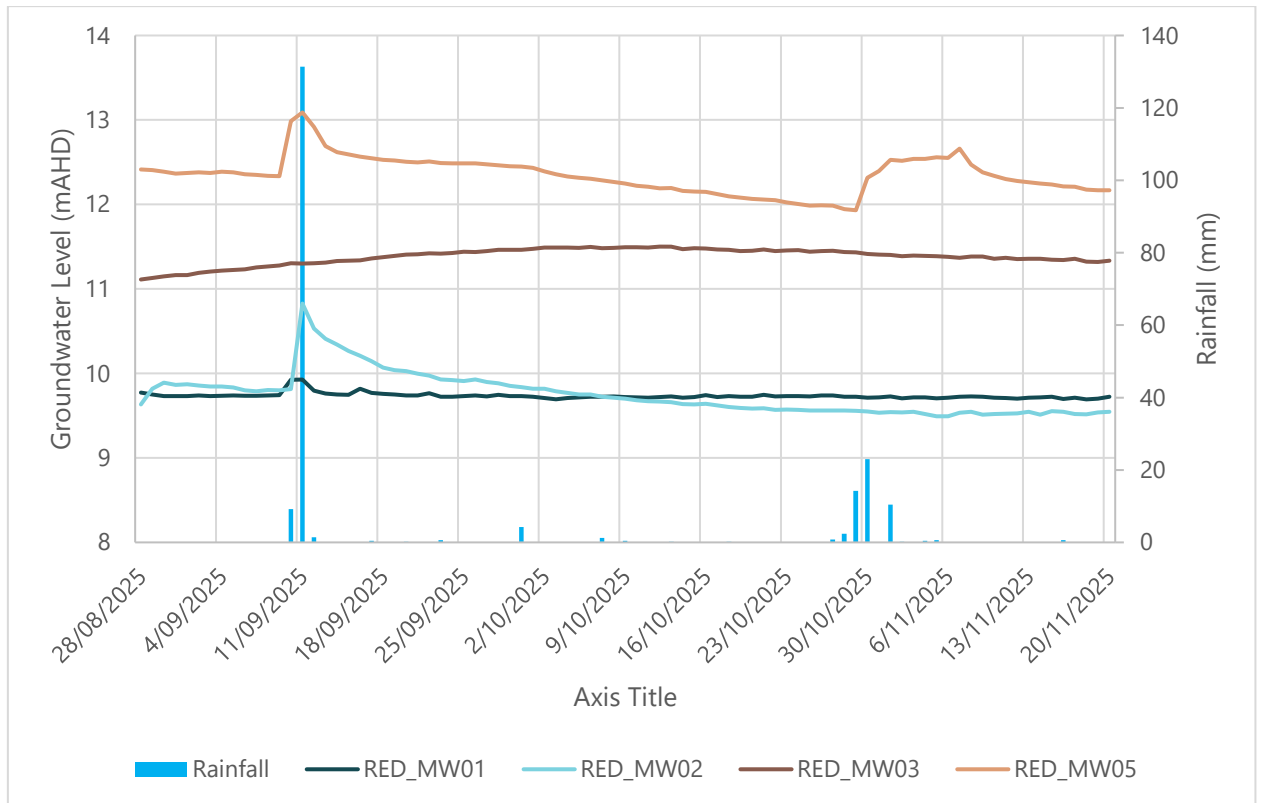


Figure 5-1. RED_MW01, RED_MW02, RED_MW03 and RED_MW05 recorded groundwater levels from 28 August to 11 November 2025

A summary of groundwater data is presented in **Table 5-3** below. Groundwater contours presented on **Figure 3, Appendix A**, indicate that the hydraulic gradient in the Stage 2a area slopes to the west towards North Corrimal Creek and Towradgi Creek located in the central portion of the site.

The groundwater elevation data presented indicates that groundwater is directly influenced by rainfall at locations RED_MW01, RED_MW02 and RED_MW05. This is expected as these wells were installed and screened directly into the unconsolidated fill materials at the site. Data recorded at location RED_MW03 was screened within the underlying natural shallow alluvial deposit and did not show any indication of change during high rainfall events indicating that groundwater in this location may not be directly influenced by rainfall.

Table 5-3. Summary of groundwater elevations between 28 August and 26 September 2025

ID	MINIMUM	MAXIMUM	RANGE
	mAHd	mAHd	(m)
RED_MW01	9.69	9.93	0.23
RED_MW02	9.49	10.83	1.33
RED_MW03	11.11	11.50	0.39
RED_MW05	11.93	13.09	1.16

5.2.4 SITE-SPECIFIC HYDRAULIC CONDUCTIVITY

Rising head slug testing data was obtained from two onsite wells (RED_MW02 and RED_MW05) located on the boundaries of the Stage 2a basement footprint. Outputs generated from computational software are presented in **Appendix D**. This test was completed to measure the change in hydraulic head overtime and to determine the aquifer characteristics of the wells. It is noted that the remaining wells installed as part of the Stage 2a development (RED_MW01, RED_MW03, RED_MW04, and RED_106-RED_MW108) were either dry or did not contain enough water within the well to conduct a slug test.

Following the fieldwork, the data was plotted using both the Bouwer-Rice and Hvorslev Method. Estimates of hydraulic conductivity were calculated and are summarised in **Table 5-4** below.

Table 5-4. Hydraulic conductivity estimates

WELL ID	LITHOLOGY	HYDRAULIC CONDUCTIVITY (M/DAY) BOUWER-RICE 1976 SOLUTION (UNCONFINED AQUIFER)		HYDRAULIC CONDUCTIVITY (M/DAY) HVORSLEV 1951 SOLUTION (UNCONFINED AQUIFER)	
		MIN	MAX	MIN	MAX
MW02	Carbonaceous fill material (gravelly sand) and silty clay alluvium	1.42	2.07	4.08	5.21
MW05	Carbonaceous fill material (gravelly sand) and re-worked natural sandy clay	4.13	4.38	8.17	9.74
Minimum:		1.42 m/day			
Maximum:		9.74 m/day			
Mean:		4.9 m/day			
Median:		4.26 m/day			

The above estimates of hydraulic conductivity are noted to be generally consistent with literature values for clay, silt, silty sand and sandstone (Fitts, C.R. 2013 Groundwater Science (2nd ed. Academic Press)).

5.3 Water Quality and contaminated sites

5.3.1 GROUNDWATER QUALITY SAMPLING

Groundwater samples were collected by Reditus on 28 August 2025 at two monitoring wells (RED_MW02 and RED_MW05) as well as a duplicate and triplicate sample during the groundwater monitoring event (GME) and were sampled for the following:

- Turbidity, Total suspended solids (TSS), Total Organic Carbon (TOC) and Sodium absorption ration (SAR).
- Nutrients including ammonia as N (NH₃), nitrite (NO₂), Nitrate (NO₃), Total Kjeldahl Nitrogen (TKN), organic nitrogen (Norg), nitric oxide (NOX), total nitrogen (N), total phosphorus (P) and phosphate (PO₄).
- Metals including aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), strontium (Sr), uranium (U), vanadium (V) & zinc (Zn).
- Major ions (Calcium, Sodium, Potassium, Magnesium, Chloride, Sulfate, Carbonate, Bicarbonate, Hardness and Total Alkalinity).
- TRH.
- BTEX.
- PAHs
- Silica, Bromide and Fluoride.
- Pathogens, including faecal coliforms, faecal enterococci and E.coli.

For preliminary assessment purposes, groundwater analytical results were compared against ANZG (2018) Freshwater and Marine 95% species protection criteria and ANZECC (2000) default trigger values for physical and chemical

stressors for south-east Australia for slightly disturbed ecosystems. Results were found to be below the criteria with the exception of the following:

- Cobalt (filtered) at location RED_MW02 exceeded the ANZG (2018) Marine 95% species protection criteria.
- Zinc (filtered) at locations RED_MW02, RED_MW05, DUP01 and TRIP01 exceeded the ANZG (2018) Marine 95% species protection criteria.
- Manganese (filtered) at location RED_MW02 exceeded the ANZG (2018) Freshwater 95% species protection criteria.
- Ammonia, NO_x, and Total Nitrogen at location RED_MW02 exceeded the ANZECC (2000) trigger values for south-east Australia slightly disturbed ecosystems.

Results are presented in **Appendix E** with lab reports presented in **Appendix F**.

5.3.2 GROUNDWATER PHYSICO-CHEMICAL PARAMETERS

During the GME, monitoring wells were purged using a low-flow pump until water quality physicochemical parameters were stabilised to the adopted stabilisation criteria (where possible). The readings are summarised in **Table 5-5** below.

Table 5-5 Groundwater Physico-chemical properties

WELL ID	PH	TEMP (°C)	EC (uS/cm)	DO (PPM)	ORP * (mV)	COMMENTS
RED_MW02	6.06	18.5	1,073	1.06	406.2	Pale brown, moderately turbid with no odours or sheen. Fields did not stabilise.
RED_MW05	6.13	17.1	1,600	0.68	418.7	Clear with some suspended solids, no odours or sheen. Fields stabilised

* ORP adjusted to the standard hydrogen electrode (SHE) by adding 199mV to field result.

Based on the physicochemical parameters recorded during the groundwater monitoring event the following observations have been made:

- pH indicated neutral to slightly acidic conditions in the underlying shallow aquifer.
- Electrical conductivity readings indicated a slightly brackish groundwater environment with dissolved salt and inorganics in relatively moderate concentrations.
- Dissolved oxygen (DO) readings indicated hypoxic groundwater.
- ORP results indicate oxidising conditions in the underlying shallow aquifer.

5.3.3 CONTAMINATED SITES RECORDS

A search of the public register of licences issued under the POEO Act (1997) identified no Environmental Protection Licence within a 1 km radius of the site.

A search of records held by NSW EPA including the Contaminated Land Record of Notices and the List of Notified Sites under Section 60 of the CLM Act (1997) found that there were two (2) sites located within 1km of the site that were on the List of Notified Sites. The sites are identified as Woolworths Petrol – Corrimal and is located approximately 400m west of the site, and 7-Eleven Corrimal located approximately 700m north-west of the site.

Based on review of publicly available data and aquifer interference activities to occur as part of the proposed Stage 2a development, potential sources of groundwater contamination have been identified, however are not considered to preclude the development. As dewatering activities during Stage 2a construction will account for the treatment of contaminated water as outlined further in this DMP, no further assessment is required to assess on-site groundwater quality in the vicinity of the site.

5.3.4 REGISTERED GROUNDWATER BORE SEARCH

A search of the WaterNSW Registered Groundwater Bore Database (<https://realtimedata.waternsw.com.au/water.stm>) indicated there are four (4) registered groundwater bores with a 1 km radius of the site. All four bores are used for monitoring purposes and located west of the site.

The closest registered groundwater bore is GW115679, which is located approximately 470 m west of the site. The bore was drilled to 7.0 m and is noted to be screened from 1.5m to 7.0m within clay and gravel fill, clayey sand and sandy clay material. There are no registered groundwater supply bores within a 1 km radius of the site.

5.4 Groundwater Dependant Ecosystems

Groundwater dependent ecosystems (GDEs) are a diverse and important component of biological diversity. The term GDE takes into account ecosystems that use groundwater as part of their survival strategies. GDEs can potentially include wetlands, vegetation, mound springs, river base flows, cave ecosystems, playa lakes and saline discharges, springs, mangroves, river pools, billabongs and hanging swamps and near-shore marine ecosystems.

The groundwater dependence of ecosystems can range from complete to partial reliance on groundwater, such as might occur during droughts. The degree and nature of groundwater dependence will influence the extent to which they are affected by changes to the groundwater system, both in quality and quantity.

Many land and water use activities within a catchment can affect groundwater dependent ecosystem function and viability. It is important to manage these land and water use activities within a regulatory and licensing framework. Risk assessment guidelines for groundwater dependent ecosystems have been developed to operate within the regulatory and licensing framework provided by the Water Management Act 2000 and Water Sharing Plans (WSPs). The guidelines are based on an assessment of various ecological and risk factors that are important to decisions on allowing a proposed activity or development. The site is located within the following WSP:

- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023 – Sydney Basin South Groundwater Source.

There are no very-high or high Priority GDEs (NSW DCCEEW High Ecological Value Aquatic Ecosystems Map 2018) or High Priority GDEs (Water Sharing Plan Greater Metro Source 2023) within a 1.5 km radius of the site. The closest mapped GDE's is 3.5 km west of the site located on the Illawarra escarpment east of the Princes Motorway and West of Tarrawanna

5.5 Summary of Surface Water Impact Assessment (GIA Reditus 2025)

It is noted that the North Corrimal Creek is going to be re-routed to the western boundary, and the dams to the south of Stage 2a are going to be drained and filled. However, these works will form part of a separate package of work and do not pertain to this Impact Assessment. It is assumed that the Stage 2 – 4 bulk earthworks will be completed prior to this development, and as such, surface water impacts are reported with that in mind.

The GIA identified disruption during the earth work activities including land clearing and basement excavation which will cause soil disruption. Minor changes to recharge patterns in the soil and subsurface are expected, particularly where permeability of near surface conditions is altered with the increase of impervious areas. This may increase overland flow and reduced infiltration. Increased soil erosion and sediment load to surface water stream (North Corrimal Creek) is expected during rainfall events. An overall decrease in surface water quality may result from increased turbidity from surface run off waters and increased exposure to contaminants as a result of on site construction activities (chemical spills, dust, leaching of heavy metals from construction activities).

It is expected that the impacts to surface water during the operational phase will be negligible. Increase in impermeable areas may results in minor decrease in infiltration over these areas and impact to the current site features will be minor. It is not anticipated that dewatering will exacerbate surface water impacts.

6 Summary of Predicted Groundwater Inflow and Take

6.1 Analytical Groundwater Model

As detailed in the Groundwater Model and Impact Assessment (Reditus, 2025), an analytical model has been developed to predict the groundwater inflow and take for the excavation footprint of the basements in the Stage 2a development.

As groundwater elevations within the unconsolidated fill are assumed to be negligible during the construction phase, the analytical model has been developed using the groundwater elevations at RED_MW03, as this was screened in the alluvium. Groundwater elevations recorded between 28 August and November 2025 ranged between 11.11 mAHD and 11.50 mAHD. Modelling of groundwater inflow and drawdown induced from dewatering was conducted by creating three analytical models for basement excavations 2.2, 2.3 and 2.4. Additionally, as no hydraulic conductivity values were determined for the alluvial material, literature values were used.

As a conservative estimate, the analytical model calculations and results are based on the maximum standing water level recorded in RED_MW03 (11.50 mAHD). Based on the maximum standing water level, groundwater in Basement 2.2, 2.3 and 2.4 is expected to be 0.72 m, 1.9 m, and 1.9 m, respectively.

Conceptual Flow Model:

A conceptual model is a description of the site, site works, and groundwater systems presented both as text and graphically. This description can then be approximated using an analytical solution to allow prediction of groundwater behaviour.

The groundwater drawdown estimate comprises two key components to be considered:

- a) The component of groundwater present within the aquifer matrix, which will be removed as part of the excavation process (pore water).
- b) The component of inflow into the excavation from the surrounding aquifer (walls and base) during the dewatering activity.

The conceptual flow models developed for this assessment are “steady state” models – a snapshot in time representing average conditions. This snapshot was completed based on conservative assumptions of the excavation depth, which estimate the greatest groundwater inflow. Note that a more detailed analysis can be provided through a three-dimensional flow model (beyond the scope of the current assessment).

Conceptually, the drained basement design will not limit any groundwater inflow into the excavation void and is assumed to be in direct connection with the surrounding unconfined aquifer.

To estimate the groundwater extracted present within the aquifer matrix, which will be removed as part of the excavation process, the porosity of the matrix is multiplied by the saturated excavation volume. The saturated excavation volume was calculated by determining the difference between the conservative standing groundwater level and the BEL, multiplied by the approximate excavation area for the basement.

To estimate the groundwater inflow volumes, Reditus used the Marinelli and Niccoli (2000)¹ steady-state analytical solution. This solution provides a convenient means for estimating groundwater inflows into excavations and is considered applicable to use as a conservative assessment for the proposed drained basement design.

The analytical method of Marinelli and Niccoli (2000) requires a simplification of the hydrogeological environment and was used to provide a broad range of potential drawdown and groundwater inflow. The equations calculate groundwater inflow from the aquifer based on the conceptual model.

The conceptual flow model was approximated by analytical models, which are divided into two zones separated by a conceptual no-flow boundary where horizontal flow will occur level with the excavation base:

- **Zone 1** – exists above the base of the excavation and represents lateral flow to the excavation via the surrounding walls and drainage layer.
- **Zone 2** – extends from the bottom of the excavation downward and considers vertical upward groundwater inflow through the excavation base into the void and drainage layer.

¹ Marinelli, F, and Niccoli, W.L. (2000) Simple analytical equations for estimating ground water inflow to a mine pit: Groundwater, v. 38, no.2, p. 311-314

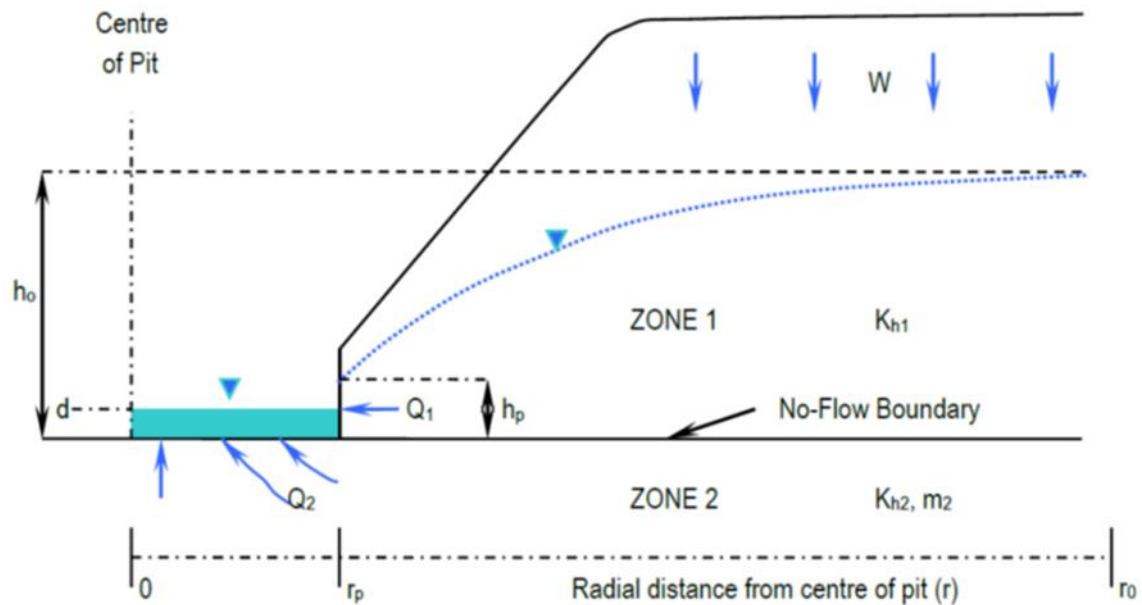


Figure 6-1. Conceptual Model of the Analytical Solution

The analytical solution for Zone 1 considered steady state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table. This represents the volume of water laterally flowing into the excavation through the excavation walls.

The analytical solution for Zone 2 is based on steady-state flow to one side of a circular disk sink of constant and uniform drawdown. The circular disk sink represents the volume of water needing to be removed to dewater the site to the target dewatering level of each basement excavation.

For the development of the conceptual flow model for the proposed excavation, the circular disk sink was assumed to encompass the approximate area of the excavation footprint. The total excavation is approximated as a single large well and as such the circular disk sink was assigned a radius of based on the footprint of the proposed excavation.

An average annual rainfall of 1,151.5 mm of rain was registered at the nearest weather station (Station No. 068228 – Bellambi AWS) over the period of 1997 to 2025. These statistics have been used as the average annual rainfall for inflow calculations. This is then converted to an assumed average daily rainfall of 0.00315 m/day.

A review of Hydrogeology map of Australia (Geoscience Australia) indicates the aquifer type beneath the site are **Semi-Confined/Confined Weathered and Fractured Sandstone Aquifer**. Based on the intrusive investigation, however, the basement excavations will not intercept the bedrock aquifer and will only intercept the alluvial aquifer that is found above the bedrock.

Summary of Aquifer Parameters

There is no site specific hydraulic conductivity data for the alluvium as there was not enough volume of water within the well at the time of the investigation. As such, a nominal hydraulic conductivity value of 1×10^{-2} was applied, based on literature values, to all three models. This value was used as it represents the silty clay geology of the aquifer.

Site specific porosity values were not measured. As such, representative porosity values were adopted from literature sources. Given groundwater storage of the aquifer is likely unconfined silty clay present as unconsolidated porous media, a porosity value 10% was assumed for the alluvial silty clays. An anisotropy ratio of 0.1 was applied, which assumes 10% more inflow of water comes through the horizontal walls compared to vertically.

Model Scenarios

All groundwater models include some degree of uncertainty in their predictions as they are, by necessity, simplifications of complex real-world systems. Whilst every effort is made to ensure that the primary model reflects the best-case, most-likely case and upper-case (less likely) understanding of site conditions, this cannot be guaranteed, and any model result presented as a single number should be viewed with a degree of caution.

Factors which affect the dewatering rate, groundwater take and extent of drawdown within the steady state model include dewatering rate, dewatering design, dewatering period, aquifer characteristics and degree of aquifer variability (including hydraulic conductivity, specific yield/Storativity, porosity, recharge, heterogeneity).

It is considered impractical to determine these factors by pumping tests and further analytical assessment, based on the relatively small scale of the development and the likely relatively low risk of impact to groundwater in the shallow water bearing zone in the top of the low yielding porous aquifer.

Typical representative values were used in the model and it is anticipated that negligible groundwater inflows will occur, the following analytical model presents an **Upper-case** scenario for each basement. That is, dewatering rates calculated assuming the maximum groundwater elevation in RED_MW03 is present for the duration of the construction period.

6.1.1 ANALYTICAL MODEL EQUATIONS

Groundwater Take Volume within the excavation matrix.

The following equation was utilised to estimate the groundwater volume present in the aquifer matrix directly removed through excavation:

$$V = \phi \times m \quad (1)$$

$$m = (H_0 - BEL) \times A \quad (2)$$

where:

V = groundwater volume present in the aquifer matrix directly removed through excavation (m³).

ϕ = matrix porosity

m = volume of saturated aquifer matrix to be excavated

H₀ = initial water table elevation (RLm)

BEL = basement excavation level (RLm)

A = area of excavation

Groundwater Inflow Take Volume

The steady state inflow rate into the disk sink is given by the following equations²:

Zone 1:

$$Q_1 = W\pi(r_o^2 - r_p^2) \quad (3)$$

$$h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]} \quad (4)$$

Zone 2:

$$Q_2 = 4r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d) \quad (5)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}} \quad (6)$$

where:

Q = groundwater flux (m³/day)

K_{h1} = horizontal hydraulic conductivity (m/day) at Zone 1

K_{h2} = horizontal hydraulic conductivity (m/day) at Zone 2

K_{v2} = vertical hydraulic conductivity (m/day) at Zone 2

m₂ = vertical hydraulic conductivity anisotropy parameter

d = depth of water (above target dewatering level) within final excavation (m) (*assumed to be 0 at final excavation depth*)

r_p = radius from centre of excavation (circular disk sink) (m)

r_o = drawdown radius from centre of excavation (iterative calculation)

h_o = initial saturated thickness above base of excavation (m)

h_p = saturated thickness above the base of excavation at the excavation wall (r_p), which is assumed 0 m

W = rainfall recharge rate (assumed % of the mean daily rainfall)

Groundwater Drawdown extent

The following equations were used to calculate the groundwater drawdown resulting from the groundwater take into the excavation²:

$$H_{1(r)} = H_0 - h_o + \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]} \quad (7)$$

where:

H_{1(r)} = hydraulic head elevation (m) at a radial distance (r) from excavation centre

H_0 = initial groundwater elevation (mRL)

h_0 = initial saturated thickness above base of excavation (m)

r = radial distance from excavation centre (m)

z = vertical depth below the excavation bottom (assumed to be 0 m)

W = rainfall recharge rate (assumed % of the mean daily rainfall)

K_{h1} = horizontal hydraulic conductivity (m/day) at Zone 1

6.1.2 MODEL ASSUMPTIONS AND INPUT PARAMETERS

Assumptions

The analytical solution was based on the following assumptions, after Marinelli and Niccoli (2000):

- Steady state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table.
- The excavation walls are approximated as a circular cylinder.
- Groundwater flow is horizontal. The Dupuit-Forchheimer approximation (McWhorter and Sunada 1977) is used to account for changes in saturated thickness due to depression of the water table.
- The static (pre-excavation) water table is approximately horizontal.
- Uniform distributed recharge occurs across the site as a result of surface infiltration. All recharge within the radius of influence (cone of depression) of the pit assumed to be captured by the excavation. A 10% recharge rate due to surface water infiltration through the deep soil zones around the perimeter of the basement excavation.
- Groundwater flow toward the pit is axially symmetric.
- Hydraulic head is initially uniform (hydrostatic) throughout Zone 2. Initial head is equal to the elevation of the initial water table in Zone 1.
- The disk sink has a constant hydraulic head equal to the elevation of the "pit lake water surface". If the pit is completely dewatered, the disk sink head is equal to the elevation of the pit bottom – in this case the target dewatering level.
- Flow to the disk sink is three dimensional and axially symmetric.
- Materials within Zone 2 are anisotropic, and the principal coordinate directions for hydraulic conductivity are horizontal and vertical. It has been assumed that horizontal permeability is greater than vertical permeability by a factor of 10.

