

**Specialist Advice on
Groundwater Impact Assessment**

Proposed Mixed Use Development

100 Edinburgh Road, Castlecrag NSW

Prepared for Conquest

Project 237568.01

14 November 2025

Document History

Details

Project No.	237568.01
Document Title	Groundwater Impact Assessment
Site Address	100 Edinburgh Road, Castlecrag NSW
Report Prepared For	Edinburgh Development Group Pty Ltd
Filename	237568.01.R.001.Rev0

Status and Review

Status	Prepared by	Reviewed by	Date issued
Rev 0	Warren Smith	Joel Huang	14 November 2025

Distribution of Copies

Status	Issued to
Rev 0	Joseph Puckeridge, Conquest

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature

Date

Author		14 November 2025
Reviewer		14 November 2025

Table of Contents

	Page No
1. Introduction.....	3
1.1 Purpose of this report.....	3
1.2 Regulatory framework and guidance.....	4
1.3 Assessment requirements	4
2. Proposed development	5
2.1 Proposed development and construction	5
2.2 Proposed dewatering.....	5
3. Site description	5
4. Hydrogeological setting	7
4.1 Topography and hydrology	7
4.2 Climate.....	7
4.3 Geology.....	7
4.4 Hydrogeology and groundwater source	8
4.5 Groundwater receptors.....	8
4.6 Acid sulfate soils and salinity	8
4.7 Soil resources and riparian lands.....	8
5. Previous Investigation results	9
5.1 Geotechnical	9
5.2 Groundwater	10
5.2.1 Groundwater levels.....	11
5.2.2 Hydraulic conductivity	12
6. Conceptual hydrogeological model	13
7. Groundwater inflow and drawdown assessment.....	13
7.1 Numerical modelling methodology	13
7.2 Model geometry.....	13
7.3 Model layers.....	14
7.4 Model calibration – Initial Heads	15
7.5 Basement dewatering	15
7.6 Sensitivity scenarios.....	16
7.7 Groundwater modelling results	16
7.7.1 Predicted groundwater inflow.....	16
7.7.2 Predicted groundwater drawdown and settlement.....	16

8.	Impact assessment	17
8.1	Aquifer Interference Policy consideration	17
8.1	Environmental risk assessment.....	18
9.	Approvals and licensing.....	18
9.1	Water Access Licence (WAL) and entitlements.....	19
9.2	Water Supply Works Approval (WSWA).....	19
10.	Conclusion	19
11.	References	20
12.	Limitations.....	20

Appendix A: About This Report

Appendix B: Dewatering Management Plan (KD2026/03, dated 25 September 2025)

Appendix C: Rock Core Photographs (MW1C, MW2C and MW3C)

Approximate Borehole Location Plan (MW1C, MW2C and MW3C)

Appendix D: Architectural Drawings

Groundwater Impact Assessment

100 Edinburgh Road Castlecrag

100 Edinburgh Road, Castlecrag NSW

1. Introduction

1.1 Purpose of this report

This specialist advice report prepared by Douglas Partners Pty Ltd (Douglas) outlines the Groundwater Impact Assessment (GIA) for a proposed mixed-used development at 100 Edinburgh Road, Castlecrag NSW (the site). The work was undertaken in accordance with Douglas' proposal 237568.00.P.001.Rev0, dated 8 August 2025.

The purpose of this GIA is to support the submission of a State Significant Development Application (SSDA), addressing the assessment requirements specified in Section 1.3.

A brief overview of the development is provided in Section 2.

This GIA is based on the findings of site-specific investigations and monitoring by others with the reports provided to Douglas, including:

- Geotechnical investigation (EI 2023) (EI Australia, Ref. E26044.G03 dated 27 September 2023);
- Dewatering Management Plan (DMP) (KD 2025) (Katarina David, Ref. KD2026/03, dated 25 September 2025) (attached as Appendix B). This DMP was based on a previously development proposal with a shallower basement, now superseded.

The following key information is relevant to the preparation of this GIA:

- The proposed works will intercept the groundwater table.
- Groundwater levels on site have been observed between Reduced Level (RL) 75.6 m and RL 81.3 m, relative to Australian Height Datum (AHD).
- The finished floor level (FFL) of the proposed lowest basement level (Basement 4) is RL 68.9 mAHD.
- The basement is intended to be drained during construction and in the long term.
- The proposed method of dewatering is sump and pump.

This GIA is intended as a preliminary document and will be superseded post DA by a detailed GIA with a dewatering management plan (DMP) that includes water treatment and discharge schematics, monitoring plans, and triggers and contingencies to be implemented during construction and operation for long term dewatering.

This report must be read in conjunction with all appendices including the notes provided in Appendix A.