Parameters

The parameters used to estimate the groundwater removal (excavation and inflow) within the analytical solution for the three basement excavations are provided in **Table 6-1**.

Table 6-1 Groundwater Inflow Analytical Model Input Parameters for the three basements

PARAMETER	UNIT	BASEMENT 2.2	BASEMENT 2.3	BASEMENT 2.4
Excavation Matrix Storage				
Effective Porosity (ϕ)	-	10%	10%	10%
Bulk Excavation Level (BEL)	RL mAHD	10.78	9.60	9.60
Excavation Area	m ²	2,002	3,273	3,325
Zone 1				
r_p	m	25.24	32.28	32.53
r_o	m	28.88	43.00	42.43
W	m/day	3.15 x 10 ⁻⁴ (10% of average annual rainfall)	3.15 x 10 ⁻⁴ (10% of average annual rainfall)	3.15 x 10 ⁻⁴ (10% of average annual rainfall)
h₀*	m	0.66	0.82	1.84
h_p**	m	0	0	0
K_{h1}	m/day	1.0 x 10 ⁻²	1.0 x 10 ⁻²	1.0 x 10 ⁻²
Zone 2				
K_{h2}	m/day	1.0 x 10 ⁻²	1.0 x 10 ⁻²	1.0 x 10 ⁻²
K_{v2}	m/day	1.0 x 10 ⁻³	1.0 x 10 ⁻³	1.0 x 10 ⁻³
d	RL m	0	0	0

6.1.3 SUMMARY OF ANALYTICAL MODEL RESULTS

The groundwater matrix removal for each basement was estimated using equation 1 and equation 2. The annual groundwater inflow for each basement was estimated using equation 3, 4, 5 & 6, and the results assume a 12-month dewatering program and continued dewatering during the operational period. Results for the analytical model for the upper-case for each scenario are presented in **Table 6-2** below.

Table 6-2. Prediction of Groundwater Volume Removed within each Basement Excavation Matrix

DEWATERING AREA	MATRIX VOLUME (ML)	INFLOW RATE (ML/YEAR) ¹	TOTAL VOLUME (ML) ²
Basement 2.2	0.144	0.162	0.306
Basement 2.3	0.622	0.559	1.181
Basement 2.4	0.632	0.563	1.195

Notes:

¹Inflow rate represents the ongoing operational inflow rates.

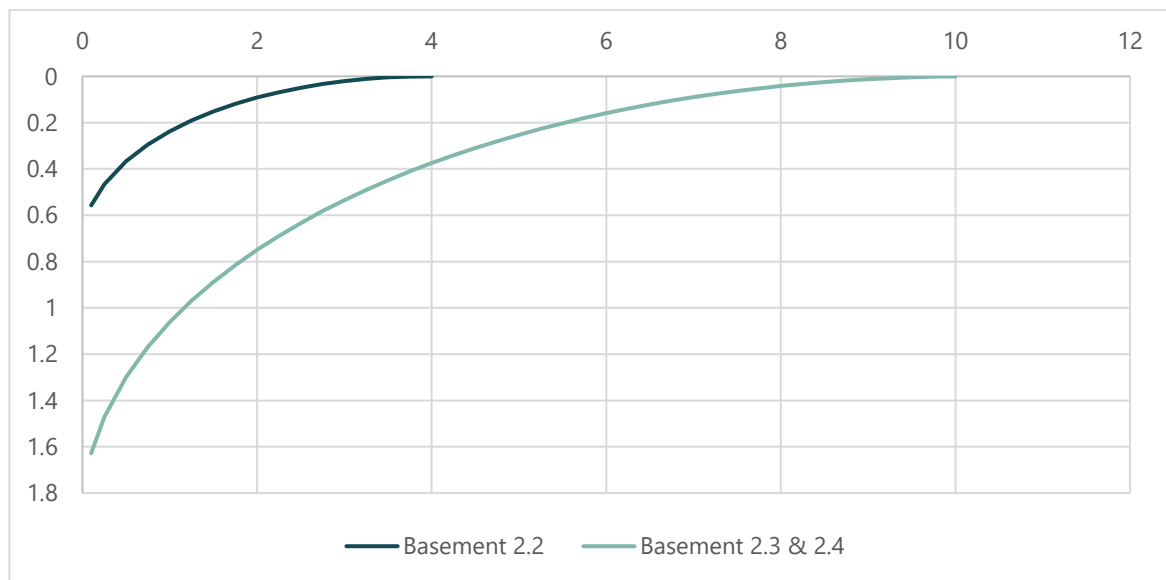
²Total volume represents the total volume modelled for the construction period (i.e. matrix volume plus inflow rate for the first 12 months).

6.1.4 PREDICTION OF DRAWDOWN DISTANCE

As part of the dewatering assessment, the extent of groundwater drawdown was estimated at regular distance intervals from the edge of the circular disk sinks (approximate excavation edge) Drawdown reaches 0 m at the following radial distance from the edge of the approximate excavation edge for each basement excavation:

- Basement 2.2: 3.5 m
- Basement 2.3: 9.75 m
- Basement 2.4: 9.75 m

It is noted that the calculated drawdown at the approximate excavation edge of each basement was ≤ 1.0 m. The estimated drawdown at distance from each excavation/basement walls have been provided in **Graph 1** below.



Graph 1. Extent of Drawdown from Basement/Excavation Wall for each basement.

There is potential that drawdown outside the site may be sufficient to induce settlement in overlying buildings unless an appropriate DMP is implemented. A suitability qualified geotechnical consultant will be required to determine the potential settlement impacts caused by the potential drawdown as a result of the proposed dewatering activities. There are no buildings there currently, however the adjacent train line and future development should be considered. Detailed geotechnical considerations are beyond the scope of this assessment.

7 Legislation, Regulation and Relevant Endorsed Guidelines

To facilitate the construction and temporary dewatering, in relation to impacts of groundwater resources and the surrounding environment, the following statutory requirements need to be achieved to address the WaterNSW regulations.

The majority of NSW groundwater is covered by statutory Water Sharing Plans and the *NSW Aquifer Interference Policy*. In the absence of a relevant Water Sharing Plan, groundwater is regulated under the Water Act 1912.

Given that groundwater will be incepted and dewatered as part of the proposed development, the construction works are considered to be an aquifer interference activity requiring authorisation from WaterNSW under either the WM Act and/or the Water Act 1912.

7.1 Water Act 1912 and Water Management Act 2000

Dewatering for construction purposes is classified as an aquifer interference activity under the NSW Aquifer Interference Policy 2012.

WaterNSW are responsible for water work approvals under the provisions of the Water Management Act 2000 (WMA) which includes regulation of all aquifer interference activities within Water Sharing Plan management areas. WaterNSW also are responsible for water works approvals for all groundwater extraction in areas outside Water Sharing Plan management areas, as well as State Significant Developments.

While minor aquifer interference activities works are generally exempt from the full extent of the WMA 2000, an application for “Approval for Water Supply Works and/or Water Use” (previously known as a Dewatering Licence) is required, regardless if the total volume of groundwater extracted is expected to exceed <3 ML per year a Water Access License (WAL), or written approval from WaterNSW/NRAR if no licence is required, must be obtained prior to commencement. It is noted that SSDs are often exempt from requiring a Water Supply Works Approval, and consent conditions for SSD-8389711 indicate that it is not required. Additionally, as the anticipated groundwater take is <3 ML/year (see **Section 7.1**), and so no WAL will be required during the operational phase of the development.

Further information on the aquifer interference policy and licencing requirements are available from the WaterNSW website.

Reditus note that if/once approval has been provided, an application for a “new water access licence with a zero share component” may be required to be completed and a suitable groundwater entitlement may also need to be obtained from the market to account for the groundwater take within the same groundwater source (in this case, Sydney Basin – South Groundwater Source), under the Water Sharing Plan for the Greater Metropolitan Groundwater Sources 2023. This will need to be obtained within three months of granting of the Zero Access Licence.

Works or activities that intersect or interfere with groundwater systems and where take is incidental to the primary purpose of the activity, or where there is no take, are managed as aquifer interference activities. Aquifer interference activities taking 3 ML or less of groundwater per year are exempt from requiring a WAL.

7.1.1 WATER SHARING PLANS (WSPS)

WSPs are being progressively developed for rivers and groundwater systems across NSW following the introduction of the Water Management Act (WMA) 2000. WSPs made under the WMA are being prepared as Minister’s plans under Section 50 of the Act. These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water.

WSPs provide a legislative basis for sharing water between the environment and consumptive purposes. Under the WMA, a plan for the sharing of water must protect each water source and its dependent ecosystems and must protect basic landholder rights.

The site is located within the following WSP:

- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023 – Sydney Basin South Groundwater Source.

Water sharing plan for the Greater Metropolitan region groundwater sources (2023) – Sydney Basin South Groundwater Source

The Sydney Basin South Groundwater Source bounded by the coast to the east, Kangaroo River to the east and the Nepean Management Zone. The groundwater source ranges from north of Wollongong to Nerriga in the south. National parks cover much of the southern and western portion of the groundwater source and the bore distribution is concentrated to the north-east around Camden and the south-western areas around Moss Vale. The geology consists predominantly of sedimentary rocks of the Sydney Basin, which includes coal measures, shales and sandstone. The long-term average annual extraction limit (LTAAEL) is 50,584 ML/yr (2023).

7.2 NSW Aquifer Interference Policy 2012

The purpose of the NSW Aquifer Interference Policy 2012 is to explain the role and requirements of the Minister administering the WM Act in the water licensing and assessment processes for aquifer interference activities under the WM Act and other relevant legislative frameworks. The NSW Aquifer Interference Policy 2012:

1. Clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation; and
2. Establishes and objectively defines considerations in assessing and providing advice on whether more than minimal impacts might occur to a key water-dependent asset.

The proposed development will result in aquifer interference under the NSW Aquifer Interference Policy (2012) as groundwater will be removed from at least one aquifer. Groundwater licensing may be required according to the inference by moving water from one source to another.

7.2.1 LICENCING OF WATER TAKEN THROUGH AQUIFER INTERFERENCE

A water access licence (WAL) is required under the WM Act (unless an exemption applies or water is being taken under a basic landholder right) where any act by a person carrying out an aquifer interference activity causes:

- The removal of water from a water source; or
- The movement of water from one part of an aquifer to another part of an aquifer; or
- The movement of water from one water source to another water source, such as:
 - from an aquifer to an adjacent aquifer; or
 - from an aquifer to a river/lake; or
 - from a river/lake to an aquifer.

Although dewatering for construction and operation of a drained basement is considered an aquifer interference activity, an exemption for a WAL is granted as it meets the criteria of <3 ML/yr and is not taken for consumption or supply.

7.3 Environmental Planning and Assessment Act 1979

Conditions of consent in relation to dewatering are prescribed by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) in the Development Consent and NSW DPE General Terms of Approval for the works issued under the Environmental Planning and Assessment Act (1979). A copy of the approval must be kept on location at all times.

7.4 Protection of the Environment Operations (POEO) Act 1997

The POEO Act 1997 and its associated schedules and regulations are directly relevant to dewatering operations. In particular, the Act includes requirements prohibiting the pollution of waters, preventing or minimising air and noise pollution, regarding maintenance and operation plant in a proper and efficient condition/manner, and for minimising and managing wastes.

The Act also requires notification to the NSW Environmental Protection Authority (EPA) and Council, when a pollution incident occurs that causes or threatens material harm to the environment (including discharges above the set limits to the stormwater and where any unacceptable impact to the receiving waters is identified).

7.5 NSW Water Quality Objectives (2006)

The NSW Water Quality Objectives are the agreed environmental values and long-term goals for NSW's surface waters. They set out:

- the community's values and uses for our rivers, creeks, estuaries and lakes (i.e. healthy aquatic life, water suitable for recreational activities like swimming and boating, and drinking water); and
- a range of water quality indicators to help us assess whether the current condition of our waterways supports those values and uses.

Water Quality Objectives have been agreed for Fresh and Estuarine surface waters and Marine Water Quality Objectives.

The Objectives are consistent with the agreed national framework for assessing water quality set out in the ANZECC 2000 Guidelines. These guidelines provide an agreed framework to assess water quality in terms of whether the water is suitable for a range of environmental values (including human uses). The Water Quality Objectives provide environmental values for NSW waters and the ANZECC 2000 Guidelines provide the technical guidance to assess the water quality needed to protect those values.

The River Flow Objectives are the agreed high-level goals for surface water flow management. They identify the key elements of the flow regime that protect river health and water quality for ecosystems and human uses.

7.6 Relevant National and NSW EPA Endorsed Guidelines

The adopted water quality guidelines for discharge waters are the:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018).
- ANZECC/ARMCANZ (2000) Default Trigger Values (TVs) for Physical and Chemical Stressors (used in the absence of ANZG 2018 criteria).
- Guidelines for Managing Risks in recreational Water (NHMRC 2008) / Drinking Water Criteria (NHMRC 2017).

Use of the 95% protection level (for the ANZG 2018 Guidelines) is based on an assumption that the surrounding watercourses are moderately disturbed ecosystems (as receiving road and stormwater runoff from adjacent highly urbanised environment). In the absence of ANZG (2018) DGVs, the ANZECC (2000) trigger values (TVs) were adopted.

The DMP will need to be revised if changes to the DGVs occur. If this change occurs during the current proposed dewatering period, this is to be reflected in a revised DMP.

8 Groundwater Impact Assessment

8.1 Minimal Impact Considerations

The WMA 2000 includes the concept of ensuring "no more than minimal harm" for both the granting of water access licences and the granting of aquifer interference approvals.

The NSW Aquifer Interference Policy includes a set of minimal impact considerations for assessing the impacts of all aquifer interference activities, including those regulated under the WMA 2000, the Water Act 1912 and those decided under other legislation. The NSW DPE (2023) Groundwater Impact Assessment Criteria provides a framework for the Minimal Impact threshold criteria.

Aquifer interference approvals are not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems, as a consequence of its being interfered with in the course of the activities to which the approval relates.

Whilst aquifer interference approvals are not required to be granted, the minimal harm test under the WMA 2000 is not activated for the assessment of impacts. Therefore, this Policy establishes and objectively defines minimal impact considerations as they relate to water-dependent assets and these considerations will be used as the basis for providing advice to the Minister.

All NSW groundwater sources have been categorised as being either highly productive or less productive, based on the general character of the water source meeting or not meeting the criteria of 1500 mg/L total dissolved solids and a bore yield rate of greater than 5 L/s. This categorisation applies to a whole groundwater source as it is defined in a water sharing plan, not to the specific groundwater conditions at a particular location. The minimal impact considerations for the highly productive groundwater sources are different to those for the less productive groundwater sources.

Thresholds for minimal impact considerations have been developed for each groundwater source in NSW. Within the WM Act, Table 1 – Minimal Impact Considerations for Aquifer Interference Activities are categorised into type of groundwater sources and are presented in **Table 8-1** below. The thresholds relate to impacts on groundwater table and pressure, and to groundwater and surface water quality.

Table 8-1 Highly and Less Productive Groundwater Source Types

HIGHLY PRODUCTIVE	LESS PRODUCTIVE
Alluvial	
Coastal Sands	
Porous Rock	
– Great Artesian Basin - Eastern Recharge and Southern Recharge; – Great Artesian Basin – Surat, Warrego and Central – other porous rock	Alluvial Porous Rock Fractured Rock
Fractured Rock.	

The proposed basement drainage design will take water from the Sydney Basin South Groundwater Source. The Pheasants Nest Formation is considered a “Less Productive” alluvial and fractured rock groundwater sources as yields are less than 5 L/s and total dissolved solids are likely <1,500 mg/L.

Thresholds for minimal impact considerations have been developed for each groundwater source in NSW. The thresholds relate to impacts on groundwater table and pressure, and to groundwater and surface water quality.

A summary of the groundwater impact assessment completed for the applicable Sydney Basin South Groundwater Source is provided in **Table 8-2** below.

Table 8-2. Minimal Impact Considerations under the Aquifer Interference Policy (2012) & NSW Department of Planning and Environment (2023) Groundwater Impact Assessment Criteria

GREATER METROPOLITAN REGION GROUNDWATER SOURCE: SYDNEY BASIN SOUTH GROUNDWATER SOURCE	
CATEGORY: LESS PRODUCTIVE / UNCONFINED SYSTEM	
IMPACT ASSESSMENT CRITERIA	ASSESSMENT RESULTS
1. Cumulative extraction over a ten-year period must not cause drawdown to exceed 0.1 metres at any: a) groundwater dependent ecosystem identified in the water sharing plan. b) high priority culturally significant site.	No high or very high groundwater dependant ecosystems identified in the water sharing plan or high priority culturally significant sites have been identified within a 500 m radius of the site.
2. Cumulative extraction over a ten-year period must not cause drawdown to exceed 10% of the <i>Total Available Drawdown</i> to a maximum of 2 metres at any: a) 3rd or higher order connected surface water source. b) vegetation groundwater dependent ecosystem identified in the water sharing plan.	At a radial distance of 10 m from the proposed dewatering activity, the estimated drawdown reaches 0m in the 'Upper Case' scenario (worst case). This is considered by Reditus to be consistent with Minimal Impact. No other third order or higher surface water sources or vegetation groundwater dependant ecosystems have been identified within a 500 m radius of the site.
3. Cumulative extraction over a ten-year period must not cause the recovered water level (metres below ground level) to drop below 25% of the Relative Total Available Drawdown at: a) a distance of 200 metres from any production water supply works including the applicant's bores (e.g. bores on an approval linked to an access licence). b) any other water supply work including the applicant's bores (i.e. at any basic landholder rights bores).	At a radial distance of 10 m from the proposed dewatering activity, the estimated drawdown reaches 0m in the 'Upper Case' scenario (worst case). This is considered by Reditus to be consistent with Minimal Impact. There are no production water supply bores or any other water supply works within a 500m radius of the site.
4. Additional drawdown over a ten-year period cannot exceed 10% of the Total Available Drawdown to a maximum of 2 metres at any 3rd - party water supply works.	At a radial distance of 10 m from the proposed dewatering activity, the estimated drawdown reaches 0m in the 'Upper Case' scenario (worst case). This is considered by Reditus to be consistent with Minimal Impact. There are no 3rd-party water supply works within a 500m radius of the site.

Based on the results of the groundwater impact assessment, the proposed partially drained basement water take activities are considered to be of **Minimal Impact** under the NSW DPI (2012) Aquifer Interference Policy, Water Management Act 2000 and the NSW DPE (2023) Groundwater Impact Assessment Criteria. Reditus believe that the development can be managed under a 'drained basement' design with the successful implementation of this DMP.

9 Water Quality Objectives

9.1 Receiving Environment

The site is situated within a formerly industrialised, highly modified environment, adjacent both urbanised residential and commercial/ industrial areas. It is understood that the extracted groundwater is to be treated and discharged to the stormwater network.

The receiving waters of the discharge groundwater is understood to be North Corrimal Creek which is located within the site boundary.

Downstream, Towradgi Creek is considered to be a moderately disturbed ecosystem, which receives water from a highly urbanised environment, and has overall poor water quality. Use of the ANZG (2018) 95% protection level for ecological receptors has been adopted on this basis and 99% protection for analytes that bioaccumulate.

9.2 Adopted Discharge Water Quality Guidelines

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) provide detailed approaches and advice on identifying appropriate guideline values for the protection of environmental receptors. These guideline values help to ensure that agreed community values and their management goals are protected.

The ANZG (2018) have been endorsed by the NSW EPA, which supersedes the previous ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Applying the ANZECC (2000) guidelines to the range of community values relied largely on a single line of evidence (chemical assessment) to determine whether or not a guideline value was exceeded. The ANZG (2018) Water Quality Guidelines improve confidence in our assessments by:

- Introducing a systematic approach to assessing a number of lines of evidence along the pressure–stressor–ecosystem receptors pathway.
- Promoting decisions on the basis of the integrated weight of evidence.

For the protection of aquatic ecosystems, locally derived guideline values are most appropriate. In the absence of locally derived guideline values or other jurisdictionally-legislated requirements (as in this case), the ANZG (2018) provide default guideline values (DGVs) for assessing the impacts of physio-chemical parameters and potential toxicants on aquatic ecosystems, as well as advice on tailoring DGVs to suit the local region. Where DGVs are not available within the ANZG (2018), the ANZECC (2000) guidelines trigger values (TVs) are adopted.

It is specifically noted in the ANZG (2018) guidelines that “the Water Quality Guidelines are not intended to directly apply to contaminant concentrations in industrial discharges or stormwater quality (unless stormwater systems are regarded as having relevant community value)”.

The ANZG (2018) provides guidance on assessing a waste discharge. The ANZG (2018) Water Quality Management Framework and associated monitoring data can be used to assess compliance or potential impacts of a waste discharge on water quality. Assessing a waste discharge in this way aims to ensure that it complies with the conditions of approval and is not causing environmental harm. The Water Quality Management Framework provides a step-by-step approach to protect the community values of waterways.

9.2.1 WATER QUALITY MANAGEMENT FRAMEWORK

The Water Quality Management Framework has the following steps which will be adopted as part of this DMP:

Step 1: Examine current understanding

- Use current understanding to develop or refine a conceptual model of key waterway processes and how the waste discharge could affect local waterways.
- Site-specific information on the operation and receiving environment (e.g., current water quality and temporal and spatial release characteristics of the discharge, mixing zones and regulatory compliance points, water quality and ecology of the receiving environment).
- As further monitoring data become available, update and refine the current understanding.

Step 2: Define community values and management goals

- Establish or refine community values and more specific management goals (including level of protection) for the relevant waterways at stakeholder involvement workshops.
- The relevant values adopted are the 95% protection level of marine ecosystems and recreational use.

Step 3: Define relevant indicators

- Select indicators for relevant pressures identified for the system, the associated stressors and the anticipated ecosystem receptors.
- Based on previous groundwater quality information, the analytical suite has been developed as primary indicators. Other indicators include visual inspection at the discharge point of the stormwater into North Corrimal Creek for any signs of potential adverse effects (e.g., turbidity, increased algae presence, discolouration).

Step 4: Determine water quality guideline values

- Determine the water quality guideline values for each of the relevant the biological, chemical and physical indicators required to provide the desired level of protection for the management goals of relevant waterways.
- The DMP adopts the ANZG (2018) DGVs, and the ANZECC (2000) TVs in the absence of DGVs. Results of monitoring data from the stormwater drain will also be used for the assessment to determine if adverse environmental impact are occurring from groundwater discharge.

Step 5: Define draft water quality objectives

- Use the guideline values or narrative statements chosen for each selected indicator as draft water quality objectives to ensure the protection of all identified community values and their management goals.

Step 6: Assess if draft water quality objectives are met

- Use measurements from monitoring of each relevant indicator to assess whether current water quality meets the draft water quality objectives.
- This includes comparison of the water quality monitoring data for each relevant indicator with the water quality objectives, together with the evidence from any additional lines of evidence (such as results from at the edge of the mixing zone).
- The weight-of-evidence process evaluates results from multiple lines of evidence across the pressures, stressors and ecosystem receptors relevant to the waste discharge. It is the key process by which the protection of community values is assessed. Multiple potential outcomes are possible from a weight-of-evidence evaluation. The resulting evaluation of water quality results will be used to determine if adverse trends are evident as a result of the discharge of groundwater to stormwater.
- If the Water Quality Objectives are met, then management should focus on maintaining discharge quality. If Water Quality Objectives are not met and potential adverse trends are evident, the following options will be considered:
 - Formulate, assess, and prioritise management strategies to improve existing water quality associated with the waste discharge (Steps 8 to 10), and/or
 - Reassess the appropriateness of the water quality guideline values (Step 7), and/or
 - Consider selection of additional or alternative indicators or lines of evidence (Step 7).

Step 7: Consider additional indicators or refine water quality objectives

- Assess the need to revise or add to the lines of evidence or indicators and the water quality guideline values.

Step 8: Consider alternative management strategies

- Evaluate the effectiveness of current management strategies to address the identified water quality issues and recommend possible improvements. Improved or alternative management strategies are formulated, assessed and prioritised.

Step 9: Assess if water quality objectives are achievable

- Use information gained from Steps 6 to 8 to assess whether the water quality objectives are achievable.

Step 10: Implement agreed management strategy

- Document and implement agreed management strategies, including, in some cases, a suitable and agreed adaptive management framework.

This DMP details the current management strategy to be implemented.

9.2.2 ANZG (2018) PHYSICAL AND CHEMICAL STRESSOR DETAILS

As noted above, there are two types of physical and chemical stressors that directly affect aquatic ecosystems that can be distinguished: those that are directly toxic to biota, and those that, while not directly toxic, can result in adverse changes to the ecosystem (e.g., algae blooms). In the absence of site-specific guideline values, the following DGVs were adopted as water quality assessment criteria in order to assess this situation:

- **ANZECC (2000)** Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems in Estuaries. These trigger values do not represent direct toxicity to biota, but can potentially result in non-toxic impacts to the ecosystem. ANZG (2018) do not currently provide DGV for physical and chemical stressors, therefore the ANZECC (2000) trigger values have been adopted.
- **ANZG (2018) DGVs & ANZECC (2000)** Australian and New Zealand Guidelines for Water Quality. Trigger values for Fresh and Marine Water under the 95% protection levels. These trigger values represent toxicity to biota.

The adopted DGV criteria are protective of receptors at the point of exposure (i.e., stormwater drain, North Corrimal Creek and Towradgi Creek) and are overly conservative for the assessment of direct discharge water quality in areas where ecological receptors are not present (i.e. Site discharge into stormwater drains). On this basis, North Corrimal Creek and Towradgi Creek is considered the only receiving environment requiring protection. Reditus notes that the use of the DGVs is conservative and may not represent the local system. Water bodies downstream of Towradgi creek are not considered for assessment based on the significant dilution factor and low expected abstraction volumes.

Since the publication of ANZECC (2000), an Errata document (Department of Agriculture, Fisheries and Forestry) has been issued which details that Nitrate values in Table 3.4.1 (page 3.4-5) are deleted and replaced with "Under Review". Furthermore, Nitrate guidelines values in ANZECC 2000 have been reviewed and recalculated², the recalculated trigger value for 95% level of protection was 2.4 mg/L for Nitrate-N.

It is important to note that the Draft Water Quality Objectives (WQO) listed below are specific to aquatic ecosystems only and are not intended as discharge water quality criteria. The adopted guidelines contain information on the comparison of test data with guideline DGVs & TVs. It emphasises that exceedances of the DGVs and TVs are an early warning mechanism to alert managers of a potential problem and are not intended to be an instrument to assess compliance and should not be used in this capacity.

The guidelines recognise that the environmental values and unique conditions of a site and specific behaviour of contaminants in different environments are important considerations when applying the guidelines. Factors relevant to assessing point source discharges include the flow rate of the discharge, receiving water flows and/or intensity of tidal exchange, and the levels of risk that vary from acute to chronic exposure.

Mixing zones are a tool for responsible management of the environment. As detailed within the ANZG (2018), mixing zone are described as an explicitly defined area around an effluent discharge where some, or all, water quality objectives may not be met. It is a generally accepted practice to apply the concept of a mixing zone for wastewater discharges (such as stormwater). As a consequence, some community values of the water body may not be protected. The responsibility lies with the discharger to minimise this impact by keeping the mixing zone as small as practicable. They are designed to limit the impact to the environment that would otherwise occur if discharges were allowed to flow unchecked into waterways.

Critical to assessing the impact of an effluent discharge on beneficial uses and values is understanding the dilution and dispersion of the effluent. For discharges to marine environments, characteristics such as tidal and current movements, density and temperature differences, depth of water and rate of flow need to be considered to assess the dilution capabilities of the waterbody under various scenarios.

9.2.3 RECREATIONAL WATER QUALITY (NHMRC 2012 & 2017)

The greater of the health-based drinking water criteria (NHMRC 2012) multiplied by ten (or the aesthetic criteria if no health-based criteria is available) have been chosen to address the primary and secondary contact recreational uses of water.

² <https://envirolink.govt.nz/assets/Envirolink/1207-ESRC255-Updating-nitrate-toxicity-effects-on-freshwater-aquatic-species-.pdf>

9.3 Draft Water Quality Objectives – DGVs

A summary of the discharge water quality criteria is provided in **Table 9-1** below for the water quality parameters and chemical of concern, which have been selected on the basis of site operational history, regional setting and site groundwater quality.

It is important to note that the Water Quality Objectives (WQO) listed below are specific to aquatic ecosystems only and are not intended as discharge water quality criteria. The ANZG (2018) framework emphasises that comparison of test data with guideline DGVs that 'exceedances of the DGVs are an "early warning" mechanism to alert managers of a potential problem and are not intended to be an instrument to assess "compliance" and should not be used in this capacity.

ANZG (2018) recognises that the environmental values and unique conditions of a site and specific behaviour of contaminants in different environments are important considerations when applying the guidelines. Factors relevant to assessing point source discharges include the flow rate of the discharge, receiving water flows and/or intensity of tidal exchange, and the levels of risk that vary from acute to chronic exposure.

Table 9-1. Draft Water Quality Objectives - DGVs

ANALYTE GROUP	ANALYTE	ANZG (2018) FRESH WATER (95% LEVEL SPECIEC PROTECTION) QUALITY GUIDELINES (UG/L)	RECREATIONAL WATER QUALITY CRITERIA (UG/L)
BTEX	Benzene	950	1,000
	Ethylbenzene	80	3,000
	Toluene	180	8,000
	Xylene (m)	75	
	Xylene (p)	200	6,000
	Xylene (o)	350	
Heavy Metals	Arsenic	24	50
	Cadmium	0.2	5
	Chromium	6.7	50
	Copper	1.4	1,000
	Nickel	11	200
	Lead	3.4	50
	Zinc	8	5,000
	Mercury	0.6	10

ANALYTE GROUP	ANALYTE	ANZG (2018) FRESH WATER (95% LEVEL SPECIEC PROTECTION) QUALITY GUIDELINES (UG/L)	RECREATIONAL WATER QUALITY CRITERIA (UG/L)
PAHs	Phenanthrene	2	-
	Anthracene	0.4	-
	Flouranthane	1.4	-
	Benzo(a)Pyrene	0.2	0.1
	Naphthalene	16	-
Pesticides	Atrazine	13	200
	Carbofuran	0.06	100
	Chlorodane	0.03	20
	Chlorpyrifos	0.009	100
	2,4-D	280	300
	DDT	0.006	90
	Diazinon	0.01	40
	Dimethoate	0.15	70
	Diquat	1.4	70
	Endosulfan	0.03	200
	Endrin	0.01	-
	Fenitrothion	0.2	70
	Glyphosate	370	1,000
	Heptachlor	0.01	-
	Lindane	0.2	100
	Malathion	0.05	700



ANALYTE GROUP	ANALYTE	ANZG (2018) FRESH WATER (95% LEVEL SPECIEC PROTECTION) QUALITY GUIDELINES (UG/L)	RECREATIONAL WATER QUALITY CRITERIA (UG/L)
	Methomyl	3.5	200
	Molinate	3.4	40
	Parathion	0.004	200
	Simazine	3.2	200
	2,4,5-T	36	1,000
	Tebuthiuron	2.2	-
	Temephos	0.05	4,000
	Thibencarb	2.8	400
	Thiram	0.01	70
	Toxafene	0.1	-
	Trifluralin	2.6	900
PCBs	Aroclor 1242	0.3	-
	Aroclor 1254	0.01	-
VOCs	1,1-DCA	90	-
	1,2-DCA	1,900	30
	1,1,1-TCA	270	-
	1,1,2-TCA	6,500	-
	1,1,2,2-TCA	400	-
	PCA	80	-
	DCM	4,000	40
	Chloroform	370	30

ANALYTE GROUP	ANALYTE	ANZG (2018) FRESH WATER (95% LEVEL SPECIEC PROTECTION) QUALITY GUIDELINES (UG/L)	RECREATIONAL WATER QUALITY CRITERIA (UG/L)
	Carbon Tetrachloride	240	30
	Vinyl Chloride	100	3
	DCE	700	600
	TCE	330	-
	PCE	70	500
	CB	55	100
	1,2-DCB	160	10
	1,3-DCB	260	200
	1,4-DCB	60	3
	1,2,3-TCB	3	50
	1,2,4-TCB	20	
	1,3,4-TCB	8	-
	1,2,3,4-PCB	2	-
	1,2,3,5-PCB	3	-
	1,2,4,5-PCB	5	-
	PCB	1.5	-
Total Petroleum Hydrocarbons	TPH/TRH	2 (mg/L) ^a	-
Total Nitrogen	Total Nitrogen	500 ^b	-
Nitrate	Nitrate	7,200 ^c	500,000
Total Phosphorus	Total Phosphorus	50 ^b	-
Ammonia	Ammonia	900 (pH dependant)	5,000

ANALYTE GROUP	ANALYTE	ANZG (2018) FRESH WATER (95% LEVEL SPECIEC PROTECTION) QUALITY GUIDELINES (UG/L)	RECREATIONAL WATER QUALITY CRITERIA (UG/L)
pH	pH	6.0-8.0 ^b	6.5-8.5
Total Suspended Solids	TSS	50,000	-
Turbidity	Turbidity	10 NTU	5 NTU
Temperature	Temperature	15-30 °C	-
Sheens/Odours	Sheens/Odours	No Observable Sheen or Odour	-
Dissolved Oxygen	Dissolved Oxygen	-	-
Conductivity	Conductivity	-	-

a - Recommended water quality criteria (NSW EPA).

b - ANZECC (2000) Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems for Estuaries (Table 3.3.2 Chapter 3 Aquatic Ecosystems).

c - Errata document has been issued which details that Nitrate values in Table 3.4.1 (page 3.4-5) are deleted and replaced with "Under Review" (Department of Agriculture, Fisheries and Forestry). The Nitrate guidelines values in ANZG (2018) have been reviewed and recalculated³ with the value for 95% level of protection reported at 2.4mg/L for Nitrate-N.

d – Derived from HEPA (2025) Ecological water quality guideline values (Table 8) 99% species protection for interim marine.

Analytes such as Total Suspended Solids (TSS) and other easily observable aspects from the dewatering process will need to be monitored closely as adverse public interest in this site is a foreseeable possibility. Which includes the following water quality objectives:

- Total suspended solids (TSS) < 50 mg/L
- No observable sheen or odour
- Turbidity < 10 NTU
- Temperature < 30°C

³ <https://envirolink.govt.nz/assets/Envirolink/1207-ESRC255-Updating-nitrate-toxicity-effects-on-freshwater-aquatic-species-.pdf>

10 Potential Dewatering Impacts

Dewatering operations have the potential to impact receptors and the surrounding environment if not managed appropriately. This section outlines key areas of concern with respect to dewatering and potential environmental impacts.

Procedures for the management of potential environmental impacts are detailed in **Section 11**.

There is potential for the decline in water levels as a result of dewatering. These impacts have been discussed in detail in Section 8 and further in the Groundwater Model and Impact Assessment (Reditus 2025). The conclusion is that there are minor impacts to the underlying groundwater and any effects can be mitigated appropriately through implementation of this DMP.

10.1 Receiving Water Quality

Typically, large volume and/or well flushed water bodies have a capacity to buffer the discharge of potential contaminants depending on the flow rate and duration of discharge. While the receiving waters are subject to the influences of an urbanised catchment, dewatering activities must not contribute to or cause significant decreases in receiving waters quality. Potential impacts associated with releasing dewatered groundwater to receiving waters (via the stormwater network) are summarised below.

10.1.1 PHYSICOCHEMICAL PARAMETERS

Changes to natural pH levels in a receiving waterway can be directly or indirectly detrimental to aquatic biota as particular species can be intolerant to specific conditions caused by dewatering processes.

Acidifying the receiving waters can cause metals bound to sediment and organic matter to be liberated, increasing toxicity, and enhancing the bioavailability of background metals. Oxidation of dissolved metals can also strip oxygen from the receiving waters resulting in fish kills, however this is unlikely in non-perennial streams and less likely in medium to high flow systems such as Towradgi Creek.

Turbidity and suspended solids impact on a receiving environment include siltation, reduction of the euphotic zone affecting photosynthetic organisms by limiting light transmission through the water column, this has a flow on effect as the food chain is disrupted affecting benthic organisms and higher-level organisms.

10.1.2 NUTRIENTS

Streams/ivers, canals and coastal lakes environments have the ability to assimilate and export nutrients (such as nitrogen and phosphorus) through a variety of pathways including flushing, bacterial conversion and permanent accumulation in sediments. Under favourable conditions these cycles can help buffer the receiving environment from potentially deleterious effects of nutrient loading. These effects can include eutrophication, potentially toxic algal blooms, increased oxygen demand and ammonia toxicity.

While the buffering ability of the receiving environment should not be relied upon as a management strategy, the efficiency of a particular water body to process nutrients is an important consideration in assessing the potential impacts of eutrophication of a water body.

10.1.3 HEAVY METALS

High concentrations of potentially harmful metals may be encountered in the groundwater depending on geology and historical uses of the site (and surrounding properties).

Whilst metals and associated compounds occur naturally in the environment and are essential for many organisms, the potential toxicity of metals to aquatic biota generally increases with concentration, particularly when in dissolved form. Furthermore, concentrations of dissolved metals may fluctuate throughout dewatering as water is drawn in from surrounding environments.

Metal toxicity also varies between different species of a particular metal, the physical and chemical characteristics of the receiving environment, and biological receptors. Thus, the size, tidal/mixing/flushing regime, and background concentrations of metals in the receiving waterway must be taken into account when assessing compliance.

Importantly, the total load and duration of metals discharged also needs to be considered when assessing potential chronic effects of metals on biota, though this is less crucial in deeper water with strong tidal interaction where the risk of accumulation is minimised.

Groundwater analytical results (Reditus 2025) reported exceedances of filtered heavy metals which exceeded the assessment criteria for determinants cobalt, zinc, manganese and ammonia (**Section 5.3.1**). Prior to discharge, treatment of groundwaters will be required to ensure water quality adheres to guideline criteria.

10.1.4 PETROLEUM HYDROCARBONS

Groundwater sample analytical results (Reditus 2025) reported no exceedances or detections above the laboratory limit of reporting (LOR) from the groundwater sample collected from the onsite groundwater monitoring wells on 28 August 2025 for TRH/TRP (see **Section 5.3**).

Research indicates that petroleum hydrocarbons toxicity is highly variable, as they contain many hydrocarbon chain compounds. Generally, petroleum hydrocarbon based compounds can naturally biodegrade given the right conditions and generally degrade to lesser toxic substances.

The chemical degradation products of the potential VOC contaminants in groundwater, specifically chlorinated hydrocarbons including tetrachloroethene (PCE) and degradation daughter products trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride (VC) can be of greater ecological and human health risk than the parent compounds and are therefore considered to be significant. No analysis of VOCs was undertaken during the Reditus (2025) sampling event.

Whilst not currently required based on recent analytical results, TRH and VOC compounds may require treatment prior to discharge, which can be achieved via several methods. The treatment system may consist of a single remediation method, such as air stripping or filtered through activated carbon (sorption) to remediate the water to a suitable standard for disposal or re-injection.

10.1.5 OTHER CONTAMINANTS

Other hydrocarbon contamination (PAHs and Phenols) has not been identified exceeding the adopted ecological criteria within the localised groundwater. Other common anthropogenic contaminants (OCPs, OPPs) have not been identified exceeding the adopted ecological criteria within the localised groundwater.

PFAS was not sampled for during the Reditus 2025 monitoring event and is not thought to be a contaminant of concern.

10.2 Settlement of Unconsolidated Soils

Dewatering has the potential to induce settlement in loose sands and soft sediments, possibly compromising the structural integrity of surrounding structures.

A suitability qualified geotechnical consultant will be required to determine the potential settlement impacts caused by the potential drawdown as a result of the proposed dewatering activities, including potential impacts on the integrity of adjacent structures (i.e., buildings, roads, pipelines, etc.), and appropriate management measures.

Detailed geotechnical considerations are beyond the scope of this assessment.

10.3 Acid Sulphate Soils

Acid sulfate soils (ASS) occur predominantly on coastal land with elevations generally below 5 mAHD. These soils also occur further inland in saline seepage areas, rivers, lake beds and irrigation channels. Where present, drawdown of the local water table can expose ASS to oxidising conditions creating acidity and mobilising metals at potentially harmful concentrations.

Previous works on the site have included an assessment works relating to the potential for acid sulfate soils to be present within the stage 2a area. There were reported in *Acid Sulfate Soil Assessment. Proposed New Creek Alignment, Stage 2-4 Bulk Earth Works Redevelopment Site. Former Corrimal Coke Works, Railway Street, Corrimal NSW* dated 23 September 2025.

Based on the additional field observations and soil analytical results, it was concluded that:

- The field and analytical results of the ASS assessment did not identify indicators of AASS at the site for the soil sampling locations assessed to date.

- The sulfur trail is not indicative of RIS and PASS requiring management. Therefore, the soils proposed for excavation as part of the proposed development are not considered to present a potential ASS risk.

Even though the recent investigations did not identify the presence of any ASS/PASS requiring management, an Acid Sulfate Soil Management Plan (ASSMP), a precautionary approach was recommended and an ASSMP (Reditus, 2025) was prepared for the site.

10.4 Impact to Water Supply Works and GDEs

As detailed in **Section 8** above, the temporary dewatering works are not expected to adversely impact on any third-party water supply works, high priority GDEs, and is not expected to result in a change to water quality.

Based on the impact assessment completed, the temporary dewatering activities are considered to be of 'Minimal Impact' under the NSW DPE (2022) *Groundwater impact assessment criteria, NSW Aquifer Interference Policy* and WM Act

10.5 Noise, Vibration and Odour

Noise and vibrations are generated by pumps, generators and treatment systems which typically operate 24 hours a day during dewatering operations. Offensive odours, such as hydrogen sulphide can also be liberated through excavation of sand and or soils with high organic content. Other odours from volatile organic compounds can occur from sites contaminated with petroleum hydrocarbons or solvents. It is also common for diesel fumes to emanate from dewatering pumps and generators where electric systems cannot be used.

Noise, vibrations and odour have the potential to cause a public nuisance, particularly in dense residential areas such as the site, and may also impact on the natural movements or behaviour of wildlife.

11 Management of Potential Impacts

11.1 Discharge of Groundwater

Groundwater discharge shall be controlled in a manner which does not create a flooding hazard. The rate of groundwater extraction will be highly dependent on the required time frame for excavation works and can be varied to match excavation depth speed and/or discharge restrictions (if any).

An average groundwater extraction and discharge rate of approximately 0.3 L/s is expected to be maintained to keep the excavation free of water once steady-state conditions are achieved. However, initial groundwater extraction will likely exceed this as the immediate surrounding aquifer is drained prior to steady-state conditions being reached.

During extreme rainfall/storm/tide events the local stormwater drainage system can become full or flooded. If combined stormwater and dewatering flows exceed the capacity of the stormwater drainage system, discharge shall be reduced or, if necessary, stopped until stormwater flows, and/or tidal inundation subsides. Routine inspections at the stormwater inlet will need to be conducted by the Site Manager or on appropriate delegate during storm events and greater than average tides.

The following sections may be required during the dewatering process if deemed necessary by the licencing provider and Council.

11.1.1 WATER QUALITY TESTING PRIOR TO DISCHARGE

Prior to discharge of extracted groundwater, the groundwater will be recirculated back into the open excavation or temporary onsite water storage to allow clearing of sediment from the dewatering system and allow water quality to stabilised. Once conditions have stabilised, initial testing of extracted water will be completed and compared against the WQO listed in **Table 9-1**.

The treated groundwater will be tested for the adopted discharge water quality analytes. Following receipt of the test results, the Environmental Manager/Consultant, shall determine the suitability for discharge to the stormwater network. Compliance with the WQO set out in **Table 9-1** is required prior to discharge. Additional components to the water treatment process may be required if initial batch testing results do not meet the WQO.

Reditus note that the period between collecting the pre-start samples and discharging from site can exceed one week (more if test results are not favourable and retesting is required) and that this should be accounted for in the construction program.

11.2 Drawdown

The depth of groundwater extraction infrastructure and the rate of extraction shall be limited to the minimum requirements set in the hydrogeological model to achieve the lowering of groundwater within the site to undertake construction works and implement a drained basement.

Dewatering shall be managed in consultation with a suitably qualified environmental and geotechnical engineer to ensure the structural integrity of built structures is not compromised.

Whilst effort has been made to make accurate predictions in the dewatering volumes and off-site effects, it is strongly recommended that water levels be monitored regularly in the dewatered area and in surrounding properties to ensure that local variations in hydraulic properties do not result in unacceptable groundwater table depression or mounding.

Monitoring of groundwater levels outside the excavation at a minimum of three locations is recommended on a daily basis (refer to Section 13 for further details).

If drawdown approaching 1.0 m is identified in the monitoring points outside the shoring wall or near existing buildings, geotechnical and structural engineering advice should be sought, and consideration should be given to control of the off-site water table depression (if deemed required). This is likely to have an implication on the costs of the project but may be recommended in order to reduce the risk of damage to adjacent buildings and roadways.



11.3 Noise, Vibration and Odour

It is the responsibility of the Site Manager to ensure appropriate management of vibration, noise and odour during dewatering operations, and that the management approaches adopted are in accordance with the Conditions of Consent and any relevant management plans (e.g., Construction Environmental Management Plan, Demolition Management Plan, Excavation Management Plan, or Construction Noise and Vibration Management Plan). Ensuring minimum pumping rates are adhered to can aid in reducing noise and vibration pollution on site.

12 Dewatering and Water Treatment System

The proposed dewatering system and treatment system (if required) to be operated at the site is specified below.

12.1 Dewatering System

Dewatering is proposed to commence following the excavation into the water bearing stratigraphic units.

Groundwater is proposed to be extracted using an internal drainage sump and pump dewatering system during construction of the basement excavation. Further dewatering will be required as part of the operational phase 'drained basement' design. The dewatering treatment system for the proposed construction dewatering works is to be temporary only. Dewatering systems as part of the operation phase dewatering must take into account the specific drained basement design plans.

The exact specification of the construction dewatering system will be determined by the Dewatering Contractor and will be dependent on pump sizing and water flow capacity. Reinjection is currently not proposed.

If water quality results deem that treatment is required prior to discharge, a water treatment system (detailed in **Section 12.2** below) will be implemented prior to proposed discharge to the stormwater network.

12.2 Water Treatment System

Depending on the water quality results established during initial dewatering monitoring works, a water treatment plant (WTP) may be required during construction, given the excavation and dewatering method. The process diagram for a potential water treatment system is provided in **Figure 12-1** below.

The water treatment system may comprise the following elements:

- Sediment Tank.
- Chemically Enhanced Primary Treatment (CEPT) System:
- Including internal Chemical Dosing Unit for pH Adjustment and Flocculent Dosing



Figure 12-1 Water Treatment Plant Process Diagram

Details of each component of the WTP is provided in the sections below.

12.2.1 SETTLEMENT TANK

A suitability sized Settlement Tank will be installed to initially allow for the heavy suspended particles in waters to settle and also to serve as a balance tank to regulate any inconsistent or irregular flows. The settlement tank allows for a maximum settling time for a continuous flow of water.

12.2.2 CHEMICALLY ENHANCED PRIMARY TREATMENT (CEPT) SYSTEM

Following the initial sedimentation primary treatment, the water is then preferentially piped to a “Chemically Enhanced Primary Treatment (CEPT) System” unit which has an inbuilt dosing and control system provide automatic water treatment.

Physio-chemical processes allow the operator to adjust pH, remove total suspended solids and control heavy metal precipitation. The following sequence of water treatment process is proposed:

- Adjustment of pH; if pH recorded outside a range of 6.5-8.5.
- Chemical dosing with a flocculate (aluminium chloride) to remove fine sediments.
- Following the flocculation process the water flows upwards through a clarifier (similar to lamella box) to further filter suspended matter before discharging through a fabric filter.
- The CEPT is fitted with a flow meter capable of monitoring the total volume of water treated/discharged.
- Groundwater monitoring and discharge will be completed in stages to ensure the protection of the receiving water environments.
- Prior to any groundwater discharge commencing from the site to stormwater, an initial round of sampling must be conducted during the installation of the dewatering system. All groundwater will be retained onsite until water quality objectives have been achieved.
- Once groundwater discharge water quality objectives are demonstrated to be achieved (which may require modifications to the dewatering systems or implementation of water treatment technologies if required), continuous discharge may occur in accordance with the DMP.

12.2.3 CONTINGENCY WATER TREATMENT EQUIPMENT

Where the above procedures prove ineffective at decreasing concentrations of dissolved and/or total metals or other contaminants to appropriate levels, the inclusion of the following procedures in the treatment train may be recommended:

- Media Filtration Units to remove additional sediment loads to target any suspended heavy metal particulate, as well as removal of dissolved heavy metals via ionic exchange;
- pH/Eh Modification to maximum metal precipitation/flocculation;
- Air-stripping unit or Granulated Activated Carbon (GAC) unit to target any dissolved phase TPH/VOC contamination.

The role of the Media Filtration units (if required) will be to provide secondary water treatment for the removal of any residual heavy metals from the water. The Media Filtration Units may encompass a combination of sand and ionic resin units. The sand media will be appropriately sized to remove fine suspended particular matter and any bound heavy metals. The ionic resin media will be selected based on the particular heavy metal chemical properties, which will remove targeted dissolved heavy metals from the water stream through adsorption and ionic exchange. The rate of heavy metal removal will be dependent on the residence time of the water within the vessel.

The role of pH modification is to utilise the heavy metal geochemistry to change dissolved metals to insoluble precipitates by modifying pH and Eh. Certain metals will form mineral complexes under specific pH/Eh conditions, which are then able to be removed from the water stream as particulate through flocculation and coagulation process. Following removal of the heavy metals, the treated water pH/Eh is then adjusted back to within the adopted discharge criteria. This process can be enhanced through Media Filtration.

The role of the air strippers is to volatilise dissolved volatile contaminants, removing them from the groundwater influent stream. The vapour phase contaminants are captured and diverted through external GAC hoppers where they are sorbed. Treated groundwater influent then undergoes tertiary polishing treatment to remove any remaining dissolved phase hydrocarbons and reduce background heavy metals through particulate filtration. This is achieved via filtration of the groundwater influent through GAC and ion exchanging media filtration vessels via the process of adsorption and ion exchange.

Initial monitoring of discharge water quality shall provide the information required to optimise the water treatment regime.

Any addition of chemical agents must be managed by a suitably qualified environmental scientist and the chemicals approved for use by the NSW EPA. Intensive monitoring of treatment agent dose rates and discharge water quality must be undertaken to optimise the water treatment regime specific to the site.

12.2.4 MAINTENANCE OF WATER TREATMENT SYSTEM

Routine maintenance of the treatment equipment will be required to ensure optimum performance. The discharge pipeline and any protective structures, such as driveway ramps/culverts, must be checked for leaks and damage on a regular basis. Retention structures must also be inspected regularly to ensure adequate performance and structural integrity. Maintenance of the water treatment system is expected to be completed by the appointed dewatering contractor.