1.2 Regulatory framework and guidance

The following key guidelines and documents were consulted in preparation of this report:

- Minimum requirements for building site groundwater investigations and reporting (NSW DPE, 2022);
- *NSW Aquifer Interference Policy* (DPI-NSW Office of Water, 2012); and
- *NSW Aquifer Interference Policy* (NSW DPI, 2013), supplementary version.
- Groundwater assessment toolbox for Major Projects in NSW (NSW DPE, 2022);
- Guidelines for Groundwater Documentation for SSD/SSI Projects (NSW DPE, 2022);
- Minimum Groundwater Modelling Requirements for SSD/SSI Projects (NSW DPE, 2022); and
- Cumulative Groundwater Impact Assessment Approaches (NSW DPE, 2022).

1.3 Assessment requirements

Assessment requirements are presented in Table 1.

Table 1: Compliance table

SEARs Item	Assessment Requirement	Report Section / Response
12. Ground and Groundwater Conditions	Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion.	Section 4
	Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.	Sections 4 to 10

2. Proposed development

2.1 Proposed development and construction

Based on the architectural drawing set prepared by fjstudio, dated 5 November 2025, it is understood that the proposed development will comprise a multi-storey mixed-use building over four levels of basement. The proposed lowest basement level (Basement 4) has an FFL of RL 68.9 mAHD, which will require excavations of up to about 17 m with deeper localised excavations required for service trenches and lift cores.

2.2 Proposed dewatering

We expect that dewatering of the site will be achievable via conventional sumps and pumps and is expected to be redirected and discharged into council stormwater drains.

3. Site description

The site is bound by Edinburgh Road to the north, Eastern Valley Way to the west, an existing mixed-use building to the east and residential dwellings to the south. An aerial image of the site with the site boundary is shown in

Figure 1.

Based on a recent site visit, the site was vacant (refer to

Figure 1) with previous structures demolished, with the exception of the following:

- A suspended vehicular ramp located within the northeast corner of the site;
- Medium sized trees located along the southwestern corner and the southern boundary;
- A concrete block retaining wall about 2 m to 3 m in height, extending from the southwestern corner to approximately midway along the southern boundary; and
- Remnants of previous brick basement walls along northern and western boundaries.

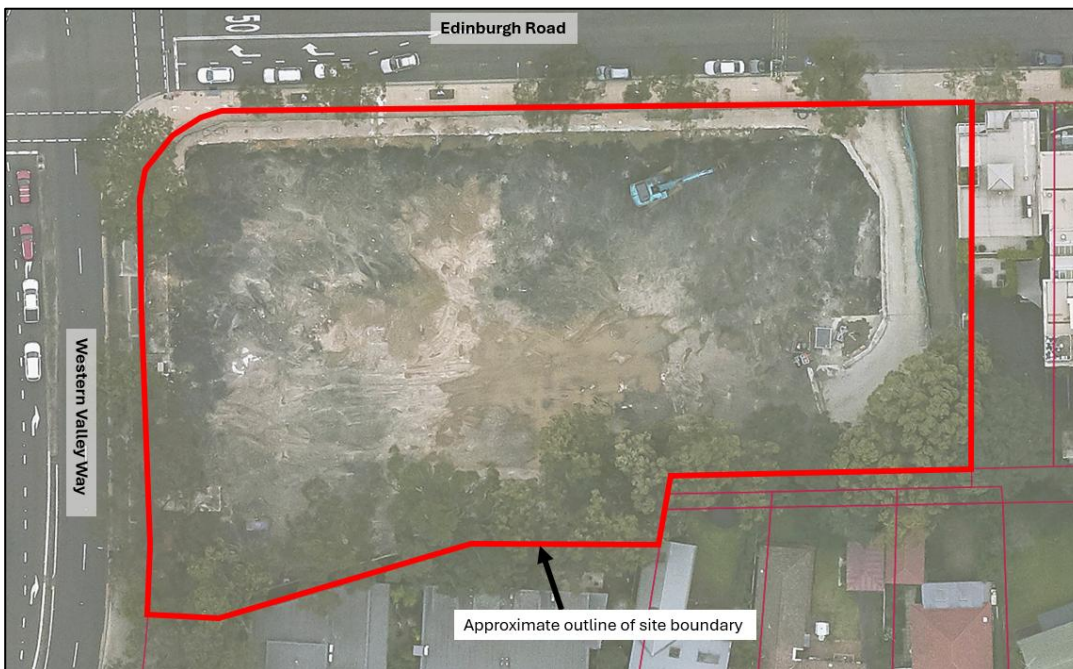


Figure 1: Aerial image of the site



Figure 2 – Photo of existing site conditions, looking northwest, dated 17 September 2025

4. Hydrogeological setting

4.1 Topography and hydrology

The site is situated near the crest of a south facing hillside which grades down toward Sailors Bay Creek located approximately 220 m to the south. Sailors Bay Creek naturally drains into Sailors Bay. Sugarloaf Creek is located approximately 400 m to the north and naturally drains into Sugarloaf Bay. These creeks present the primary surface water features influencing the local hydrology.