The use of the clarifier and chemical treatment is likely to result in the retention of organic and/or inorganic material. Removal of the accumulated material will be required periodically to avoid re-suspension of accumulated sediment and reduction of treatment system capacity. Strategies to limit the volume of waste to be removed should be developed in consultation with the project environmental consultant.

13 Water Quality Monitoring Program

Monitoring of the discharge water will be completed for the duration of the dewatering activities in accordance with the monitoring schedules below.

All monitoring of water quality will be completed by a suitably qualified person, using calibrated equipment to collect samples that are representative of the discharge and analysis completed by a NATA accredited laboratory.

The authorised regulatory authority (ARA) must be notified of any results received that indicate an adverse environmental impact within 24 hours of results being obtained.

Specifications set out in the dewatering and discharge licence (if any) will outline the specific frequency of assessment, an interim sampling and monitoring program is outlined below.

13.1 Water Quality Monitoring Locations

Water quality samples will be collected from the following locations as presented in the flow chart in **Figure 13-1** below.

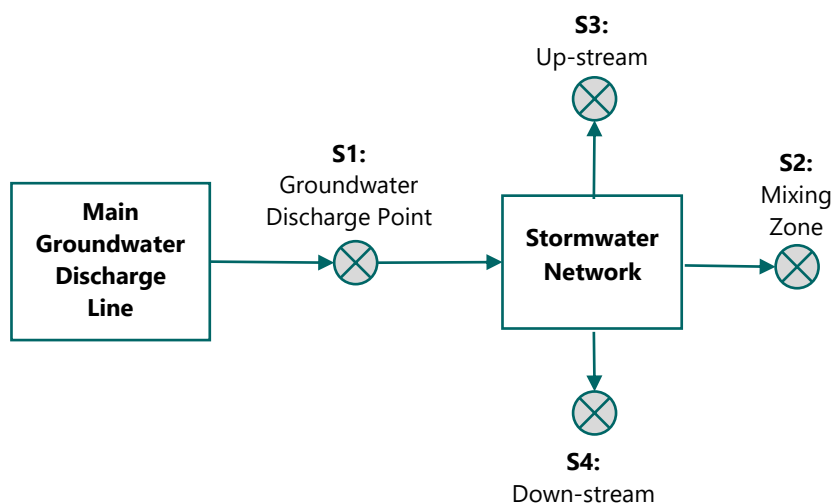


Figure 13-1 Water quality monitoring location schematic

The following descriptions of the sampling locations are provided below, noting these may need to be updated based on the as constructed discharge points:

S1: Groundwater Discharge Point:

- A sample of the groundwater discharge prior to discharge into the stormwater drain. The sample will be collected directly from the main groundwater discharge line, representing the water quality following final treatment. Location of groundwater discharge should be confirmed by dewatering site manager.

S2: Stormwater Channel – Mixing Zone:

- A sample of the receiving waters at the mixing zone boundary. This location would be the outlet of the stormwater drainage or the point of discharge may feasibly be directly into North Corrimal creek.

S3: Stormwater Channel – Up-stream:

- A sample of the receiving waters at a location approximately 100m up-stream from the groundwater/stormwater discharge point.

S4: Stormwater Channel / Broad Water Outlet– Down-stream:

- A sample of the receiving waters at an accessible location 100 m downstream of the discharge point.

The proposed water quality sample locations are presented in **Figure 4, Appendix A**.

In the event that groundwater discharge waters (S1) can be demonstrated to consistently meet the adopted DGVs, sampling of the receiving waters at monitoring points S2, S3 and S4 can cease.

It is noted that the up-stream, down-stream and at the mixing zone sample locations are dependent on the location of the discharge point selected.

13.2 Water Quality Monitoring Frequency and Analysis

Water quality treatment may be required prior to discharge of the extracted groundwater to the stormwater systems or the environment.

Water quality monitoring would need to be performed prior to commencement of treated water discharge. This monitoring period is defined as the 'Stage 1: Initial Assessment / Trial Run Period' and will allow for assessment of water quality treatment performance, compliance against the adopted discharge criteria, establish if additional water treatment methods are required to achieve discharge criteria and establish background water quality in the event that deviations from the adopted discharge criteria are technically justifiable.

Subsequent ongoing monitoring will also be required to confirm the on-site treatment system is functioning as intended. This monitoring has been segmented into two stages, 'Stage 2: Initial Operational Discharge Monitoring Period' to establish treated water quality trends during continuous discharge, and 'Stage 3: Ongoing Operational Discharge Monitoring Period' with a lower testing frequency to confirm ongoing treatment performance once Stage 2 water quality trends have been established.

NSW EPA must be notified immediately of any pollution incidents as the regulator (including discharges above the set limits in **Table 9-1** to the stormwater or environment and where any unacceptable impact to the receiving waters is identified).

13.2.1 STAGE 1: INITIAL COMMISSIONING ASSESSMENT/TRIAL RUN PERIOD

An initial sampling program must be conducted during the installation and commissioning of the dewatering pumping and treatment system, prior to any discharge of groundwater from the site. This will enable baseline discharge water quality to be established and determine if the employed level of groundwater treatment is suitable to ensure compliance with the adopted discharge criteria, prior to offsite discharge.

The initial commissioning sampling program should be completed on daily sampling events, and at minimum comprise two (2) representative samples, one collected prior to treatment, and one collected from the discharge line of the dewatering treatment system, post treatment.

Representative samples of the receiving water (S3) should also be collected to establish baseline/ background conditions.

The samples must be analysed for all water quality parameters as per below and as listed in **Table 9-1**, per the minimum requirements.

Daily field monitoring of the following parameters from the inlet and outlet sides of the treatment system.

- pH
- Electrical Conductivity (EC)
- Dissolved oxygen (DO)
- Redox Potential (mV)
- Turbidity (NTU)

As per Appendix A of the NSW DPIE (2021) *Minimum Requirements for Building Site Groundwater Investigations and Reporting guidelines*, discharge water quality samples collected will be submitted for analysis to a NATA accredited laboratory for the following analytes listed in **Table 13-1** below.

Table 13-1. List of Required Laboratory Water Quality Tests and Schedule (NSW DPIE 2021 – Appendix A)

TYPE	CORRESPONDING LABORATORY ANALYSIS	TESTING REQUIREMENT
Physical Parameters	Alkalinity (bicarbonate, carbonate, hydroxide and total), electrical conductivity (EC), pH, redox potential (Eh), total dissolved solids (TDS), total hardness, temperature, dissolved oxygen (DO).	Mandatory
Other Physical Parameters	Turbidity* (NTU), total suspended solids* (TSS), total organic carbon* (TOC), sodium absorption ratio* (SAR)	Mandatory for discharge to any receiving waters
Major Anions	Sulfate (SO ₄), chloride (Cl), carbonates (CO ₃), bromide (Br), fluoride (F)	Mandatory
Major Cations	Calcium (Ca), magnesium (Mg), sodium (Na), potassium (K)	Mandatory
Ionic Balance	Cation/Anion balance (as a percentage)	Mandatory
Dissolved Inorganics and Dissolved Heavy Metals	Aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silica (dissolved SiO ₂), silver (Ag), strontium (Sr), uranium (U), vanadium (V), zinc (Zn)	Mandatory for baseline thereafter negotiable, depending on site setting unless otherwise required by another regulatory body
Nutrients	Ammonia (NH ₃), nitrate (NO ₃), total nitrogen (N), oxidised nitrogen (N), total phosphorus (P), reactive phosphorus (P)	Mandatory for baseline thereafter negotiable, depending on site setting unless otherwise required by another regulatory body
Microbiological organisms	Faecal coliforms, faecal streptococci, Escherichia coli	Mandatory for baseline thereafter negotiable, depending on site setting unless otherwise required by another regulatory body
Organics	Benzene toluene ethylbenzene xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRHs)	Mandatory for baseline thereafter negotiable, depending on site contamination status unless otherwise required by another regulatory body.
Other	Range of analytes relevant to site-specific contaminants of environmental concern.	As required by the NSW EPA, on the advice of a specialist environmental consultant or as required by another regulatory body.

The sampling frequency should be maintained until the target parameters and chemical concentrations in treated water stabilised (i.e., consecutive tests are within $\pm 10\%$ of the observed results) and within the adopted discharge criteria for three consecutive periods.

Following completion of the initial baseline/trail run monitoring program, an assessment will be completed by a suitability qualified environmental consultant to determine that groundwater discharge will not pose an environmental risk and will not result in adverse environmental effects. If potential unacceptable impact to the receiving waters is identified, contingency groundwater treatment options should be considered and adopted where appropriate.

The Stage 1 Initial Assessment / Trial Run Period may be extended if stabilisation is not observed, or the treated water exiting the treatment system does not satisfy the adopted discharge criteria.

During the Stage 1 Initial Assessment / Trial Run Period, all collected groundwater seepage (including treated waters) must be retained/recirculated on-site and is not permitted to be discharged to the stormwater network until it is proven to meet the adopted discharge criteria or considered to not pose an unacceptable risk to the receiving waters.

13.2.2 STAGE 2: INITIAL OPERATIONAL DISCHARGE MONITORING PERIOD

After successful completion of the Stage 1 Trial Run period, treated groundwater will be primarily discharged under a 'Batched' process, where samples are collected and analysed prior to discharge, to ensure that concentrations of contaminants are below the adopted NSW EPA endorsed water quality criteria (ANZG 2018 Water Quality Guidelines 95% freshwater). During rainfall periods, the water treatment system may be continuously operated, however discharge to the stormwater system is not permitted.

A daily sampling frequency of the S1 discharge waters for a 1 week period is recommended during the Stage 2 Initial Operational Discharge of the onsite water treatment system.

The daily sampling program should at minimum comprise two (2) representative samples, one collected prior to treatment, and one collected from the discharge line of the dewatering treatment system.

If considered necessary, representative samples of the receiving water (S3) should also be collected to establish background conditions and allow assessment of any impact from the discharge.

The samples must be analysed for all water quality parameters as per below and as listed in **Table 13-1** above.

The daily sampling frequency should be maintained for a minimum of 1 week, until the target parameters and chemical concentrations in treated water stabilised (i.e., consecutive tests are within $\pm 10\%$ of the observed results) and within the adopted discharge criteria for five consecutive days.

Following completion of the initial operational period, an assessment will be completed by a suitability qualified environmental consultant to determine that groundwater discharge is not posing an environmental risk and is not resulting in adverse environmental effects. If an unacceptable impact to the receiving waters is identified, discharge of groundwater must stop, and contingency groundwater treatment options should be considered and adopted where appropriate. Following the initial daily sampling for 1 week, Reditus will determine a suitable sampling frequency for the duration of the dewatering project (i.e. weekly sampling).

NSW EPA must be notified immediately of any pollution incidents as the regulator (including discharges above the set limits in **Table 13-1** to the stormwater and where any unacceptable impact to the receiving waters is identified).

13.2.3 STAGE 3: ONGOING OPERATIONAL DISCHARGE MONITORING PERIOD

After successful completion of the Stage 2 Initial Operation Discharge period, treated groundwater may be continuously discharged directly to the stormwater system or natural water environment.

Daily monitoring of pH and Turbidity of the Treated Discharge Waters (S1) must be maintained throughout the dewatering process. Daily field monitoring of the following parameters from the inlet and outlet sides of the treatment system.

- pH
- Turbidity (NTU)

The sampling program should at minimum comprise two (2) representative samples, one collected prior to treatment and one collected from the discharge line of the dewatering treatment system.

Representative samples of the receiving water (S3) is recommended to be collected to establish background conditions and allow assessment of any impact from the discharge. However, if onsite samples meet the adopted discharge criteria, downstream sampling may not be required.

Fortnightly water samples will be collected from the dewatering discharge point during the active construction dewatering and discharge activities, as listed in **Table 13-2** below.

The fortnightly sampling frequency should be maintained for the remainder of the dewatering and discharge program unless results suggest that the frequency can be reduced. This will be assessed by Reditus over the course of the dewatering period based on the stabilised groundwater results.

Monthly groundwater sampling is also required from the surrounding groundwater monitoring wells on site and with laboratory testing as per **Table 13-1** above.

Results of the monitoring must be reviewed by the appointed environmental consultant on a weekly basis to determine that groundwater discharge is not posing an environmental risk and is not resulting in adverse environmental effects. If an unacceptable impact to the receiving waters is identified, discharge of groundwater must stop and contingency groundwater treatment options should be considered and adopted where appropriate.

Council must be notified immediately of any pollution incidents as the regulator (including discharges above the set limits in **Table 9-1** to the stormwater and where any unacceptable impact to the receiving waters is identified).

13.3 Water Sample Collection

Discharge and receiving waters will be analysed in the field using a calibrated water quality meter to assess the EC, DO, pH, Turbidity, ORP and Temperature.

Water samples will be taken directly from the discharge line sample ports or using a surface water grab sampler for the remaining analytes mentioned in **Section 13.2** above.

Samples are to be placed directly into appropriately preserved, laboratory supplied sampling containers, labelled with the project identification, sample name/location, sample date and who collected the sample. Samples for dissolved heavy metal analysis shall be field filtered using 0.45um disposable filters.

Once samples are obtained, they are to be stored and transported in an ice cooled Esky to the laboratory under a chain-of-custody (CoC).

13.4 Monitoring of Discharge Flow Rate, Groundwater Drawdown & In-Situ Groundwater Quality

Discharge flow rates, as well as groundwater levels and groundwater quality outside the excavation shall be monitored in general accordance with the NSW DPIE (2022) *Minimum Requirements for Building Site Groundwater Investigations*, as per **Table 13-2** below. The following monitoring will be required:

Table 13-2. Monitoring Program for Discharge Flow Rates and Groundwater Levels

PARAMETER	LOCATION	FREQUENCY
Discharge Rates and Volumes	Calibrated flow meter (e.g. inline Magflow meter) on discharge pipeline	<u>Daily</u>
Groundwater Level	From the three (3) groundwater closest monitoring wells located outside the excavation.	<u>Daily:</u> For one month prior to dewatering commencement. During the entire dewatering period For a minimum of one month following the cessation of pumping.
Groundwater In-situ Quality Measurements: - Electrical conductivity (specific conductance at 25°C). - Temperature, - pH. - Reduction-oxidation (redox) potential.	From the three (3) closest groundwater monitoring wells located outside the excavation.	<u>Weekly:</u> For 2 weeks prior to dewatering commencement. During the entire dewatering period For a minimum of two weeks following the cessation of pumping.
Groundwater Quality Testing: As per Table 13-1	From the three (3) closest groundwater monitoring wells located outside the excavation.	<u>Monthly:</u> At least 2 sampling rounds prior to dewatering to establish baseline conditions.

13.5 Trigger Action Response Plan & Contingencies

Based on the above proposed management and mitigation measures to be employed during the dewatering activities, the DMP should be effective to manage the potential impacts, however contingent actions may be required should the scenarios listed in **Table 13-3** below arise.

Table 13-3. Trigger Action Response Plan & Mitigation Measures for Potential Dewatering Issues

POTENTIAL SCENARIO	MITIGATION MEASURES
Treated water does not achieve the adopted discharge criteria following completion of the Stage 1 monitoring period.	Implementation/adjustment of physical and/or treatment processes and/or installation of larger retention structures should be completed. Once additional treatment technologies are installed, the Stage 1 monitoring period should be repeated to confirm that the adopted discharge criteria will be achieved. The ARA must be notified immediately of any pollution incidents as the regulator (including discharges above the set limits in Table 9-1 to the stormwater and where any unacceptable impact to the receiving waters is identified).
During the Stage 2 and Stage 3 monitoring periods, if quality of treated water does not meet the adopted discharge criteria.	Discharge to the stormwater system must be suspended, tail water should be retained onsite and stored in appropriate bulk containers for further on-site treatment and sampling until it is proven to meet the adopted discharge criteria. If unexpected monitoring results indicate that the quality of the receiving water has changed (as a direct result of the dewatering activities), modification of management practices must be implemented, including up-scaling of the treatment measures. Implementation/adjustment of physical and/or treatment processes and/or installation of larger retention structures should be completed as an initial procedure to mitigate unacceptable levels of chemical contaminants (e.g., dissolved heavy metals). Where increased dissolved oxygen of the discharge waters is required, an aerator should be installed within the treatment line. Where implemented contingencies prove ineffective at mitigating risks to the receiving water way, ceasing dewatering may be the only options until such time that other management techniques can be applied. To avoid potential damage to the constructed excavation pit in such a situation, consideration should be given to obtaining an Emergency Permit to discharge to sewer. Otherwise, it may be necessary to have collected waters removed by a licenced liquid waste contractor should quantities accumulate beyond the onsite storage capacity. The ARA must be notified immediately of any pollution incidents as the regulator (including discharges above the set limits in Table 9-1 to the stormwater and where any unacceptable impact to the receiving waters is identified).
The treated groundwater quality cannot satisfy the nominated discharge criteria.	Should all feasible onsite water treatment options become exhausted, application to the asset owner (such as Sydney Water) for a Trade Waste Licence could potentially be obtained for discharge to sewer. Alternatively, an Environmental Protection Licence (EPL) may be applied for with the NSW EPA for direct discharge into natural waters. If groundwater pH is observed to be decreasing or is more acidic than the pre-dewatering baseline pH consideration should be given to control the offsite depression of the water table via extension of shoring walls to a depth into continuous low permeability soil such as clay; and reinjection of extracted groundwater along the site boundary (following approval to vary the licence

POTENTIAL SCENARIO	MITIGATION MEASURES
	from WaterNSW/NRAR). If the above contingency options do not manage acidic groundwater, injection of an acid neutralising agent such as calcium may need to be implemented. If monitoring results indicate the quality of the receiving water has been altered due to the dewatering process, management practices must be modified and implemented to treat the receiving water. If the onsite treated groundwater quality continues to fail the discharge criteria, it may be necessary to have collected waters removed by a licenced liquid waste disposal contractor.
Excessive groundwater drawdown (>1m), as determined by geotechnical/structural engineer, resulting in unacceptable offsite settlement.	If offsite drawdown is <1.0 m but approaching 1.0 m in the monitoring points outside the excavation, or if groundwater quality is observed to change beyond 'pre-dewatering' baseline conditions, consideration should be given to control of the off-site water table depression (i.e., through re-injection). This is likely to have in implication on the costs of the project but is recommended in order to reduce the risk of damage to adjacent buildings and roadways. The primary control method of reinjection would require some injection well to be installed outside the excavation boundary and may require a variation to the dewatering licence obtained from the WaterNSW / NRAR. If groundwater drawdown exceeds levels >1.0 m, immediately cease dewatering and contact hydrogeologist, geotechnical engineer and structural engineer.

13.6 Principal Contractor Inspection Requirements

The Principal Contractor will be responsible for the following inspection activities and reporting requirements:

- Perform daily visual inspection of groundwater discharge stream at the stormwater connection point for any signs of unexpected conditions (e.g., discolouration, odours, sheens, oils, sediment).
- Routine maintenance of the groundwater dewatering system will be required to ensure optimum performance. The discharge pipeline and any protective structures, such as driveway ramps/culverts, must be checked for leaks and damage on a regular basis. Retention structures must also be inspected regularly to ensure adequate performance and structural integrity.
- Record and report any incidents of poor drainage, uncontrolled discharge or spills within the basement drainage system capture zone. Groundwater discharge must be immediately suspended in the event of any spills or environmental incidents and immediately reported to a suitability qualified environmental consultant. Groundwater discharge must not re-commence until discharge quality can be demonstrated to not result in unacceptable adverse environmental impact.
- Maintain erosion and sediment control measures in a functioning condition until all earthwork activities are completed.
- Devise and implement appropriate remedial measures where any controls or devices are not functioning effectively or are inappropriate.
- The site manager will maintain records and comments on the condition of existing erosion and run-off controls (drains, silt fences, catch drains etc) dewatering procedures and test results, discharge rates and volumes, groundwater level and pH measurements, and any site instruction issued to contractors to undertake works on the dewatering and treatment equipment.
- Maintain rainfall data, to be filled onsite.
- All daily inspection reports, environmental incidents and controlled discharge records will be maintained and the information provided within monitoring assessment reports.
- The ARA must be notified immediately of any pollution incidents as the regulator (including discharges above the set limits in **Table 9-1** to the stormwater and where any unacceptable impact to the receiving waters is identified).

14 Records and Reporting

The Principal Contractor shall maintain a record of all water quality and groundwater level monitoring, along with details of corrective and preventative actions implemented in relation to the dewatering activity.

The following reports shall be prepared:

- Stage 1 & 2: A weekly (interim) report issued upon receipt of laboratory analysis results that identifies potential compliance issues or water quality impacts that require immediate action, and other recommended preventive/corrective actions.
- Stage 3: Fortnightly dewatering report summarising the water quality data and management strategies implemented during the entire works. The report shall include a summary of discharge and receiving waters quality results, a statistical appraisal of the data, control charts showing quality results, a compliance assessment, indications of potential environmental harm, and comments and/or corrective actions implemented during the works.

The following information must be maintained and may be required to be submitted to WaterNSW / NRAR on completion of construction dewatering as part of the "Completion Report" within six months of completion of the dewatering during construction:

- Volume of groundwater pumped, the volume discharged offsite (and/or reinjected if applicable), the discharge/reinjection rate and the duration of pumping.
- Groundwater level monitoring data and water table map depicting the aquifer's settled groundwater conditions and a comparison to the baseline conditions.
- All water quality monitoring data including results of any water quality testing.
- Location and construction of groundwater extraction works that are abandoned after dewatering has ceased.
- A detailed interpreted hydrogeological report identifying all actual resource and third party impacts, including an assessment of altered groundwater flows and an assessment of any subsidence or excessive settlement induced in nearby buildings and property and infrastructure.



15 Limitations

The report or document does not purport to provide legal advice and any conclusions or recommendations made should not be relied upon as a substitute for such advice.

The report does not constitute a recommendation by Reditus for the client (ATF LegPro 70 Unit Trust c/- Legacy Property Pty Ltd) or any other party to engage in any commercial or financial transaction and any decision by the client or other party to engage in such activities is strictly a matter for the client.

The report relies upon data, surveys, measurements and results taken at or under the site at particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the client. Furthermore, the report has been prepared solely for use by the client and Reditus accepts no responsibility for its use by other parties. The client agrees that Reditus' report or associated correspondence will not be used or reproduced in full or in part for promotional purposes and cannot be used or relied upon by any other individual, party, group or company in any prospectus or offering. Any individual, party, group or company seeking to rely this report cannot do so and should seek their own independent advice.

No warranties, express or implied, are made. Subject to the scope of work undertaken, Reditus assessment is limited strictly to identifying typical environmental conditions associated with the subject property based on the scope of work and testing undertaken and does not include and evaluation of the structural conditions of any buildings on the subject property or any other issues that relate to the operation of the site and operational compliance of the site with state or federal laws, guidelines, standards or other industry recommendations or best practice. Scope of work undertaken for assessments are agreed in advance with the client and may not necessarily comply with state or federal laws or industry guidelines for the type of assessment conducted.

Additionally, unless otherwise stated Reditus did not conduct soil, air or wastewater analyses including asbestos or perform contaminated sampling of any kind. Nor did Reditus investigate any waste material from the property that may have been disposed off the site, or undertake and assessment or review of related site waste management practices.

The results of this assessment are based upon (if undertaken as part of the scope work) a site inspection conducted by Reditus personnel and/or information from interviews with people who have knowledge of site conditions and/or information provided by regulatory agencies. All conclusions and recommendations regarding the site are the professional opinions of the Reditus personnel involved with the project, subject to the qualifications made above.

While normal assessments of data reliability have been made, Reditus assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Reditus, or developments resulting from situations outside the scope of this project/assessment.

Reditus is not engaged in environmental auditing and/or reporting of any kind for the purpose of advertising sales promoting, or endorsement of any client's interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Reditus assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Reditus, or developments resulting from situations outside the scope of this project.

Information relating to soil, groundwater, waste, air or other matrix conditions in this document is considered to be accurate at the date of issue. Surface, subsurface and atmospheric conditions can vary across a particular site or region, which cannot be wholly defined by investigation. As a result, it is unlikely that the results and estimations presented in this report will represent the extremes of conditions within the site that may exist. Subsurface conditions including contaminant concentrations can change in a limited period of time and typically have a high level of spatial heterogeneity.

From a technical perspective, there is a high degree of uncertainty associated with the assessment of subsurface, aquatic and atmospheric environments. They are prone to be heterogeneous, complex environments, in which small subsurface features or changes in geologic conditions or other environmental anomalies can have substantial impact on water, air and chemical movement.

Major uncertainties can also occur with source characterisation, assessment of chemical fate and transport in the environment, assessment of exposure risks and health effects, and remedial action performance. These factors make



uncertainty an inherent feature of potentially impacted sites. Technical uncertainties are characteristically several orders of magnitude greater at impacted sites than for other kinds of projects.

Reditus' professional opinions are based upon its professional judgment, experience, and training. These opinions are also based upon data derived from the limited testing and analysis described in this report or reports reviewed. It is possible that additional testing and analysis might produce different results and/or different opinions or other opinions. Reditus has limited its investigation(s) to the scope agreed upon with its client. Reditus believes that its opinions are reasonably supported by the testing and analysis that has been undertaken (if any), and that those opinions have been developed according to the professional standard of care for the environmental consulting profession in this area at this time. Other opinions and interpretations may be possible. That standard of care may change and new methods and practices of exploration, testing and analysis may develop in the future, which might produce different results.



16 References

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A

Figures





Map 25234_sitelocation_v01		Legend Site Boundary Watercourses Hydrology Surface Water Stream (Perennial) Stream (Non-Perennial) Unnamed Stream (Non-Perennial) AU Railways OSM	Figure 1 - Site Location 27 Railway Street, Corrimal NSW 25234 - Dewatering Management Plan - Stage 2a, Corrimal Coke Works LegPro 70 Pty Ltd ATF LegPro 70 Unit Trust c/ - Legacy Property Pty Ltd
Date of Export 24/04/2026			
Author NB	Approver SM		
Data Source Metromap, Google Maps, Open Street Map, Geoscience Australia			



Map	
25234_RP04_Site Layout_v01	
Date of Export	Map Scale (approx. at A3)
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Author	Approver
NB	SM
Data Source	
Metromap, Google Maps, Open Street Map, Geoscience Australia	

Legend

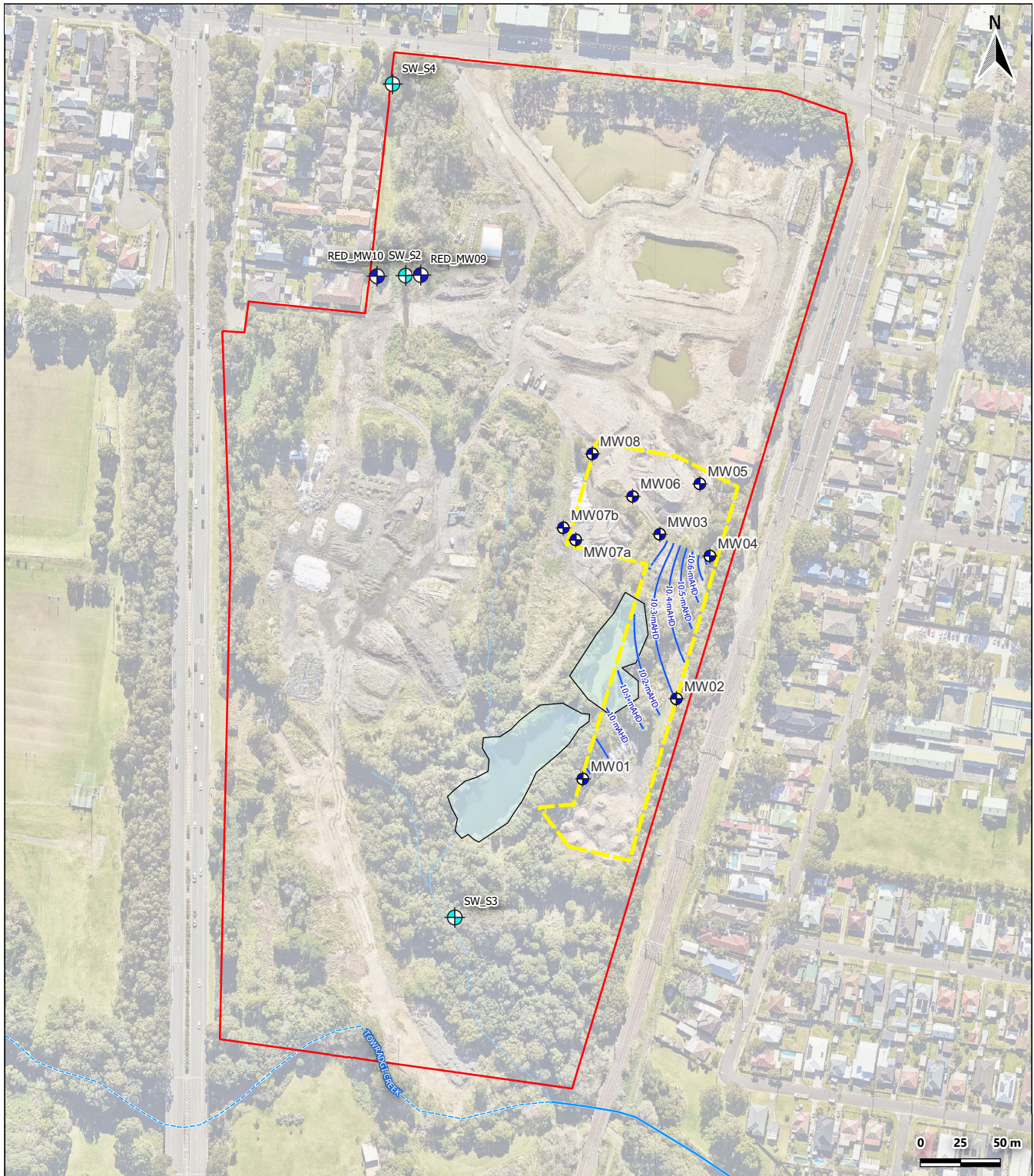
-  Site Boundary
-  Stage 2a
-  B2.1
-  B2.2
-  B2.3
-  B2.4

Figure 2 - Site Layout

27 Railway Street, Corrimal NSW

25234RP04 - Dewatering Management Plan Former
Corrimal Coke Works

LegPro 70 Pty Ltd ATF LegPro 70 Unit Trust c/- Legacy
Property Pty Ltd



Map 25234_rp02_f03_mwlocs_v01		Legend Site Boundary Stage 2a Area Monitoring Well Locations Surface Water Sample Locations	
Date of Export 03/10/2025	Map Scale (approx. at A3) 1:2,416	Figure 3 - Monitoring Well Locations and Groundwater Contours 27 Railway Street, Corrimal NSW 25234RP01 - Groundwater Impact Assessment- Stage 2a, Corrimal Coke Works LegPro 70 Pty Ltd ATF LegPro 70 Unit Trust c/- Legacy Property Pty Ltd	
Author TG	Approver SM		
Data Source Metromap, Google Maps, Open Street Map, Geoscience Australia			



Map	
25234_RP04_Sampling Locations_v01	
Date of Export	Map Scale (approx. at A3)
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Author	Approver
NB	SM
Data Source	
Metromap, Google Maps, Open Street Map, Geoscience Australia	

Legend	
Site Boundary	Bore Locations
B2.3	Stage 2a
B2.2	Hydrology
B2.4	Surface Water
Discharge Monitoring Locations	Watercourses
	Rivers
	Stream (Perennial)
	Stream (Non-Perennial)
	Unnamed Stream (Non-Perennial)
	Other Channels

Figure 4 - Discharge Sampling Locations

27 Railway Street, Corrimal NSW 25234RP04 -
Dewatering Management Plan Former
Corrimal Coke Works LegPro 70 Pty Ltd ATF LegPro 70
Unit Trust c/- Legacy
Property Pty Ltd

B

Design Plans



- All works to be in accordance with authority & statutory approvals.
- Refer to site survey for all information relating to existing site conditions.
- All Boundary information to be confirmed by registered surveyor before commencing works on site.
- Refer to Adjacent Report and Landscape Documentation for all information relating to trees and their retention/removal, and all landscape works.
- Drawings to be read in conjunction with all Specifications and Schedules, all specialist consultant documentation: BASIX, Nat-ERS, Section J Certificates.
- Minor changes to building form & configuration may be required after Development Consent.
- Do not scale from drawing; figured dimensions only to be used.
- Building Contractor to verify all dimensions before commencing work.

FUTURE STAGES

Building 2.4
Refer to DA4200 Lot Series

Building 2.3
Refer to DA4200 Lot Series

Building 2.2
Refer to DA3200 Lot Series

Building 2.1
Refer to DA2200 Lot Series

Rev	Date	By	Chk	Description
P01	5/08/2025	LB/MC	DK	Issue for Coordination
P02	25/08/2025	LB/MC	DK	Issue for Coordination
A	8/09/2025	LB/MC		Issue for Development Application

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Project Name
Project Number
Project Address

The Works Corimal - Stages 2a
13687
Corimal Coke Works - Railway Street
Corimal NSW 2518

Country

Dharawal

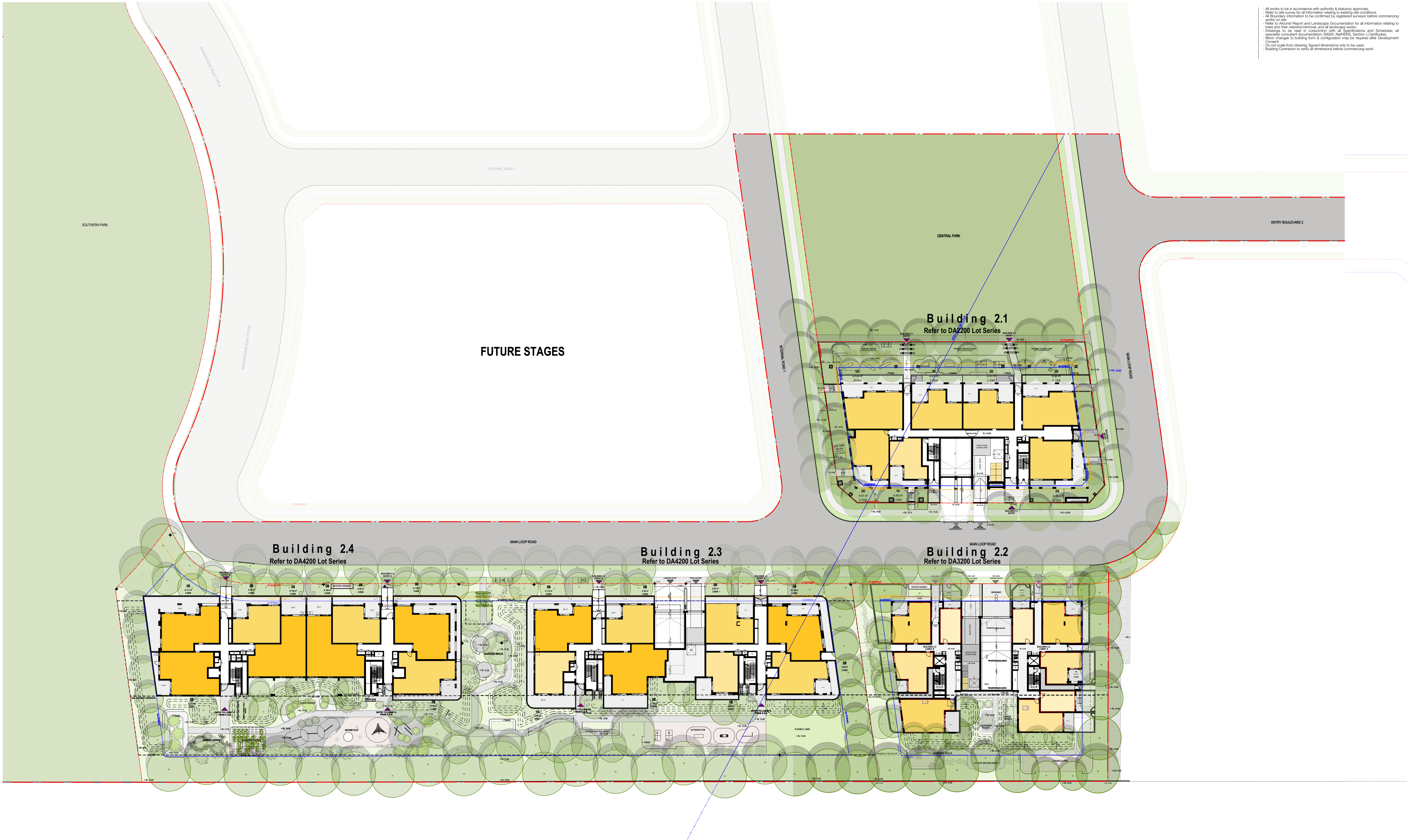
DEVELOPMENT APPLICATION

Drawing Name
Stage 2a - Basement Level 1

Drawing Scale
Drawing No.
DA1200

1:400 @ A1
Revision
A

- All works to be in accordance with authority & statutory approvals.
- Refer to site survey for all information relating to existing site conditions.
- All Boundary information to be confirmed by registered surveyor before commencing works on site.
- Refer to Adjacent Report and Landscape Documentation for all information relating to trees and their retention/removal, and all landscape works.
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- Minor changes to building form & configuration may be required after Development Consent.
- Do not scale from drawing; figured dimensions only to be used.
- Building Contractor to verify all dimensions before commencing work.



LEGEND

- SITE BOUNDARY
- HERITAGE CURTILAGE
- SITE SETBACK
- ARTICULATION ZONE

DEVELOPMENT APPLICATION

Drawing Name
Stage 2a - Ground Level Plan

Drawing Scale
Drawing No.
DA1201

1:400 @ A1
Revision
B

Rev	Date	By	Chk	Description
P01	5/08/2025	LB/MC	DK	Issue for Coordination
P02	25/08/2025	LB/MC	DK	Issue for Coordination
A	8/09/2025	LB/MC		Issue for Development Application
B	17/10/2025	LB/MC		Issue for Development Application

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DKO

Project Name
Project Number
Project Address

The Works Corimal - Stages 2a
13687
Corimal Coke Works - Railway Street
Corimal NSW 2518

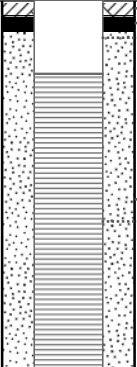
Country
Dharawal

C

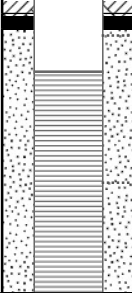
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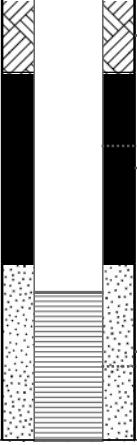
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Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 2.5 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1		Fill		M	Fill. Gravelly SAND. SP: very loose, black / grey, fine grained, fine to coarse sized gravel, moist, carbonaceous material (coal, coke fine and gravel).	Carbonaceous material (coal, coke fine and gravel)	 Concrete Cement Grout Bentonite 50mm PVC Solid Washed 1-2mm graded sand 50mm PVC Slotted	
	2		Alluvial		W-M	Alluvial. Silty CLAY. CI-CH: soft, medium to high plasticity, grey / brown, trace fine sized gravel, organic, wet to moist.			
						RED_MW01 Terminated at 2.5 m			

Latitude : -34.37355	Drill Supplier : XSITE Drilling Pty Ltd	Job Number : 25234	Sheet : 1 OF 1
Longitude : 150.90069	Driller Company : XSITE Drilling Pty Ltd	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 2 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1		Fill		M	Fill. Gravelly SAND. SW: very loose, black / grey, fine to coarse grained, coarse sized gravel, moist, carbonaceous material (coal, coke fine and gravel).	Carbonaceous material (coal, coke fine and gravel)		
			Alluvial		W-M	Alluvial. Silty CLAY. CI-CH: soft, medium to high plasticity, grey / brown, organic, wet to moist.			
						RED_MW02 Terminated at 2 m			

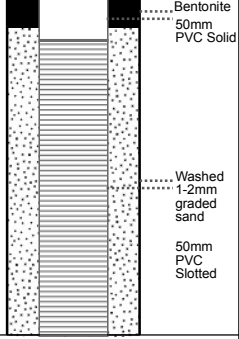
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Longitude : 150.90069	Driller Company : XSITE Drilling Pty Ltd	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 3 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1		Fill		M	Fill. Gravelly SAND. SP: very loose, black / grey, fine grained, fine to coarse sized gravel, moist, carbonaceous material (coal, coke fine and gravel).	Carbonaceous material (coal, coke fine and gravel)		
	2		Alluvial		M	Alluvial. Silty CLAY. CI-CH: soft, medium to high plasticity, grey / brown, organic, moist.			
						RED_MW03 Terminated at 3 m			

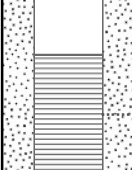
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Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 2.2 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1 								

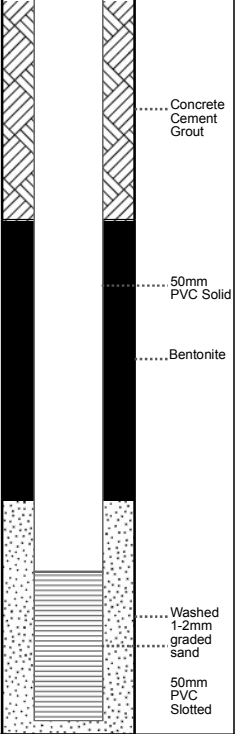
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Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 2.3 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1		Fill		W	Fill. Gravelly SAND. SP: very loose, black / grey, fine grained, fine to coarse sized gravel, wet, carbonaceous material (coal, coke fine and gravel).	Carbonaceous material (coal, coke fine and gravel)		
			Fill		W-M	Fill. Sandy to Silty CLAY. CI-CH: medium to high plasticity, soft, grey / brown, coarse grained sand, with medium sized gravel, organic, wet to moist.			
	2		Fill		W-M	As above, but Sandy reddish brown.			
						RED_MW05 Terminated at 2.3 m			

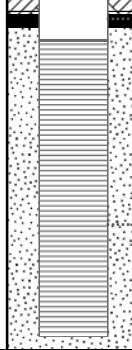
Latitude : -34.37355	Drill Supplier : XSITE Drilling Pty Ltd	Job Number : 25234	Sheet : 1 OF 1
Longitude : 150.90069	Driller Company : XSITE Drilling Pty Ltd	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 3.2 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1		Fill		M	Fill. Gravelly SAND. SP: very loose, black / grey, fine grained, fine to coarse sized gravel, moist, carbonaceous material (coal, coke fine and gravel).	Carbonaceous material (coal, coke fine and gravel)		
	2		Fill		M	As above, but carbonaceous material (coal, coke fine and gravel) with brick and concrete.	Carbonaceous material (coal, coke fine and gravel) with brick and concrete		
	3		Alluvial		M-D	Alluvial. Silty CLAY. CI-CH: soft to firm, medium to high plasticity, brown, organic, moist to dry.			
						RED_MW06 Terminated at 3.2 m			

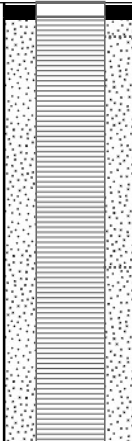
Latitude : -34.37355	Drill Supplier : XSITE Drilling Pty Ltd	Job Number : 25234	Sheet : 1 OF 1
Longitude : 150.90069	Driller Company : XSITE Drilling Pty Ltd	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 5 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1		Fill		M-D	Fill. Gravelly SAND. SP: very loose, black / grey, fine grained, fine to coarse sized gravel, moist to dry, carbonaceous material (coal, coke fine and gravel) with concrete, steel and brick.	Carbonaceous material (coal, coke fine and gravel) with concrete, steel and brick		
	2								
	3								
	4		Fill		M-D	As above, but carbonaceous material (coal, coke fine and gravel) with clay and sand.	Carbonaceous material (coal, coke fine and gravel) with clay and sand		
			Fill		M-D	As above, but Sandy GRAVEL. GW: dense, coarse grained sand, carbonaceous material (coal and gravel).	Carbonaceous material (coal and gravel)		
			Fill		M-D	As above, but loose, fine grained sand, carbonaceous material (coal and coke fine).	Carbonaceous material (coal and coke fine)		
						RED_MW07 Terminated at 5 m			

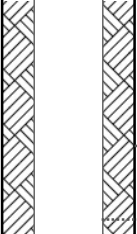
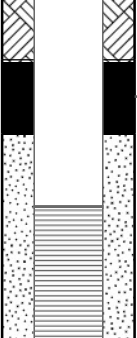
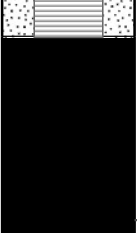
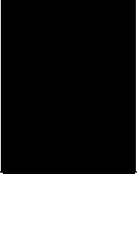
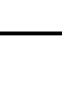
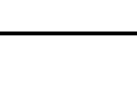
Latitude : -34.37355	Drill Supplier : XSITE Drilling Pty Ltd	Job Number : 25234	Sheet : 1 OF 1
Longitude : 150.90069	Driller Company : XSITE Drilling Pty Ltd	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 2.4 m	Date : 19/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1 2		Fill		D	Fill. Gravelly SAND. SP: very loose, black / grey, fine grained, fine to coarse sized gravel, dry, carbonaceous material (coal, coke fine and gravel).	Carbonaceous material (coal, coke fine and gravel)	 Concrete Cement Grout 50mm PVC Solid Bentonite Washed 1-2mm graded sand 50mm PVC Slotted	
						RED_MW08 Terminated at 2.4 m			

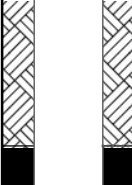
Latitude : -34.37355	Drill Supplier :	Job Number : 25234	Sheet : 1 OF 1
Longitude : 150.90069	Driller Company :	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 3 m	Date : 18/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
			Alluvial		M	Alluvial. Silty CLAY. CI: medium plasticity, pale brown, organic, moist, with rootlets.	with rootlets		
	1		Alluvial		W	As above, but pale brown, wet.			
	2		Residual		W	Residual. CLAY. CH: very stiff, high plasticity, grey / brown and orange, organic, wet.			
			Residual		W	As above, but grey mottled orange, with ironstone gravels.	with ironstone gravels		
						RED_MW09 Terminated at 3 m			

Latitude : -34.37355	Drill Supplier :	Job Number : 25234	Sheet : 1 OF 1
Longitude : 150.90069	Driller Company :	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 8.5 m	Date : 18/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
	1		Fill		M	Fill. Sandy CLAY. CL: low plasticity, brown mottled orange, organic, moist, with sandstone, ironstone gravels and asphalt.	with sandstone, ironstone gravels and asphalt		
	2		Residual		M	Residual. Silty CLAY. Cl: soft, medium plasticity, pale brown mottled grey, organic, moist.			
	3								
	4		Residual		M	As above, but firm, grey mottled orange.			
	5		Residual		M	As above, but pale brown.			
	6		Residual		M	As above, but reddish brown.			
	7		Residual		W-M	As above, but pale brown, wet to moist.			
	8		Residual		W-M	As above, but dark grey.			
						RED_MW10 Terminated at 8.5 m			

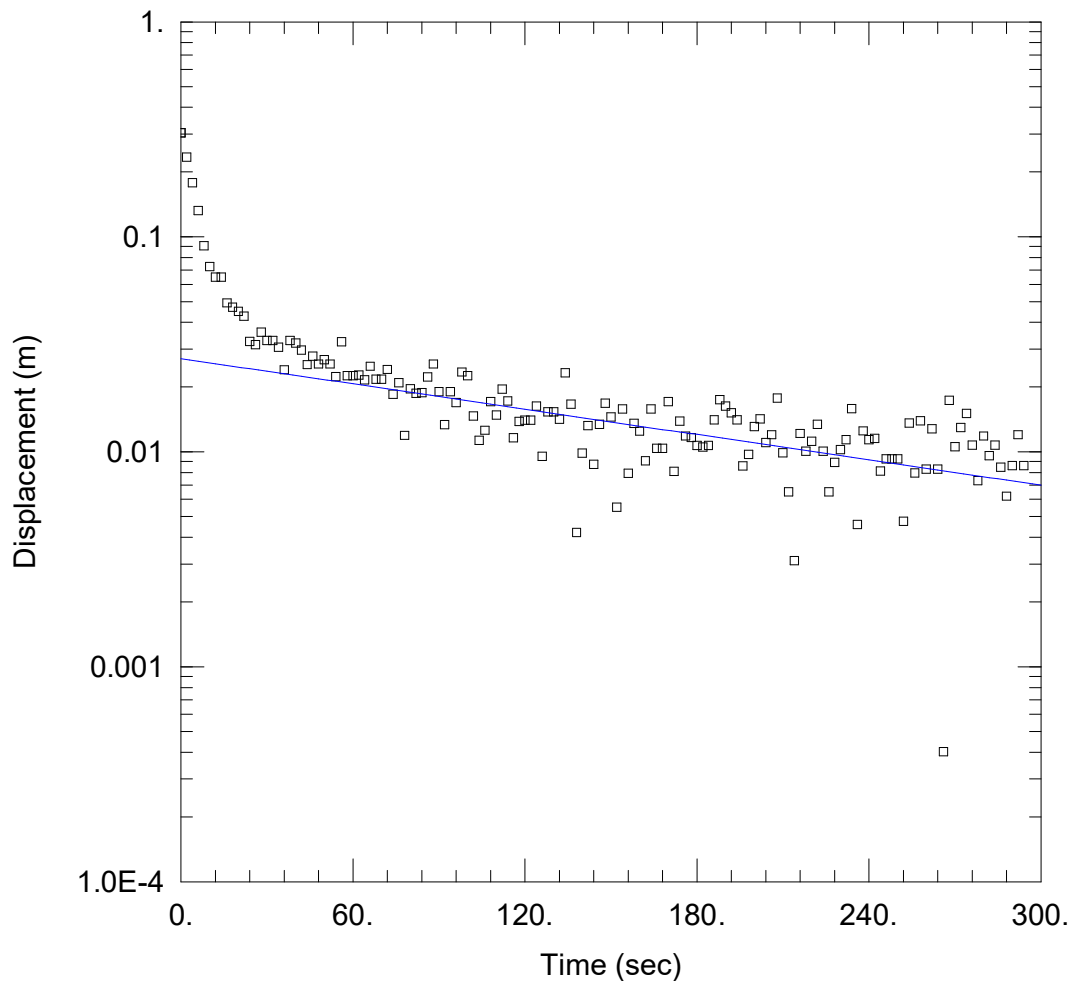
Latitude : -34.37355	Drill Supplier :	Job Number : 25234	Sheet : 1 OF 1
Longitude : 150.90069	Driller Company :	Client :	
Elevation : Not Surveyed	Logged By : Tanner Graham	Project : Corrimal Coke Works - Stage 2 Hydrogeological Assessment	
Total Depth : 7 m	Date : 18/08/2025	Location : 23 Railway St, Corrimal NSW 2518, Australia	