4.2 Climate

The region experiences a generally subtropical climate, characterised by mild winters and hot, humid summers. The average annual rainfall is approximately 1.2 m, contributing to seasonal variations in surface runoff and groundwater recharge.

4.3 Geology

Reference to the Sydney 1:100 000 Geological Series Sheet and inspection of the area surrounding the site indicates that the site is underlain by Hawkesbury Sandstone. Hawkesbury Sandstone is of Triassic age and typically comprises medium to coarse grained sandstone, both massive and cross bedded.



Figure 3: Geological map and approximate location of site

4.4 Hydrogeology and groundwater source

Based on the hydrogeological setting, the site is expected to be underlain by a groundwater system comprising multi-layered minor fractured aquifers predominantly hosted within the Hawkesbury Sandstone bedrock. This aquifer system is characterised by low to moderate permeability. Groundwater occurs primarily within fractures, joints, and bedding planes, with limited storage in the sandstone matrix due to its low primary porosity. The rock defects are typically discontinuous and exhibit variable hydraulic conductivities, with possible localised zones of higher permeability associated with major structures such as faults or shear zones.

The Hawkesbury Sandstone does not behave as a single, uniform aquifer. Instead, it forms a multi-layered fractured aquifer system, influenced by geological heterogeneity and structural features. This layering is primarily due to variations in sandstone bedding, the presence of shale lenses, and fracture networks that create zones of differing hydraulic properties. Vertical connectivity between zones is generally poor due to lack of vertical fractures and shale interbeds, but localised faults or shear zones can create preferential pathways, allowing deeper recharge and potential hydraulic communication.

The proposed basement is expected to intercept the shallow zone of the aquifer, which typically receives recharge from direct infiltration of rainfall through exposed sandstone outcrops and thin overlying soils.

4.5 Groundwater receptors

In assessing potential impacts of dewatering on environmental receptors, those potential groundwater receptors need to be identified.

A search of the Bureau of Meteorology (BoM)'s groundwater dependent ecosystems Atlas (the GDE Atlas) indicate that there are no GDEs within 500 m of the site.

A review of the BoM national groundwater information system (NGIS) indicates there are no registered bores within 500 m of the site.

4.6 Acid sulfate soils and salinity

The 1:25,000 Acid Sulfate Soil Risk Map (1994-1998, NSW Department of Environment and Climate Change) indicates that the site is not located within an area with known potential for acid sulfate soils (ASS). The site is located above RL 82 mAHD and is therefore considered very low risk of ASS occurrence.

Reference to the Environmental Planning Instrument (EPI) – Salinity Mapping (SEED Web Map), published by the State Government of NSW and the NSW Department of Planning, Housing and Infrastructure, indicates the site is located outside the mapped area of salinity potential.

4.7 Soil resources and riparian lands

The site is underlain predominantly by Hawkesbury Sandstone, which is not considered as a soil resource. A search of "Soil and Land Resources of Central and Eastern NSW" Map published by DCCEE in 2016 indicates the site is located outside the mapped area of soil resources.

Reference to the NSW “Riparian Lands and Watercourses” Map indicates that the site is not within an area mapped as a protection zone and the nearest riparian land is located outside the 500 m radius of the site. Therefore, soil erosion caused by the development, if any, will not affect riparian lands.

5. Previous Investigation results

5.1 Geotechnical

A geotechnical investigation was undertaken by EI Australia in September 2023 (EI 2023) which included the drilling of five boreholes (BH1, BH2M, BH3, BH4M and BH5M) to depths ranging from 9 m (BH3) and 12.9 m (BH5M). Monitoring wells were installed within boreholes BH2M, BH4M and BH5M.

It is understood that additional four boreholes (BH101, MW1C, MW2C and MW3C) were drilled with monitoring wells installed as part of the KD 2025 investigation. It should be noted that borehole BH101 was logged without accompanying rock core photographs. Core box photographs and indicative borehole locations were provided by Andrew Bishay of Builtcom (Appendix C) for boreholes MW1C, MW2C, and MW3, however, these boreholes do not appear to have been logged.

The indicative location of the boreholes is shown in Figure 4.