Drilling Method	Depth (m)	Elevation (m)	Soil Origin	Graphic Log	Moisture	Material Description	Comments	Well Diagram	Water
			Fill		M	Fill. Sandy CLAY. CL-CI: low to medium plasticity, dark brown, organic, moist.			
	1		Residual		M	Residual. Sandy CLAY. CL: firm, low plasticity, orange mottled red, fine grained sand, organic, moist.			
			Residual		M	As above, but reddish orange.			
	2		Residual		D	As above, but red mottled grey, dry, with gravels.	with gravels		
			Residual		D	As above, but grey / white mottled red, with pebbles.	with pebbles		
	3		Residual		D	Residual. Gravelly to Clayey SAND. SC: low plasticity clay, red, coarse grained, coarse sized gravel, dry.			
	4		Residual		D	As above, but grey / red and white.	with sub-angular gravels		
			Residual		M	As above, but red, moist.			
	5		Residual		M	As above, but white.			
			Residual		M	As above, but Clayey reddish grey.			
	6		Residual		W	Residual. Sandy CLAY. CL: stiff, low plasticity, white, medium grained sand, organic, wet.			
						RED_MW11 Terminated at 7 m			

D

Rising Head Test Analysis





WELL TEST ANALYSIS

Data Set: C:\...\RED_MW02_RHT1.aqt

Date: 10/02/25

Time: 12:03:24

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 0.74 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (RED_MW02)

Initial Displacement: 0.3047 m

Static Water Column Height: 0.74 m

Total Well Penetration Depth: 0.74 m

Screen Length: 0.74 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

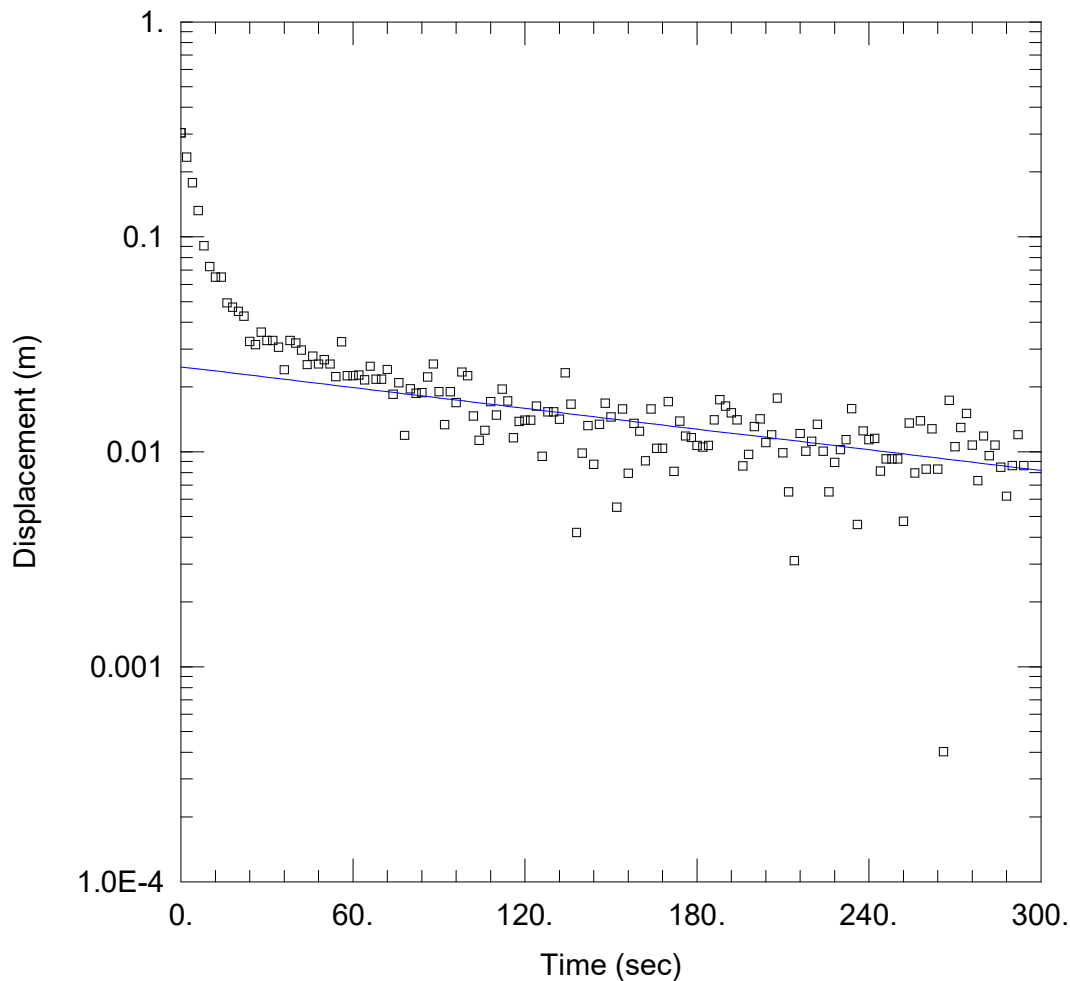
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.3049 m/day

y0 = 0.02713 m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW02_RHT1.aqt

Date: 10/02/25

Time: 12:03:51

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 0.74 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (RED_MW02)

Initial Displacement: 0.3047 m

Static Water Column Height: 0.74 m

Total Well Penetration Depth: 0.74 m

Screen Length: 0.74 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

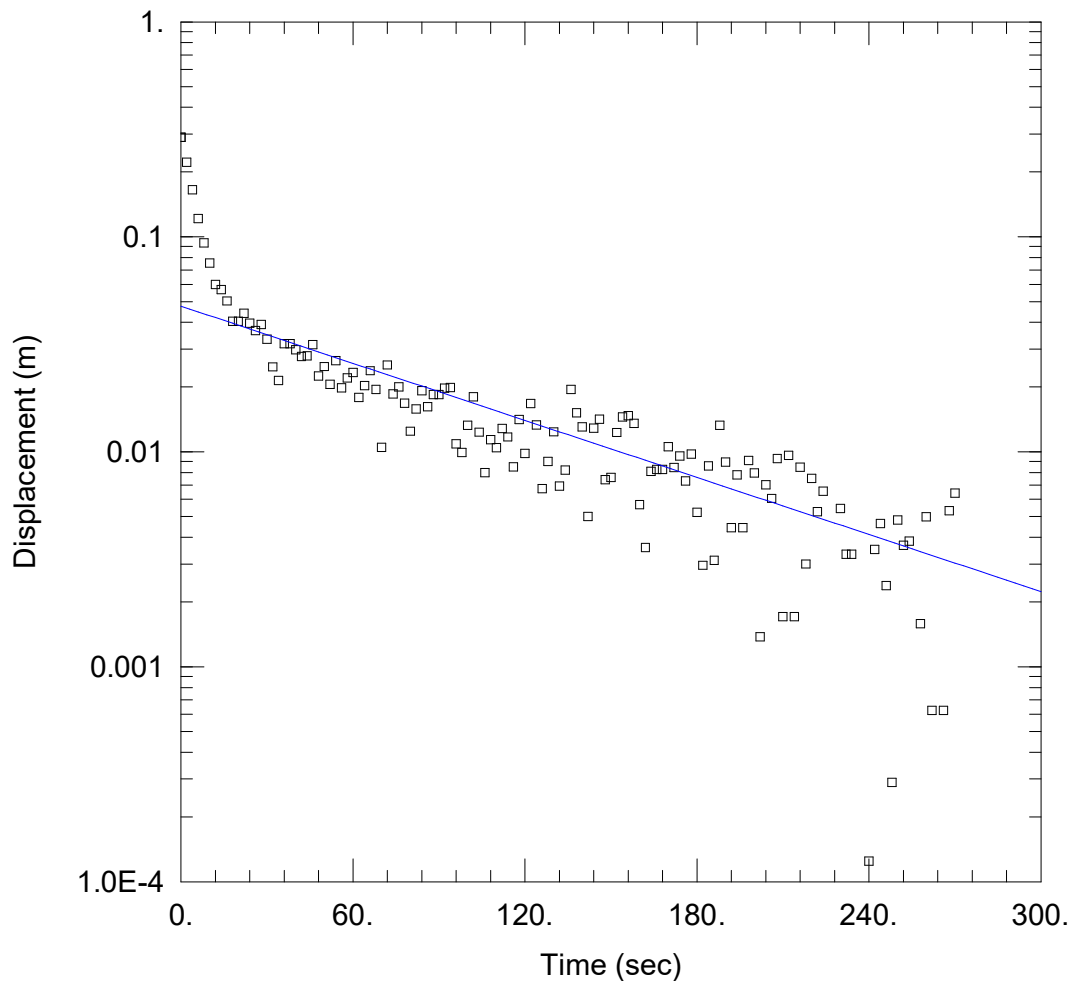
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K =$ 0.715 m/day

$y_0 =$ 0.02481 m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW02_RHT2.aqt

Date: 10/02/25

Time: 12:04:48

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 0.74 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (RED_MW02)

Initial Displacement: 0.2905 m

Static Water Column Height: 0.74 m

Total Well Penetration Depth: 0.74 m

Screen Length: 0.74 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

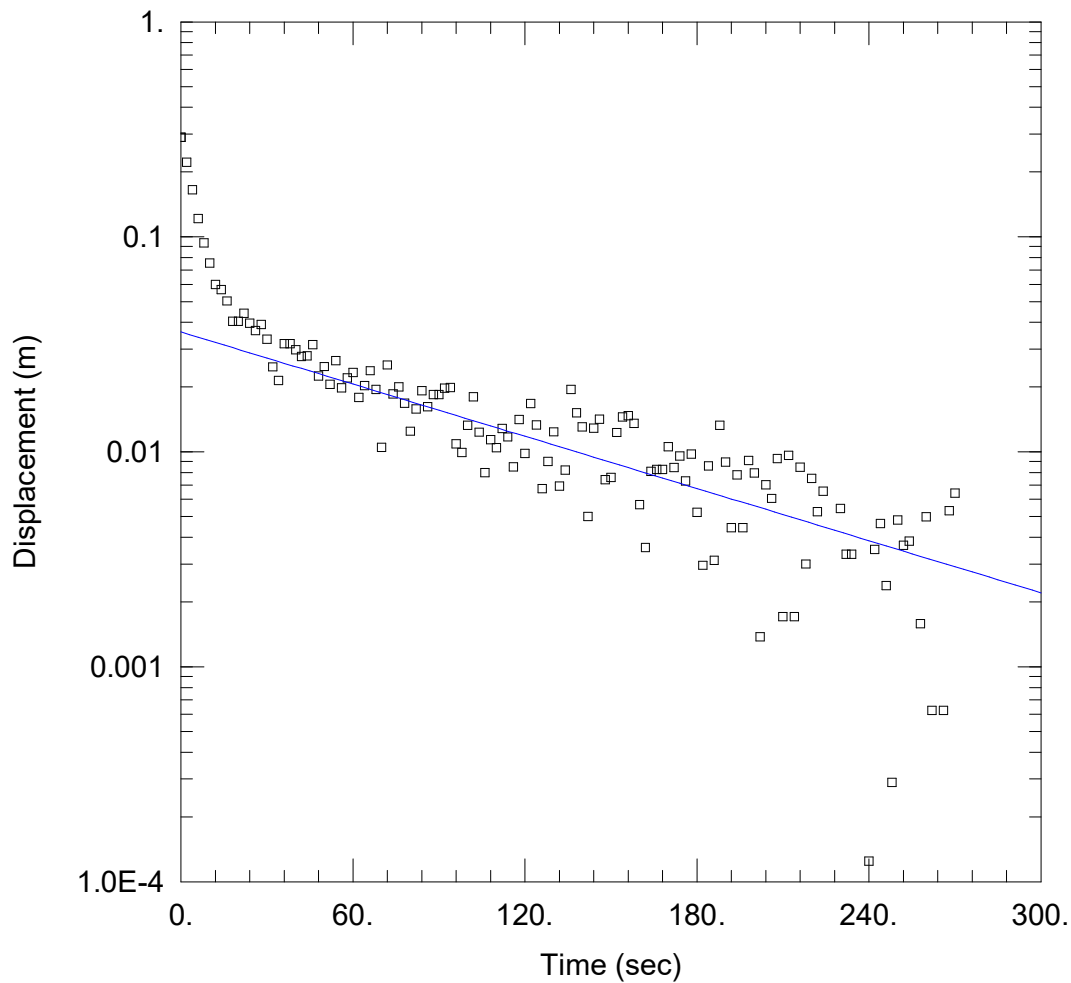
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.6874$ m/day

$y_0 = 0.04751$ m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW02_RHT2.aqt

Date: 10/02/25

Time: 12:04:27

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 0.74 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (RED_MW02)

Initial Displacement: 0.2905 m

Static Water Column Height: 0.74 m

Total Well Penetration Depth: 0.74 m

Screen Length: 0.74 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

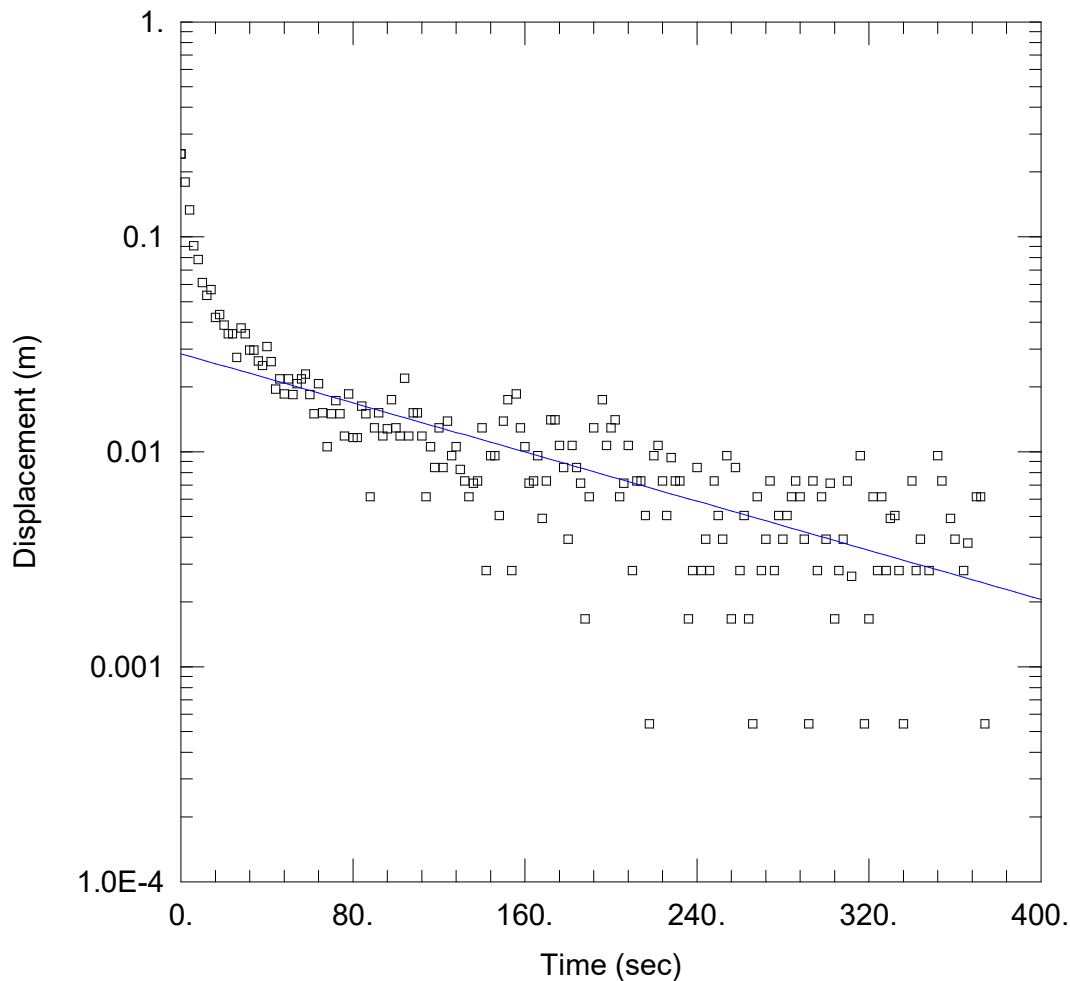
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 1.801$ m/day

$y_0 = 0.03608$ m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW02_RHT3.aqt

Date: 10/02/25

Time: 12:05:23

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 0.74 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (RED_MW02)

Initial Displacement: 0.243 m

Static Water Column Height: 0.74 m

Total Well Penetration Depth: 0.74 m

Screen Length: 0.74 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

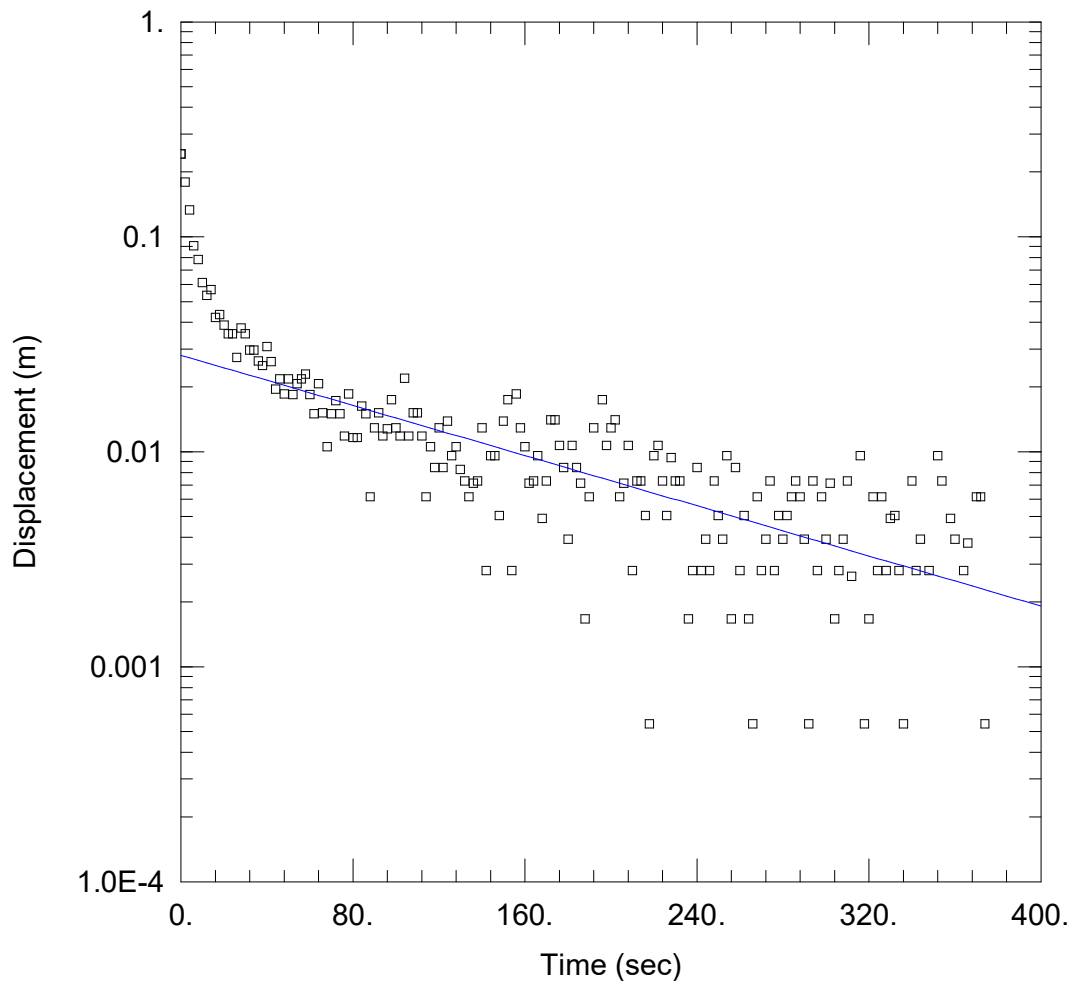
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.444 m/day

y0 = 0.02857 m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW02_RHT3.aqt

Date: 10/02/25

Time: 12:05:43

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 0.74 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (RED_MW02)

Initial Displacement: 0.243 m

Static Water Column Height: 0.74 m

Total Well Penetration Depth: 0.74 m

Screen Length: 0.74 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

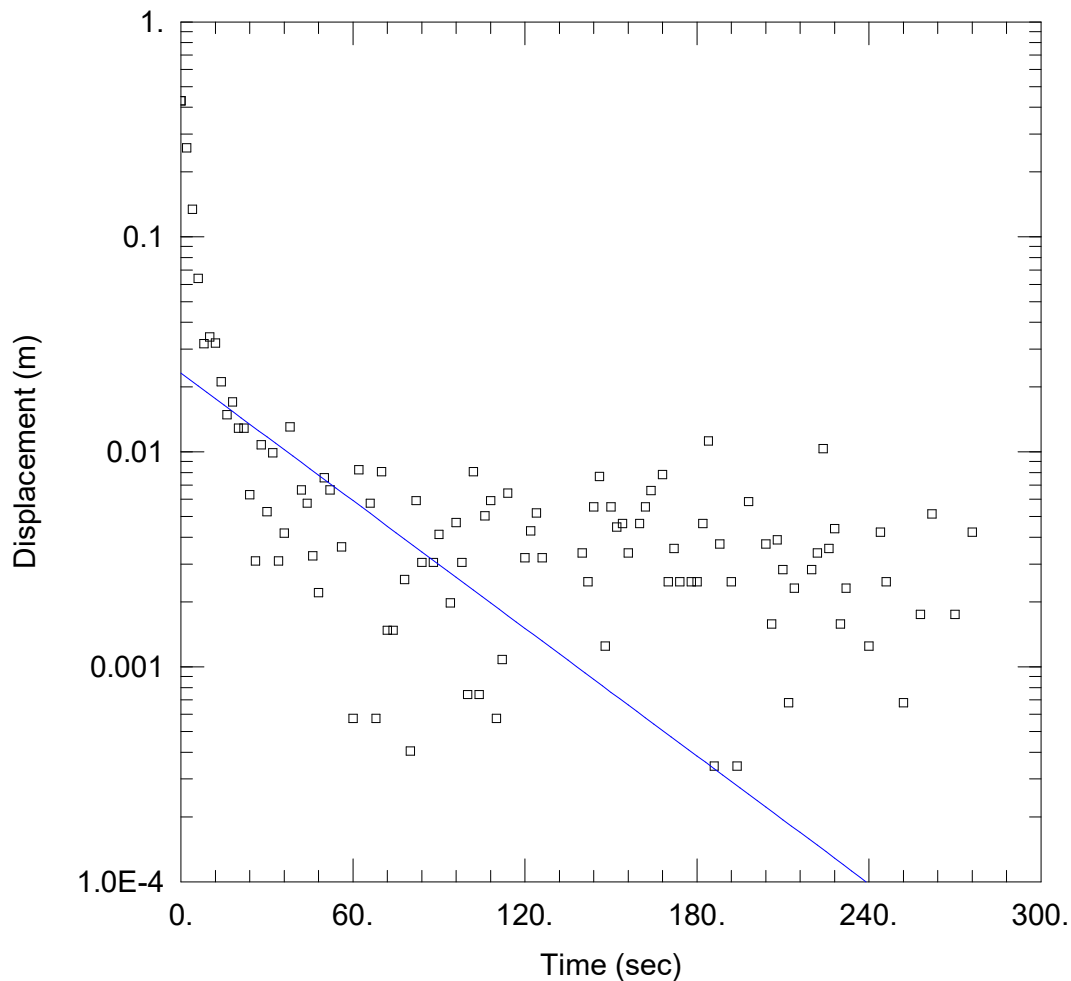
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

K = 1.299 m/day

y0 = 0.02811 m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW05_RHT1.aqt

Date: 10/02/25

Time: 12:06:32

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 1.675 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (RED_MW05)

Initial Displacement: 0.4302 m

Static Water Column Height: 1.675 m

Total Well Penetration Depth: 1.675 m

Screen Length: 1.675 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

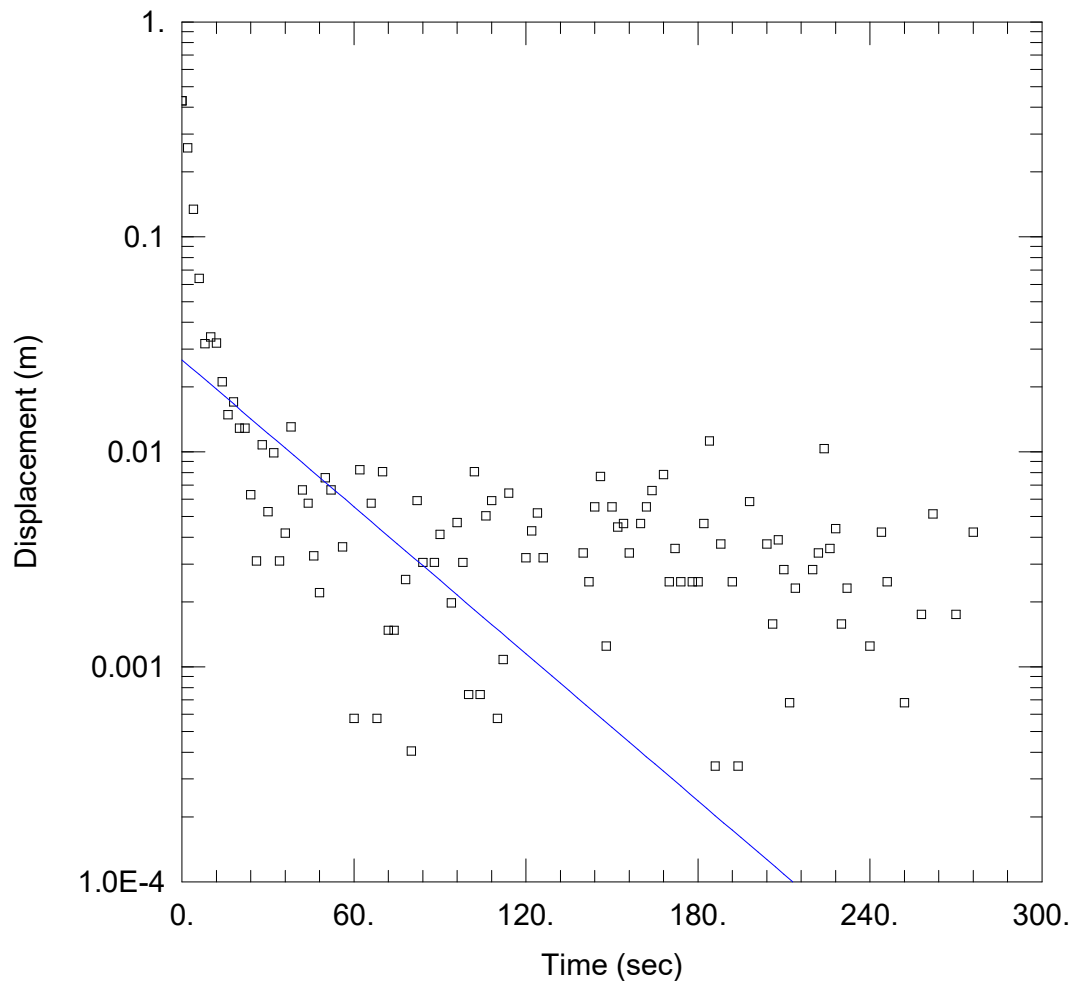
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.9349$ m/day

$y_0 = 0.02322$ m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW05_RHT1.aqt

Date: 10/02/25

Time: 12:06:57

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 1.675 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (RED_MW05)

Initial Displacement: 0.4302 m

Static Water Column Height: 1.675 m

Total Well Penetration Depth: 1.675 m

Screen Length: 1.675 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

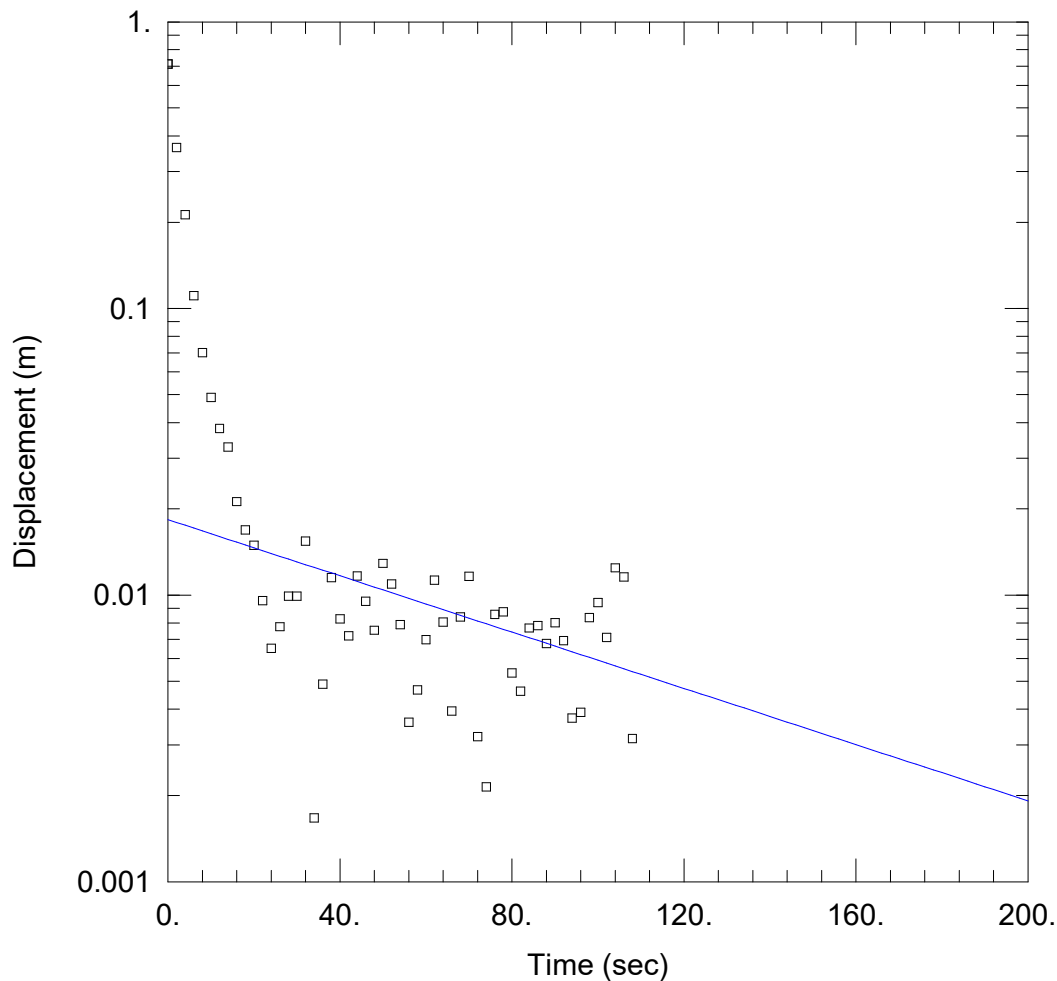
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 2.241$ m/day

$y_0 = 0.02675$ m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW05_RHT3.aqt

Date: 10/02/25

Time: 12:08:23

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 1.675 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (RED_MW05)

Initial Displacement: 0.7117 m

Static Water Column Height: 1.675 m

Total Well Penetration Depth: 1.675 m

Screen Length: 1.675 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

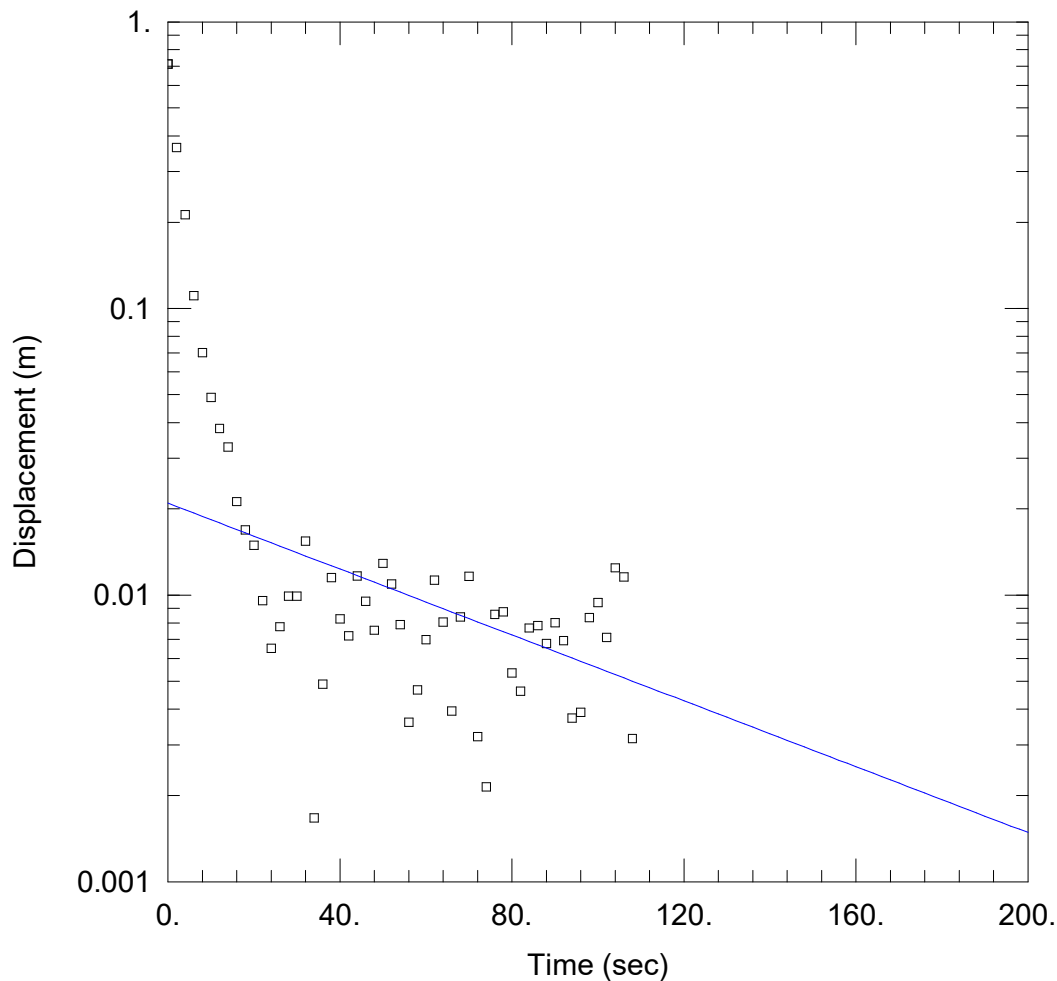
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.4635$ m/day

$y_0 = 0.01833$ m



WELL TEST ANALYSIS

Data Set: C:\...\RED_MW05_RHT3.aqt

Date: 10/02/25

Time: 12:08:08

PROJECT INFORMATION

Company: Reditus

Client: Chester Project Management

Project: 25234

Location: 27 Railway Street, Corrimal

Test Well: RHT1

Test Date: 26/08/2025

AQUIFER DATA

Saturated Thickness: 1.675 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (RED_MW05)

Initial Displacement: 0.7117 m

Static Water Column Height: 1.675 m

Total Well Penetration Depth: 1.675 m

Screen Length: 1.675 m

Casing Radius: 0.025 m

Well Radius: 0.0575 m

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

K = 1.13 m/day

y0 = 0.0209 m

E

Tabulated Groundwater Analytical Data

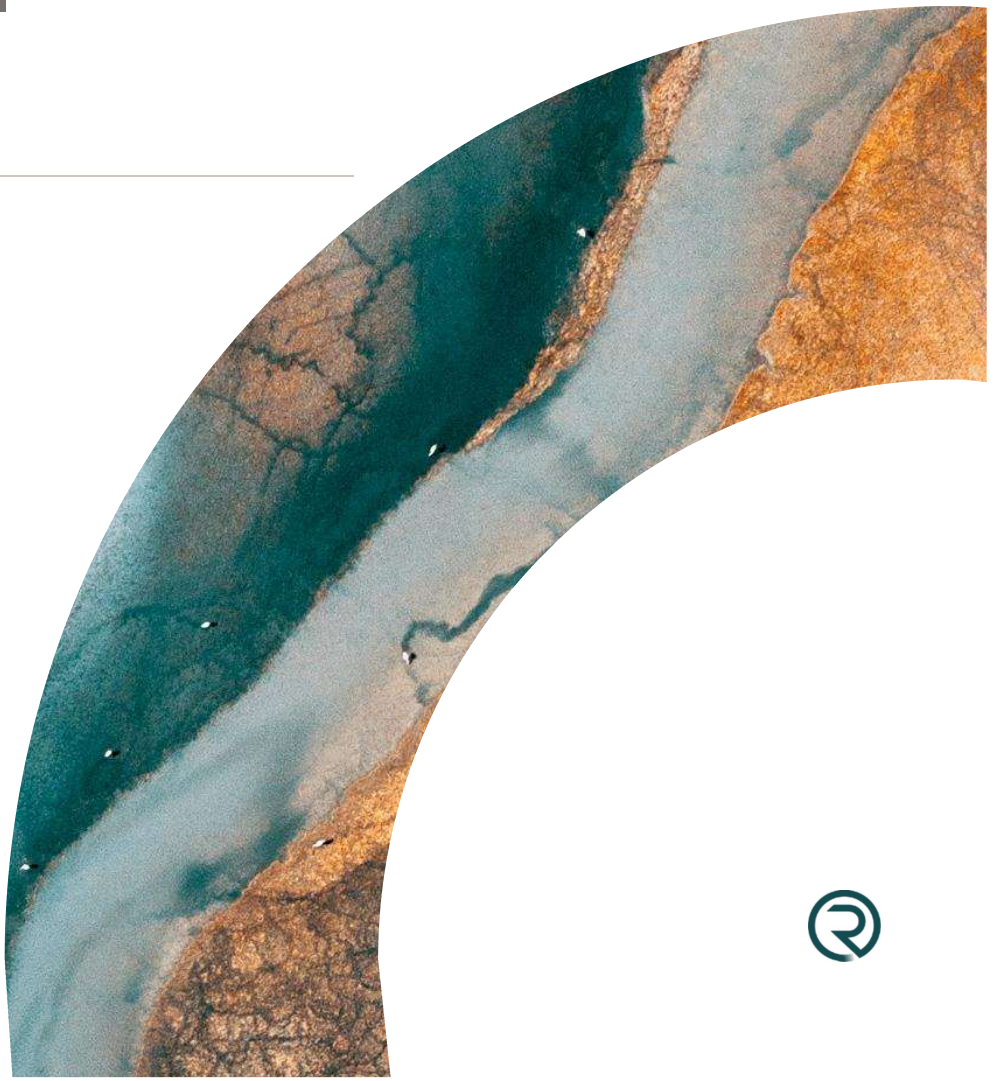


Table E1
Ground Water Analytical Results Summary



Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)								TRH - NEPM Fractions							Total Recoverable Hydrocarbons (TRH)				
Benzene (Total)	Toluene (Total)	Ethylbenzene (Total)	meta- & para-Xylene (Total)	ortho-Xylene (Total)	Total Xylenes (Total)	Sum of BTEX (Total)		C8 - C10 Fraction (Total)	C8 - C10 Fraction minus BTEX (F1) (Total)	>C10 - C16 Fraction (Total)	>C10 - C16 Fraction minus Naphthalene (F2) (Total)	>C16 - C24 Fraction (Total)	>C24 - C40 Fraction (Total)	>C10 - C40 Fraction (sum) (Total)	C8 - C9 Fraction (Total)	C10 - C14 Fraction (Total)	C15 - C28 Fraction (Total)	C29 - C36 Fraction (Total)	C10 - C36 Fraction (sum) (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
1	1	1	2	1	2	1		10	10	50	50	100	100	50	10	50	100	50	50
950	180	80	-	350	-	-		-	-	-	-	-	-	-	-	-	-	-	-
700	180	80	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-

Field ID	Sampled Date	Lab Report No.	Matrix	<1	2	<1	<2	<1	-	-	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
RED_MW02	28-08-2025	389647	Water	<1	2	<1	<2	<1	-	-	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
RED_MW05	28-08-2025	389647	Water	<1	<1	<1	<2	<1	-	-	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
DUP01	28-08-2025	389647	Water	<1	<1	<1	<2	<1	-	-	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50
TRIP01	28-08-2025	ES2527077	Water	<1	<2	<2	<2	<2	<2	<1	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50

Notes:
1 = Detected
0 = Not detected at 0.1 g/kg limit-of-reporting

Table E1
Ground Water Analytical Results Summary



				Heavy Metals																				
				Antimony (Total)	Antimony (Filtered)	Arsenic (Total)	Arsenic (Filtered)	Barium (Total)	Barium (Filtered)	Beryllium (Total)	Beryllium (Filtered)	Boron (Total)	Boron (Filtered)	Cadmium (Total)	Cadmium (Filtered)	Chromium (Total)	Chromium (Filtered)	Cobalt (Total)	Cobalt (Filtered)	Copper (Total)	Copper (Filtered)	Lead (Total)	Lead (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	
				0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.05	0.0001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
ANZ Guidelines for Fresh & Marinewater Quality - toxicant DGVs Freshwater - 95% Species Protection				-	-	-	-	-	-	-	-	-	940	-	0.2	-	-	-	-	-	-	1.4	-	3.4
ANZ Guidelines for Fresh & Marinewater Quality - toxicant DGVs Marine Water - 95% Species Protection				-	-	-	-	-	-	-	-	-	-	-	-	5.5	-	-	-	1	-	1.3	-	4.4
Field ID	Sampled Date	Lab Report No.	Matrix																					
RED_MW02	28-08-2025	389647	Water	<1	<1	2	2	150	140	<0.5	<0.5	240	210	<0.1	<0.1	<1	<1	8	9	2	<1	<1	<1	
RED_MW05	28-08-2025	389647	Water	<1	<1	3	3	110	110	<0.5	<0.5	80	80	<0.1	<0.1	<1	<1	<1	<1	2	<1	<1	<1	
DUP01	28-08-2025	389647	Water	<1	<1	3	3	110	110	<0.5	<0.5	60	70	<0.1	<0.1	<1	<1	<1	<1	2	<1	<1	<1	
TRIP01	28-08-2025	ES2527077	Water	<1	<1	4	3	142	116	<1	<1	70	60	<0.1	<0.1	1	<1	<1	<1	4	<1	2	<1	

Notes:
1 = Detected
0 = Not detected at 0.1 g/kg limit-of-reporting

Table E1
Ground Water Analytical Results Summary



				Heavy Metals																						
				Lithium (Total)	Lithium (Filtered)	Mercury (Total)	Mercury (Filtered)	Molybdenum (Total)	Molybdenum (Filtered)	Nickel (Total)	Nickel (Filtered)	Selenium (Total)	Selenium (Filtered)	Silicon as SiO2 (Filtered)	Silicon as SiO2 (Total)	Silver (Filtered)	Silver (Total)	Strontium (Filtered)	Strontium (Total)	Uranium (Filtered)	Uranium (Total)	Vanadium (Total)	Vanadium (Filtered)	Zinc (Total)	Zinc (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
				0.001	0.001	0.0001	0.0001	0.001	0.001	0.001	0.001	0.01	0.01	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.005
ANZ Guidelines for Fresh & Marine water Quality - toxicant DGVs Fresh water - 95% Species Protection				-	-	-	0.6	-	-	-	11	-	11	-	-	0.05	-	-	-	-	-	-	-	8		
ANZ Guidelines for Fresh & Marine water Quality - toxicant DGVs Marine Water - 95% Species Protection				-	-	-	0.4	-	-	-	70	-	-	-	-	1.4	-	-	-	-	-	-	100	-	8	
Field ID	Sampled Date	Lab Report No.	Matrix	210	200	< 0.05	< 0.05	7	5	5	4	< 1	< 1	-	-	< 1	< 1	1,600	1,500	5.1	6.5	2	2	32	24	
RED_MW02	28-08-2025	389647	Water	88	89	< 0.05	< 0.05	10	8	1	< 1	< 1	< 1	-	-	< 1	< 1	1,100	1,100	0.6	0.6	11	10	15	12	
RED_MW05	28-08-2025	389647	Water	90	90	< 0.05	< 0.05	10	7	1	< 1	< 1	< 1	-	-	< 1	< 1	1,100	1,100	0.6	0.7	11	10	16	13	
DUP01	28-08-2025	389647	Water	91	90	< 0.1	< 0.1	11	9	2	< 1	< 10	< 10	24,700	26,400	< 1	< 1	1,020	1,040	< 1	< 1	10	10	25	11	
TRIP01	28-08-2025	ES2527077	Water																							

Notes:
1 = Detected
0 = Not detected at 0.1 g/kg limit-of-reporting

Table E1
Ground Water Analytical Results Summary



Polycyclic Aromatic Hydrocarbons (PAH)																					
Acenaphthene (Total)	Acenaphthylene (Total)	Anthracene (Total)	Benzo(a)pyrene (Total)	Benzo(a)anthracene (Total)	Benzo(a)pyrene TEQ (Total)	Benzo(a)pyrene TEC (zero) (Total)	Benzo(b+g)fluoranthene (Total)	Benzo(b,h,i)fluoranthene (Total)	Benzo(g,h,i)perylene (Total)	Benzo(k)fluoranthene (Total)	Chrysene (Total)	Dibenz(a,h)anthracene (Total)	Fluoranthene (Total)	Fluorene (Total)	Indeno(1,2,3-cd)pyrene (Total)	Naphthalene (Ex. SVOC) (Total)	Naphthalene (Total)	Phenanthrene (Total)	Pyrene (Total)	Total +ve PAH's (Total)	Sum of polycyclic aromatic hydrocarbons (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
0.1	0.1	0.1	0.1	0.1	0.5	0.5	1	0.2	0.1	1	0.1	0.1	0.1	0.1	0.1	0.1	1	0.1	0.1	0.1	0.5
-	-	0.4	0.2	-	-	-	-	-	-	-	-	-	1.4	-	-	16	-	2	-	-	-
-	-	0.4	0.2	-	-	-	-	-	-	-	-	-	1.4	-	-	70	-	2	-	-	-

Field ID	Sampled Date	Lab Report No.	Matrix
RED_MW02	28-08-2025	389647	Water
RED_MW05	28-08-2025	389647	Water
DUP01	28-08-2025	389647	Water
TRIP01	28-08-2025	ES2527077	Water

Notes:
1 = Detected
0 = Not detected at 0.1 g/kg limit-of-reporting

Table E1
Ground Water Analytical Results Summary



				Parameters	Major Anions							Major Cations											
				Total Alkalinity as CaCO3 (Total)	Bromide (Total)	Chloride (Total)	Fluoride (Total)	Nitrate as N in water (Filtered)	Nitrate as N (Total)	Nitrite as N in water (Filtered)	Nitrite as N (Total)	Nitrite + Nitrate as N (Total)	Sulfate as SO4 - Turbidimetric (Filtered)	Aluminium (Total)	Aluminium (Filtered)	Calcium (Filtered)	Iron (Total)	Iron (Filtered)	Magnesium (Filtered)	Manganese (Total)	Manganese (Filtered)	Potassium (Filtered)	Sodium (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
				1	0.01	1	0.1	0.005	0.01	0.005	0.01	0.01	1	0.01	0.01	0.5	0.05	0.05	0.5	0.001	0.001	0.5	0.5
ANZ Guidelines for Fresh & Marinewater Quality - toxicant DGVs Freshwater - 95% Species Protection				-	-	-	-	-	-	-	-	-	-	-	55	-	-	-	-	-	1,900	-	-
ANZ Guidelines for Fresh & Marinewater Quality - toxicant DGVs Marine Water - 95% Species Protection				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field ID	Sampled Date	Lab Report No.	Matrix																				
RED_MW02	28-08-2025	389647	Water	440,000	< 500	34,000	500	290	-	< 5	-	-	-	50	< 10	96,000	1,000	1,500	30,000	2,400	2,400	14,000	57,000
RED_MW05	28-08-2025	389647	Water	170,000	900	110,000	200	40	-	< 5	-	-	-	440	< 10	130,000	380	60	14,000	17	15	13,000	190,000
DUP01	28-08-2025	389647	Water	170,000	900	110,000	200	40	-	< 5	-	-	-	410	< 10	130,000	350	60	14,000	16	15	13,000	190,000
TRIP01	28-08-2025	ES2527077	Water	180,000	865	170,000	200	-	40	-	< 10	40	446,000	1,460	< 10	147,000	970	50	17,000	16	14	12,000	184,000