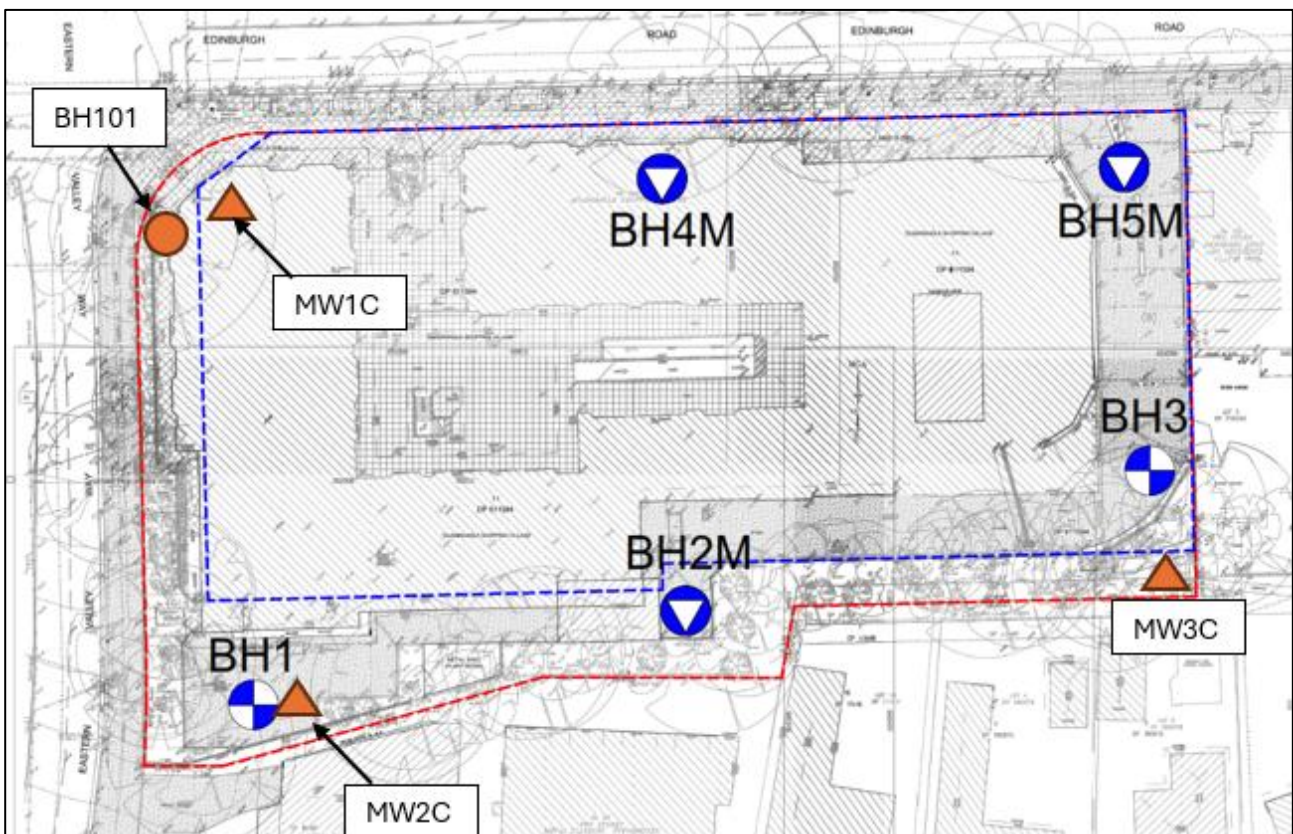


Figure 4: Approximate EI 2023 (blue) and KD 2025 boreholes (orange) location plan

Based on the above information, a general subsurface profile is summarised as follows:

Concrete Slab/Asphalt pavements:	Concrete slab or asphaltic concrete thickness of 50 mm to 170 mm; overlying
Fill:	Gravelly sand with traces of brick to depths ranging between 0.2 m and 2 m; overlying
Residual Soil:	Gravelly clayey sand, medium dense to dense to depths ranging from 0.2 m to 2 m; overlying
Weathered Siltstone Bedrock:	Encountered locally near southern site boundary to approximately 3 m depth; overlying
Weathered Sandstone Bedrock:	Hawkesbury sandstone typically distinctly weathered and very low to low strength on first contact and improving to slightly weathered and fresh and medium to high strength with depth. The sandstone bedrock was generally slightly fractured to unbroken.

5.2 Groundwater

Three groundwater wells (BH2M, BH4M and BH5M) were installed within the site a part of the EI 2023 investigation. A further four monitoring wells (BH101, MW1C, MW2C and MW3C) were installed during the KD 2025 investigation. Groundwater monitoring and testing results are summarised in subsequent sections.

Table 2 summarises the key attributes of monitoring wells installed on site.

Table 2: Monitoring well details

Well ID	Installation date	Surface RL (m AHD)	Screen depth (m bgl)	Screened lithology	Description of fracturing
BH2M	June 2023	82.1	7.1 – 10.1	Sandstone	Slightly fractured to unbroken
BH4M	June 2023	82.2	7.0 – 10.0	Sandstone	Slightly fractured to unbroken
BH5M	June 2023	82.7	7.0 – 10.0	Sandstone	Slightly fractured to unbroken
BH101	May 2025	85.7	5.0 – 11.0	Not specified	Not specified
MW1C	August 2025*	86.5***	10.0 – 21.5	Sandstone**	Slightly fractured to unbroken**
MW2C	August 2025*	81.5***	10.0 – 16.5	Sandstone**	Slightly fractured to unbroken**
MW3C	August 2025*	80.0***	9.0 – 14.0	Sandstone**	Slightly fractured to unbroken**

Notes: m bgl: metres below ground level

* based on time signature from provided rock core photographs (Appendix D)

** based on rock core photographs only (Appendix D)

***based on provided borehole location plan details (Appendix D)

5.2.1 Groundwater levels

The EI 2023 reported that groundwater was not encountered during auger drilling.

Subsequently, KD 2025 installed data loggers in monitoring wells BH101 and BH5M, which continuously recorded groundwater levels for approximately three months. BH2M was monitored for one month only, due to logger failure and a dry bore condition. The results of the KD's monitoring is shown as a hydrograph in Figure 5 and are summarised in Table 3.

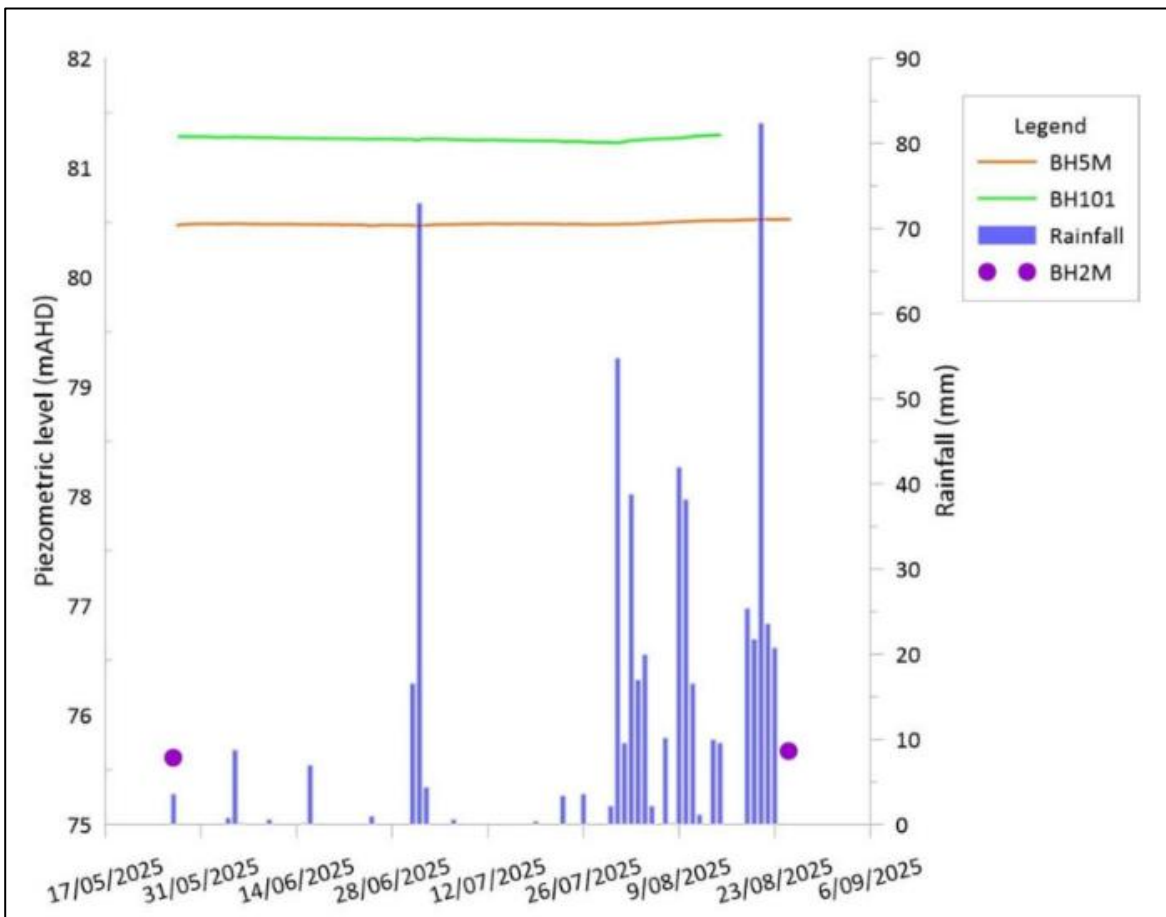


Figure 5 – Hydrograph showing groundwater level (mAHD) vs Rainfall (mm) for monitoring period between 27th May 2025 to 24th August 2025 (excerpt from KD 2025)

The hydrograph indicates minimal response to rainfall events with groundwater levels remaining relatively stable throughout the monitoring period.

Maximum, minimum and average groundwater levels recorded by the dataloggers are presented in Table 3.