Notes:
1 = Detected
0 = Not detected at 0.1 g/kg limit-of-reporting

Table E1
Ground Water Analytical Results Summary



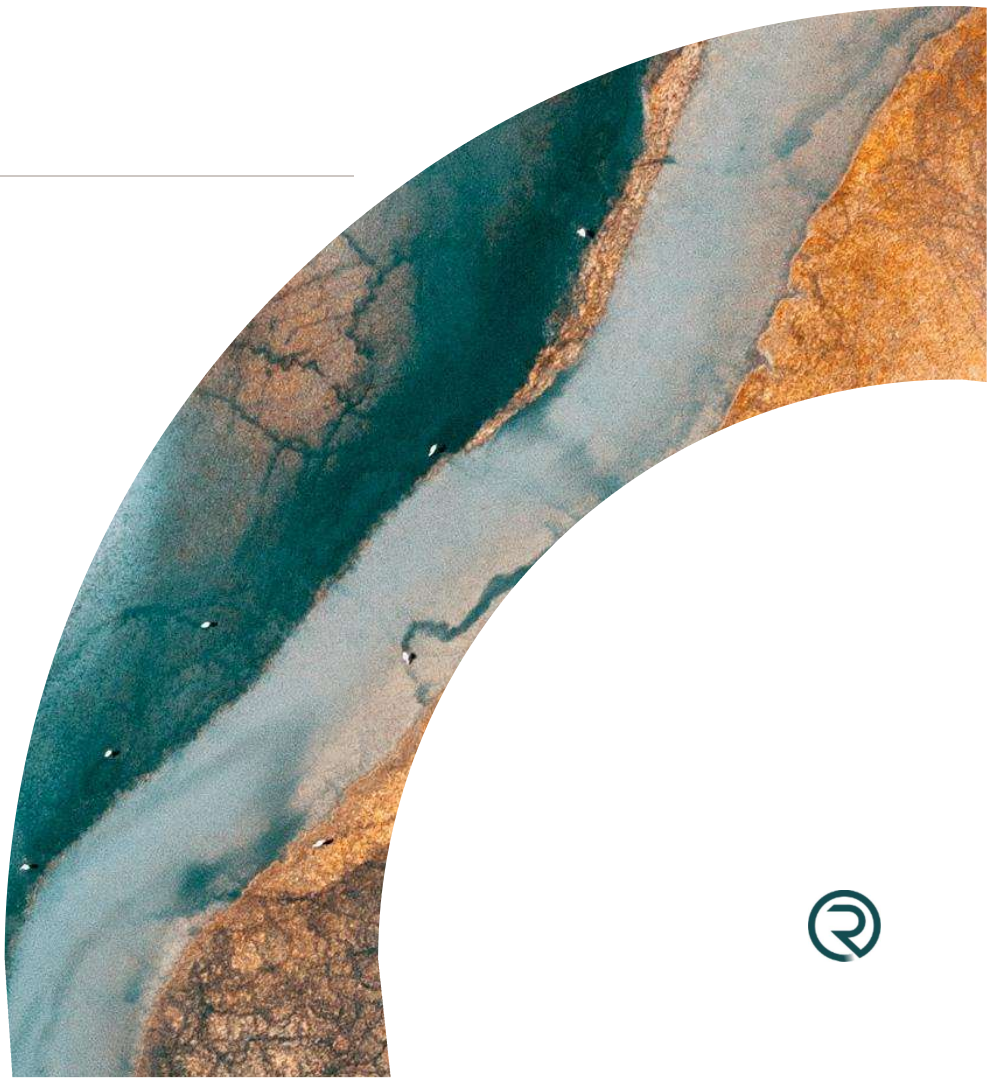
Nutrients										Other										Microbiological		
Ammonia as N in water (Filtered)	Total Kjeldahl Nitrogen as N (Total)	NOx as N in water (Total)	Total Nitrogen as N (Total)	Organic Nitrogen as N (Total)	Reactive Phosphorus as P (Filtered)	Sulphate, SO4 (Total)	Organic Nitrogen as N (Total)	Phosphorus - Total (Total)		Silica (Reactive - SiO2) (Total)	Hardness (Calc) equivalent CaCO3 (Filtered)	Hydroxide Alkalinity as CaCO3 (Total)	Carbonate Alkalinity as CaCO3 (Total)	Bicarbonate Alkalinity as CaCO3 (Total)	Total Organic Carbon (Total)	Suspended Solids (SS) (Total)	Total Hardness as CaCO3 (Filtered)			E.coli	Enterococci	Faecal Coliforms
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L		mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L			cfu/100mL	cfu/100mL	cfu/100mL
0.005	0.1	0.005	0.1	0.1	0.005	1	0.2	0.05		0.1	3	1	1	1	1	5	1					
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	40	500	-	20	-	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Field ID	Sampled Date	Lab Report No.	Matrix	1,600	1,700	290	2,000	-	< 5	75,000	< 0.2	< 50	19	360,000	< 5,000	< 5,000	440,000	7,000	53,000	-	<100	<10	<10
RED_MW02	28-08-2025	389647	Water	10	100	40	200	-	10	380,000	< 0.2	< 50	11	390,000	< 5,000	< 5,000	170,000	7,000	22,000	-	<10	<10	<10
RED_MW05	28-08-2025	389647	Water	< 5	100	40	200	-	10	380,000	< 0.2	< 50	9.3	390,000	< 5,000	< 5,000	170,000	5,000	20,000	-	<100	<10	<10
DUP01	28-08-2025	389647	Water	< 10	300	-	300	300	20	-	-	-	-	-	< 1,000	< 1,000	180,000	5,000	16,000	437,000	<1	2	-
TRIP01	28-08-2025	ES2527077	Water																				

Notes:
1 = Detected
0 = Not detected at 0.1 g/kg limit-of-reporting

F

Laboratory Reports



CERTIFICATE OF ANALYSIS 389647

Client Details

Client	Reditus Consulting
Attention	Sebastien McCulloch
Address	Shop 1, 29-33 Waratah St, KIRRAWEE, NSW, 2232

Sample Details

Your Reference	25234
Number of Samples	6 Water
Date samples received	29/08/2025
Date completed instructions received	29/08/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client unless as indicated below in the method summaries. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	05/09/2025
Date of Issue	05/09/2025

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Giovanni Agosti, Group Technical Manager
 Jack Wallis, Senior Chemist
 Loren Bardwell, Development Chemist
 Nancy Zhang, Laboratory Manager, Sydney
 Stuart Chen, Asbestos Approved Identifier/Report coordinator
 Tabitha Roberts, Senior Chemist
 Timothy Toll, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water						
Our Reference		389647-1	389647-2	389647-3	389647-4	389647-5
Your Reference	UNITS	RED_MW02	RED_MW05	DUP01	TB	TS
Date Sampled		28/08/2025	28/08/2025	28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	03/09/2025	03/09/2025	03/09/2025	03/09/2025	03/09/2025
TRH C ₆ - C ₉	µg/L	<10	<10	<10	<10	[NA]
TRH C ₆ - C ₁₀	µg/L	<10	<10	<10	<10	[NA]
TRH C ₆ - C ₁₀ less BTEX (F1)	µg/L	<10	<10	<10	<10	[NA]
Benzene	µg/L	<1	<1	<1	<1	108%
Toluene	µg/L	2	<1	<1	<1	107%
Ethylbenzene	µg/L	<1	<1	<1	<1	111%
m+p-xylene	µg/L	<2	<2	<2	<2	106%
o-xylene	µg/L	<1	<1	<1	<1	110%
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	104	105	103	103	104
Surrogate Toluene-d8	%	98	98	98	99	102
Surrogate 4-Bromofluorobenzene	%	105	103	105	103	104

vTRH(C6-C10)/BTEXN in Water		
Our Reference		389647-6
Your Reference	UNITS	Rinsate
Date Sampled		28/08/2025
Type of sample		Water
Date extracted	-	01/09/2025
Date analysed	-	03/09/2025
TRH C ₆ - C ₉	µg/L	<10
TRH C ₆ - C ₁₀	µg/L	<10
TRH C ₆ - C ₁₀ less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	108
Surrogate Toluene-d8	%	100
Surrogate 4-Bromofluorobenzene	%	105

svTRH (C10-C40) in Water					
Our Reference	UNITS	389647-1	389647-2	389647-3	389647-6
Your Reference		RED_MW02	RED_MW05	DUP01	Rinsate
Date Sampled		28/08/2025	28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025
TRH C ₁₀ - C ₁₄	µg/L	<50	<50	<50	<50
TRH C ₁₅ - C ₂₈	µg/L	<100	<100	<100	<100
TRH C ₂₉ - C ₃₆	µg/L	<100	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	<50	<50	<50
TRH >C ₁₀ - C ₁₆	µg/L	<50	<50	<50	<50
TRH >C ₁₀ - C ₁₆ less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH >C ₁₆ - C ₃₄	µg/L	<100	<100	<100	<100
TRH >C ₃₄ - C ₄₀	µg/L	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	<50	<50	<50
Surrogate o-Terphenyl	%	98	95	102	99

PAHs in Water					
Our Reference		389647-1	389647-2	389647-3	389647-6
Your Reference	UNITS	RED_MW02	RED_MW05	DUP01	Rinsate
Date Sampled		28/08/2025	28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	02/09/2025	02/09/2025	02/09/2025	02/09/2025
Naphthalene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	77	76	72	71

HM in water - dissolved					
Our Reference		389647-1	389647-2	389647-3	389647-6
Your Reference	UNITS	RED_MW02	RED_MW05	DUP01	Rinsate
Date Sampled		28/08/2025	28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water	Water
Date prepared	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025
Aluminium-Dissolved	µg/L	<10	<10	<10	<10
Antimony-Dissolved	µg/L	<1	<1	<1	<1
Arsenic-Dissolved	µg/L	2	3	3	<1
Boron-Dissolved	µg/L	210	80	70	<20
Barium-Dissolved	µg/L	140	110	110	<1
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Cobalt-Dissolved	µg/L	9	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	<1
Iron-Dissolved	µg/L	1,500	60	60	<10
Lead-Dissolved	µg/L	<1	<1	<1	<1
Lithium-Dissolved	µg/L	200	89	90	<1
Manganese-Dissolved	µg/L	2,400	15	15	<5
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Molybdenum-Dissolved	µg/L	5	8	7	<1
Nickel-Dissolved	µg/L	4	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1
Silver-Dissolved	µg/L	<1	<1	<1	<1
Strontium-Dissolved	µg/L	1,600	1,100	1,100	<1
Uranium-Dissolved	µg/L	5.1	0.6	0.6	<0.5
Vanadium-Dissolved	µg/L	2	10	10	<1
Zinc-Dissolved	µg/L	24	12	13	<1

All metals in water - total					
Our Reference	UNITS	389647-1	389647-2	389647-3	389647-6
Your Reference		RED_MW02	RED_MW05	DUP01	Rinsate
Date Sampled		28/08/2025	28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water	Water
Date prepared	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	01/09/2025	01/09/2025	01/09/2025	01/09/2025
Aluminium-Total	µg/L	50	440	410	<10
Antimony-Total	µg/L	<1	<1	<1	<1
Arsenic-Total	µg/L	2	3	3	<1
Boron-Total	µg/L	240	80	60	<20
Barium-Total	µg/L	150	110	110	<1
Beryllium-Total	µg/L	<0.5	<0.5	<0.5	<0.5
Cadmium-Total	µg/L	<0.1	<0.1	<0.1	<0.1
Cobalt-Total	µg/L	8	<1	<1	<1
Chromium-Total	µg/L	<1	<1	<1	<1
Copper-Total	µg/L	2	2	2	<1
Iron-Total	µg/L	1,000	380	350	<10
Lithium-Total	µg/L	210	88	90	<1
Mercury-Total	µg/L	<0.05	<0.05	<0.05	<0.05
Manganese-Total	µg/L	2,400	17	16	<5
Molybdenum-Total	µg/L	7	10	10	<1
Nickel-Total	µg/L	5	1	1	<1
Lead-Total	µg/L	<1	<1	<1	<1
Selenium-Total	µg/L	<1	<1	<1	<1
Silver-Total	µg/L	<1	<1	<1	<1
Strontium-Total	µg/L	1,500	1,100	1,100	<1
Uranium-Total	µg/L	6.5	0.6	0.7	<0.5
Vanadium-Total	µg/L	2	11	11	<1
Zinc-Total	µg/L	32	15	16	<1

Ion Balance				
Our Reference		389647-1	389647-2	389647-3
Your Reference	UNITS	RED_MW02	RED_MW05	DUP01
Date Sampled		28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water
Date prepared	-	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	01/09/2025	01/09/2025	01/09/2025
Calcium - Dissolved	mg/L	96	130	130
Potassium - Dissolved	mg/L	14	13	13
Sodium - Dissolved	mg/L	57	190	190
Magnesium - Dissolved	mg/L	30	14	14
Hardness (calc) equivalent CaCO ₃	mg/L	360	390	390
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	440	170	170
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	440	170	170
Sulphate, SO ₄	mg/L	75	380	380
Chloride, Cl	mg/L	34	110	110
Ionic Balance	%	-5.0	7.0	7.0

Metals in Waters - Acid extractable				
Our Reference	UNITS	389647-1	389647-2	389647-3
Your Reference		RED_MW02	RED_MW05	DUP01
Date Sampled		28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water
Date prepared	-	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	01/09/2025	01/09/2025	01/09/2025
Phosphorus - Total	mg/L	<0.05	<0.05	<0.05

Miscellaneous Inorganics				
Our Reference	UNITS	389647-1	389647-2	389647-3
Your Reference		RED_MW02	RED_MW05	DUP01
Date Sampled		28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water
Date prepared	-	01/09/2025	01/09/2025	01/09/2025
Date analysed	-	01/09/2025	01/09/2025	01/09/2025
Total Suspended Solids	mg/L	53	22	20
Turbidity	NTU	43	21	24
Total Organic Carbon	mg/L	7	7	5
Sodium Adsorption Ratio	-	1.3	4.2	4.2
Ammonia as N in water	mg/L	1.6	0.01	<0.005
Nitrate as N in water	mg/L	0.29	0.04	0.04
Nitrite as N in water	mg/L	<0.005	<0.005	<0.005
TKN in water	mg/L	1.7	0.1	0.1
NOx as N in water	mg/L	0.29	0.04	0.04
Total Nitrogen in water	mg/L	2.0	0.2	0.2
Organic Nitrogen as N	mg/L	<0.2	<0.2	<0.2
Phosphate as P in water	mg/L	<0.005	0.01	0.01
Fluoride, F	mg/L	0.5	0.2	0.2
Bromide, Br	mg/L	<0.5	0.9	0.9
Silica (Reactive - SiO ₂)	mg/L	19	11	9.3

Microbiological Testing				
Our Reference		389647-1	389647-2	389647-3
Your Reference	UNITS	RED_MW02	RED_MW05	DUP01
Date Sampled		28/08/2025	28/08/2025	28/08/2025
Type of sample		Water	Water	Water
Date of testing	-	30/08/2025	30/08/2025	30/08/2025
E. coli	cfu/100mL	<100	<10	<10
Enterococci	cfu/100mL	<10	<10	<10
Faecal Coliforms	cfu/100mL	<100	<10	<10

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-019	Suspended Solids - determined gravimetrically by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-022	Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA latest edition, 2130-B.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-120	Reactive Silica (SiO2) determined colorimetrically. Waters samples are filtered on receipt prior to analysis.

Method ID	Methodology Summary
Metals-020	Determination of various metals/elements by ICP-AES. Total Phosphate determined stoichiometrically from Phosphorus (assumed to be present as Phosphate). Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation. Submission of low masses of sample e.g. for dust samples, may result in raised PQLs. Where molecular anion forms are calculated from an element (e.g. SO₄ from S or PO₄ from P stoichiometrically), the assumption is that the element is only present in that molecular anion form.
Metals-020	Calcium and Magnesium analysed by ICP-AES and SAR calculated.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C₁₀-C₁₆)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C ₆ -C ₁₀)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			01/09/2025	1	01/09/2025	03/09/2025		01/09/2025	[NT]
Date analysed	-			03/09/2025	1	03/09/2025	04/09/2025		03/09/2025	[NT]
TRH C ₆ - C ₉	µg/L	10	Org-023	<10	1	<10	<10	0	112	[NT]
TRH C ₆ - C ₁₀	µg/L	10	Org-023	<10	1	<10	<10	0	112	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	110	[NT]
Toluene	µg/L	1	Org-023	<1	1	2	<1	67	111	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	113	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	112	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	113	[NT]
Naphthalene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	102	1	104	100	4	102	[NT]
Surrogate Toluene-d8	%		Org-023	98	1	98	99	1	101	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	105	1	105	93	12	102	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	389647-2
Date extracted	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	01/09/2025
Date analysed	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	01/09/2025
TRH C ₁₀ - C ₁₄	µg/L	50	Org-020	<50	1	<50	<50	0	120	110
TRH C ₁₅ - C ₂₈	µg/L	100	Org-020	<100	1	<100	<100	0	133	116
TRH C ₂₉ - C ₃₆	µg/L	100	Org-020	<100	1	<100	<100	0	129	104
TRH >C ₁₀ - C ₁₆	µg/L	50	Org-020	<50	1	<50	<50	0	120	110
TRH >C ₁₆ - C ₃₄	µg/L	100	Org-020	<100	1	<100	<100	0	133	116
TRH >C ₃₄ - C ₄₀	µg/L	100	Org-020	<100	1	<100	<100	0	129	104
Surrogate o-Terphenyl	%		Org-020	103	1	98	91	7	130	81

QUALITY CONTROL: PAHs in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	389647-2
Date extracted	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	01/09/2025
Date analysed	-			02/09/2025	1	02/09/2025	02/09/2025		02/09/2025	02/09/2025
Naphthalene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	81	89
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	77	76
Fluorene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	63	67
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	83	104
Anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	73	78
Pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	73	81
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	69	71
Benzo(b,j,k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	70	74
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	79	1	77	65	17	71	75

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date prepared	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	[NT]
Date analysed	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	<10	[NT]		84	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		96	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	2	[NT]		86	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	1	210	[NT]		88	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	1	140	[NT]		87	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	[NT]		87	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		82	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		84	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	9	[NT]		85	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		86	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	1	1500	[NT]		102	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		91	[NT]
Lithium-Dissolved	µg/L	1	Metals-022	<1	1	200	[NT]		88	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	2400	[NT]		90	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	98	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	5	[NT]		81	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	4	[NT]		86	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		96	[NT]
Silver-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		92	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	<1	1	1600	[NT]		90	[NT]
Uranium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	5.1	[NT]		87	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	1	2	[NT]		84	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	24	[NT]		86	[NT]

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date prepared	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	[NT]
Date analysed	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	[NT]
Aluminium-Total	µg/L	10	Metals-022	<10	1	50	[NT]		82	[NT]
Antimony-Total	µg/L	1	Metals-022	<1	1	<1	[NT]		82	[NT]
Arsenic-Total	µg/L	1	Metals-022	<1	1	2	[NT]		86	[NT]
Boron-Total	µg/L	20	Metals-022	<20	1	240	[NT]		88	[NT]
Barium-Total	µg/L	1	Metals-022	<1	1	150	[NT]		82	[NT]
Beryllium-Total	µg/L	0.5	Metals-022	<0.5	1	<0.5	[NT]		85	[NT]
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		80	[NT]
Cobalt-Total	µg/L	1	Metals-022	<1	1	8	[NT]		81	[NT]
Chromium-Total	µg/L	1	Metals-022	<1	1	<1	[NT]		81	[NT]
Copper-Total	µg/L	1	Metals-022	<1	1	2	[NT]		83	[NT]
Iron-Total	µg/L	10	Metals-022	<10	1	1000	[NT]		94	[NT]
Lithium-Total	µg/L	1	Metals-022	<1	1	210	[NT]		85	[NT]
Mercury-Total	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	99	[NT]
Manganese-Total	µg/L	5	Metals-022	<5	1	2400	[NT]		87	[NT]
Molybdenum-Total	µg/L	1	Metals-022	<1	1	7	[NT]		89	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	1	5	[NT]		82	[NT]
Lead-Total	µg/L	1	Metals-022	<1	1	<1	[NT]		89	[NT]
Selenium-Total	µg/L	1	Metals-022	<1	1	<1	[NT]		81	[NT]
Silver-Total	µg/L	1	Metals-022	<1	1	<1	[NT]		93	[NT]
Strontium-Total	µg/L	1	Metals-022	<1	1	1500	[NT]		86	[NT]
Uranium-Total	µg/L	0.5	Metals-022	<0.5	1	6.5	[NT]		85	[NT]
Vanadium-Total	µg/L	1	Metals-022	<1	1	2	[NT]		82	[NT]
Zinc-Total	µg/L	1	Metals-022	<1	1	32	[NT]		85	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	[NT]
Date analysed	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	96	96	0	92	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	14	14	0	95	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	57	58	2	91	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	30	31	3	92	[NT]
Hardness (calc) equivalent CaCO ₃	mg/L	3	Metals-020	[NT]	1	360	370	3	[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	440	450	2	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	440	450	2	118	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	1	75	[NT]		103	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	34	[NT]		98	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	-5.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	389647-2
Date prepared	-			01/09/2025	[NT]	[NT]	[NT]	[NT]	01/09/2025	01/09/2025
Date analysed	-			01/09/2025	[NT]	[NT]	[NT]	[NT]	01/09/2025	01/09/2025
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	102	100

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	389647-2
Date prepared	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	01/09/2025
Date analysed	-			01/09/2025	1	01/09/2025	01/09/2025		01/09/2025	01/09/2025
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	53	[NT]		94	[NT]
Turbidity	NTU	0.1	Inorg-022	<0.1	1	43	37	15	102	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	7	[NT]		90	[NT]
Sodium Adsorption Ratio	-	0.01	Metals-020	[NT]	1	1.3	1.3	0	95	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	1.6	[NT]		105	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.29	[NT]		98	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		100	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	1	1.7	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.29	[NT]		98	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	2.0	[NT]		94	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	1	<0.2	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	<0.005	[NT]		105	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.5	0.5	0	99	107
Bromide, Br	mg/L	0.5	Inorg-081	<0.5	1	<0.5	[NT]		92	[NT]
Silica (Reactive - SiO ₂)	mg/L	0.1	INORG-120	<0.1	1	19	[NT]		91	[NT]

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions	
Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

For Dust Deposit Gauge (DDG) analysis the sampling, sampling period and funnel exposure area do not fall under Envirolab's NATA accreditation (unless the Newcastle laboratory where responsible for the sampling), hence the annotation on the DDG units of reporting.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

Report Comments

Microbiology analysed by Sonic Food & Water Testing. Report No. W2519734 & W2519735

The time between collection and the commencement of testing should not exceed 24 hours. Samples tested outside this time may have their results compromised

TRACE METALS: In theory the total metal content should be higher than the dissolved metal content. However, in some samples this is not the case. The sample has been re-analysed for both Total and Dissolved metals and results have been confirmed.

SAMPLE RECEIPT ADVICE

Client Details

Client	Reditus Consulting
Attention	Sebastien McCulloch

Sample Login Details

Your reference	25234
Envirolab Reference	389647
Date Sample Received	29/08/2025
Date Instructions Received	29/08/2025
Date Results Expected to be Reported	05/09/2025

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	6 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	2
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	Phone: 02 9910 6200
Fax: 02 9910 6201	Fax: 02 9910 6201
Email: ahie@envirolab.com.au	Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water	HM in water - dissolved	All metals in water - total	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hardness (calc) equivalent CaCO ₃	Hydroxide Alkalinity (OH-) as CaCO ₃	Bicarbonate Alkalinity as CaCO ₃	Carbonate Alkalinity as CaCO ₃	Total Alkalinity as CaCO ₃	Sulphate, SO ₄	Chloride, Cl	Ionic Balance	Metals in Waters - Acid extractable	Total Suspended Solids	Turbidity	Total Organic Carbon	Sodium Adsorption Ratio	Ammonia as N in water	Nitrate as N in water	Nitrite as N in water	TKN in water	NOx as N in water	Total Nitrogen in water	Organic Nitrogen as N	Phosphate as P in water	Fluoride, F	Bromide, Br	Silica (Reactive - SiO ₂)	Microbiological Testing
RED_MW02	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RED_MW05	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DUP01	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TB	✓																																	
TS	✓																																	
Rinsate	✓	✓	✓	✓	✓																													

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

CHAIN OF CUSTODY FORM - Client

HT

ENVIROLAB GROUP
National phone number 1300 424 344

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
02 9910 6200 | sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt, Myaree, WA 6154
08 9317 2505 | lab@mpl.com.au

Melbourne Lab - Envirolab Services
25 Research Drive, Croydon South, VIC 3136
03 9763 2500 | melbourne@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
08 7067 6800 | adelaide@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 7, 17 Willes Rd, Berrimah, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Client: Reditus Consulting		Client Project Name/Number/Site etc (ie report title):	
Contact Person: Seb McCulloch		25234	
Project Mgr: Seb McCulloch		PO No.: 25234	
Sampler: Tanner Graham		Envirolab Quote No.:	
Address: Unit 1A, Level 1, 29-33 Waratah Street Kirrawee NSW		Date results required: Standard TAT	
Phone: 02 9521 6567 Mob: 0413 177 501		Or choose: standard / same day / 1 day / 2 day / 3 day	
accounts@reditusconsulting.com sebmcculloch@reditus.com.au		Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Email Invoice To:		Additional report format: esdat	
Email Results To: sebmcculloch@reditus.com.au, tannergraham@reditus.com.au		Lab Comments:	

Sample Information					Tests Required									
Envirolab Sample ID	Client Sample ID or Information	Depth	Date sampled	Type of sample	Total and filtered - Metals including aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), strontium (Sr), uranium (U), vanadium (V) & zinc (Zn)	Turbidity (NTU), total suspended solids (TSS), total organic carbon (TOC) & sodium absorption ratio (SAR)	Nutrient suite includes ammonia as N (NH3), nitrite (NO2), Nitrate (NO3), Total Kjeldahl Nitrogen (TKN), organic nitrogen (Norg), nitric oxide (NOX), total nitrogen (N), total phosphorus (P) and phosphate (PO4)	TRH, BTEX, PAH	Silica (SiO2), bromide (Br) fluoride (F)	Pathogens including faecal coliforms, faecal enterococci, and E.coli	Ionic balance suite including calcium (Ca), sodium (Na), potassium (K), Magnesium (Mg), chloride (Cl), sulfate (SO4), carbonate (CO3), bicarbonate (HCO3), Hardness, Total Alkalinity (OH)	TRH, BTEX		
1	RED_MW02		28.8.25	Water	x	x	x	x	x	x	x			
2	RED_MW05		28.8.25	Water	x	x	x	x	x	x	x			
3	DUP01		28.8.25	Water	x	x	x	x	x	x	x			
4	TRIP01		28.8.25	Water	x	x	x	x	x	x	x			
5	TB		28.8.25	Water								x		
6	TS		28.8.25	Water								x		
	Rinsate		28.8.25	Water	x			x						
Sample Count					5	4	4	5	4	4	4	2		

Environmental Division
Sydney
Work Order Reference
ES2527077



Telephone : + 61-2-8784 8555

Please forwards to ALS

Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis			
Relinquished by (Company): Reditus		Received by (Company): ELS Syd	
Print Name: Tanner Graham	Signature: Tony T.	Print Name: ELS Syd	Signature: [Signature]
Date & Time: 28/08/2025	Signature: [Signature]	Date & Time: 29/08/2025	Signature: [Signature]
Job number: 389047		Cooling: Ice / Ice pack / None	
Temperature: 2		Security seal: Intact / Broken / None	
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD			

Rec'd
11/12/25
1648.



02 9521 6567

admin@reditusconsulting.com

Unit 1A, 29-33 Waratah Street,
Kirrawee NSW 2232

reditus.com.au