Table 3: Summary of logger data (excerpt from KD 2025)

<i>Bore ID</i>	<i>Minimum level</i>	<i>Maximum level</i>	<i>Average water level</i>	<i>Standard deviation</i>
<i>BH101</i>	81.22	81.3	81.26	0.02
<i>BH2M</i>	75.61	75.67	NA	NA
<i>BH5M</i>	80.46	80.52	80.48	0.009

Groundwater levels readings indicate that the flow of groundwater in the vicinity of the site is grading down toward the southeast.

5.2.2 Hydraulic conductivity

Rising head hydraulic conductivity tests were carried out as part of EI 2023 and KD 2025 and included the following:

- Three rising head hydraulic conductivity tests carried out in BH101 (KD 2025);
- Two rising head hydraulic conductivity tests carried in boreholes BH2M and BH4M and were analysed using Hvorslev (1951) solution (EI 2023); and
- 18 rising head hydraulic conductivity tests were carried out within MW1C to MW3C (KD 2025) using Bower and Rice (1989) method.

As summary of the testing results is presented in Table 4.

Table 4: Summary of hydraulic testing results

Well ID	Screen depth (m bgl)	Screened lithology	Calculated Hydraulic conductivity (m/s)
BH101*	5.0 – 11.0	Sandstone	$1.7 \times 10^{-7} - 3.9 \times 10^{-8}$
BH5M	7.0 – 10.0	Sandstone	$2.1 \times 10^{-7} - 2.3 \times 10^{-7}$
BH4M	7.0 – 10.0	Sandstone	$1.5 \times 10^{-7} - 6.1 \times 10^{-8}$
MW1C	10 – 21.5	Sandstone**	$3.7 \times 10^{-7} - 2.3 \times 10^{-8}$
MW2C	10 – 16.5	Sandstone**	$4.5 \times 10^{-7} - 1.7 \times 10^{-7}$
MW3C	9.0 – 14.0	Sandstone**	$2.4 \times 10^{-7} - 7.7 \times 10^{-8}$
Geometric mean			1.2×10^{-7}

Notes: m bgl: metres below ground level

* Taken from KD 2025 Table 3

** based on core box photographs only (Appendix C)

6. Conceptual hydrogeological model

The site is predominantly underlain by Hawkesbury Sandstone. The topography of the area generally grades down toward the southeast into a gully feature that extends into Sailors Bay Creek and ultimately into Sailors Bay further to the southeast. The groundwater levels recorded within the monitoring wells to date indicate that the groundwater flow is also toward the southeast, following the natural topography.

Fluctuations and trends in response to rainfall within the wells during the monitoring period appeared to be negligible. This report should be updated upon completion of a minimum 3-months monitoring period. The recorded groundwater levels were observed to be entirely within the medium to high strength sandstone bedrock profile.

The aquifer has been identified as unconfined where groundwater sources flowing into the subject site are considered to originate from rain and surface water infiltration. Over time, these water sources permeate to the natural groundwater that has been observed to be within the bedrock profile.

It should be noted that groundwater levels are transient and fluctuate with climatic variations and other factors (e.g. adjacent excavations, pumping). Therefore, the water levels may temporarily rise during periods of heavy or prolonged rainfall and fall during dry periods. Groundwater levels in the vicinity of the site can also be affected by nearby dewatering activities and existing drained basements, if any.

7. Groundwater inflow and drawdown assessment

7.1 Numerical modelling methodology

Groundwater modelling was undertaken to assess the potential inflow rates into the proposed excavation during continuous long-term dewatering, as well as induced groundwater level changes in adjacent and surrounding areas.

A 3-dimensional (3D) numerical groundwater model was developed. The modelling was carried out using the finite element hydrogeological software SEEP3D (version 2023.1.2) (a component of GeoStudio) developed by GEOSLOPE International Ltd.

Steady-state seepage analysis model was carried out for the long-term (post construction) inflow rates for the basement.

7.2 Model geometry

The topography of the model was created by utilising NSW foundation spatial services, elevation and depth (ELVIS) contour data. A surface mesh was then created from these contours in SEEP3D to form the approximate topography of the area.

A 3D model of approximately 600 m x 900 m in area with the site located approximately in the centre was developed. The depth of the model extends to about 100 m below the BEL of the development. The model is shown below in Figure 6.

A bulk excavation level (BEL) of RL 68.4 mAHD for the basement excavation has been adopted.

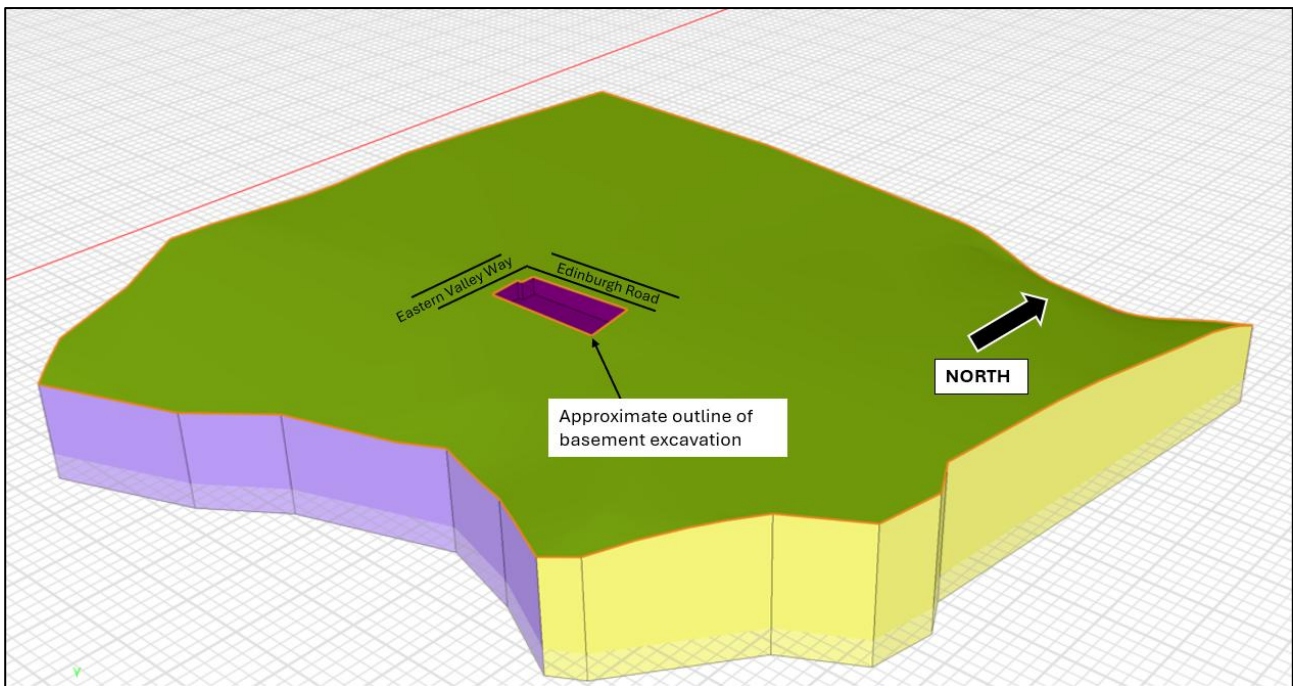


Figure 6: Seep3D Model

7.3 Model layers

A single-layer subsurface profile comprising only sandstone was adopted as the groundwater was observed wholly within the bedrock profile. Adopted hydraulic properties (base case) are presented in Table 5. Parameters were selected based on the results of the hydraulic conductivity testing by EI and KD (Section 5.2.2).

Table 5: Model layers and adopted hydraulic properties (base case)

Material	Saturated Kh (m/s)	Anisotropy Ratio (Kv/Kh)	Residual Water Content (%)	Saturated Water Content (%)	Material Model Adopted
Sandstone	1.2×10^{-7}	0.3	5	20	Saturated / Unsaturated

Notes: Kh: Horizontal hydraulic conductivity
Kv: Vertical hydraulic conductivity

7.4 Model calibration – Initial Heads

Groundwater total head boundary conditions have been placed along the sides of the model where naturally occurring groundwater levels are known (i.e. creeks) to simulate initial groundwater levels within the site being consistent with the maximum levels recorded during the groundwater monitoring to date.

An infiltration flux rate of $3.7 \times 10^{-9} \text{ m}^3/\text{s}/\text{m}^2$, which is 10% of an average annual rainfall of 1.2 m in Sydney, was adopted to simulate infiltration and seepage from rainfall to the model surface.

The simulated initial (pre-development) groundwater contour lines across the site are shown in Figure 8.

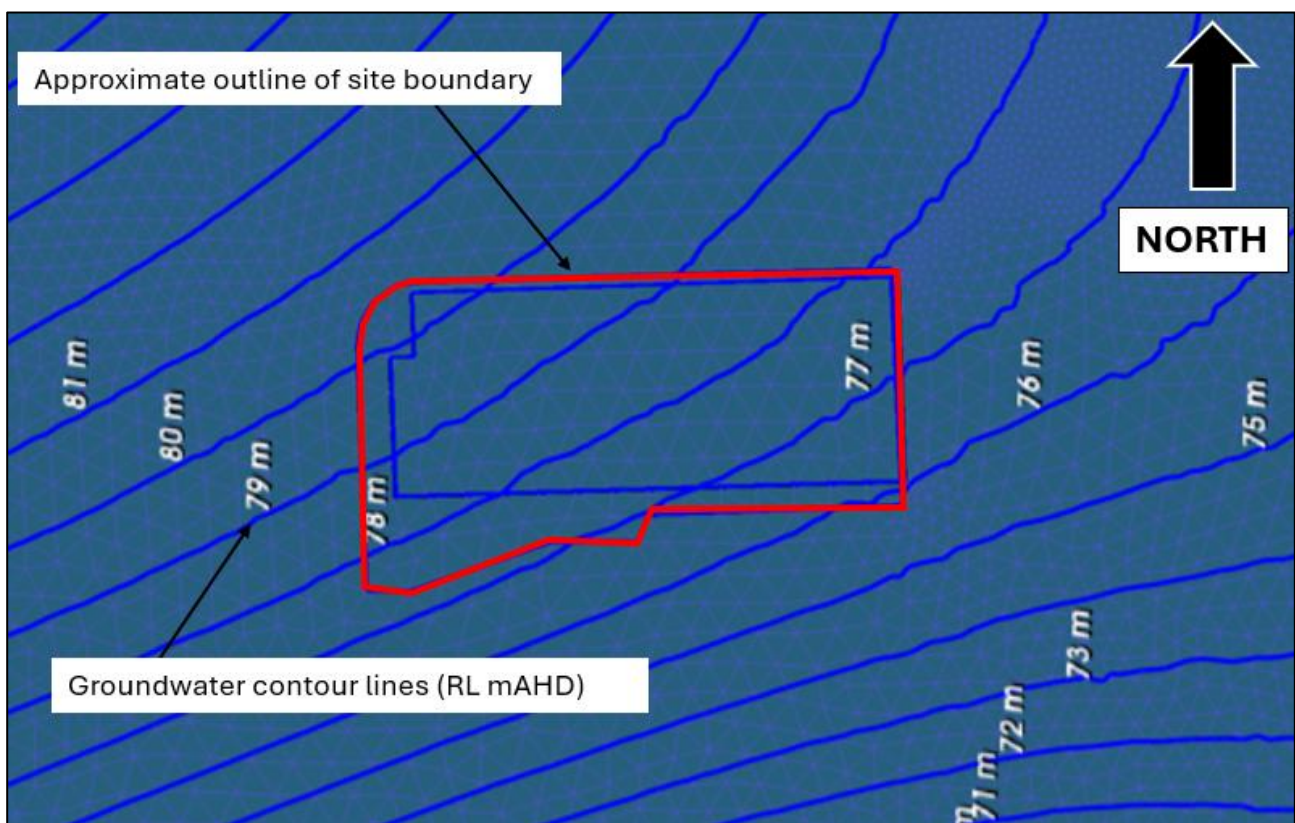


Figure 7: Initial groundwater contour lines

7.5 Basement dewatering

Dewatering for the proposed basement was simulated using the “Seepage Face” element in SEEP 3D across the footprint of the basement at BEL with no vertical flow barrier assigned to any of the excavation faces, as basement excavation will be carried out by unsupported vertical cuts in bedrock.

7.6 Sensitivity scenarios

A sensitivity analyses case was carried out adopting an increased horizontal (K_h) hydraulic conductivity of 3.6×10^{-7} m/s (3 times the base case value) to assess groundwater inflows under higher hydraulic conductivity conditions.

The model was then recalibrated with an infiltration flux rate of 1.17×10^{-8} m³/s/m², which is 30% of an average annual rainfall of 1.2 m in Sydney, was adopted to simulate infiltration and seepage from rainfall to the model surface, to simulate existing groundwater levels recorded during the monitoring period.

7.7 Groundwater modelling results

7.7.1 Predicted groundwater inflow

The results from the inflow analysis are summarised in the below Table 6 which present the estimated annual inflow rates of groundwater into the excavation during long-term dewatering.

Table 6: Summary of groundwater inflow analysis results

Case	Inflow rate		
	(m ³ / day)	(L / min)	Annual Inflow (ML/year)
Base Case	7.3	5.0	2.6
Sensitivity Case	26.4	18.3	9.6

It should be noted that these volumes predicted are 'estimates' of the average inflows spatially. It is possible that localised zones of higher permeability may be present within the site, through which the rate of inflow could be significantly higher locally, and considering the subsurface heterogeneity and fractured aquifer system, a safety margin for application in the field should be considered. It should also be noted that higher pumping rates, say 2 – 3 times higher than the long-term inflow rates, may be required initially until steady-state conditions are achieved.

Also, simulated dewatering rates and drawdown are dependent on the basement scheme adopted for the site as included in the numerical model. If the depth of basement level and dewatering systems were to change then the currently predicted dewatering rates may change, in which case further modelling would be required.

7.7.2 Predicted groundwater drawdown and settlement

Groundwater levels immediately outside the basement excavation are expected to be drawdown to BEL and by up to approximately 1 m at a distance of 230 m (upstream) from the excavation as shown in Figure 8 below. As the basement is drained, there will be no mounding occurring. There are negligible impacts expected to surrounding properties and infrastructure from drawdown as the groundwater is contained within and flowing through the fractured bedrock profile with high deformation moduli.

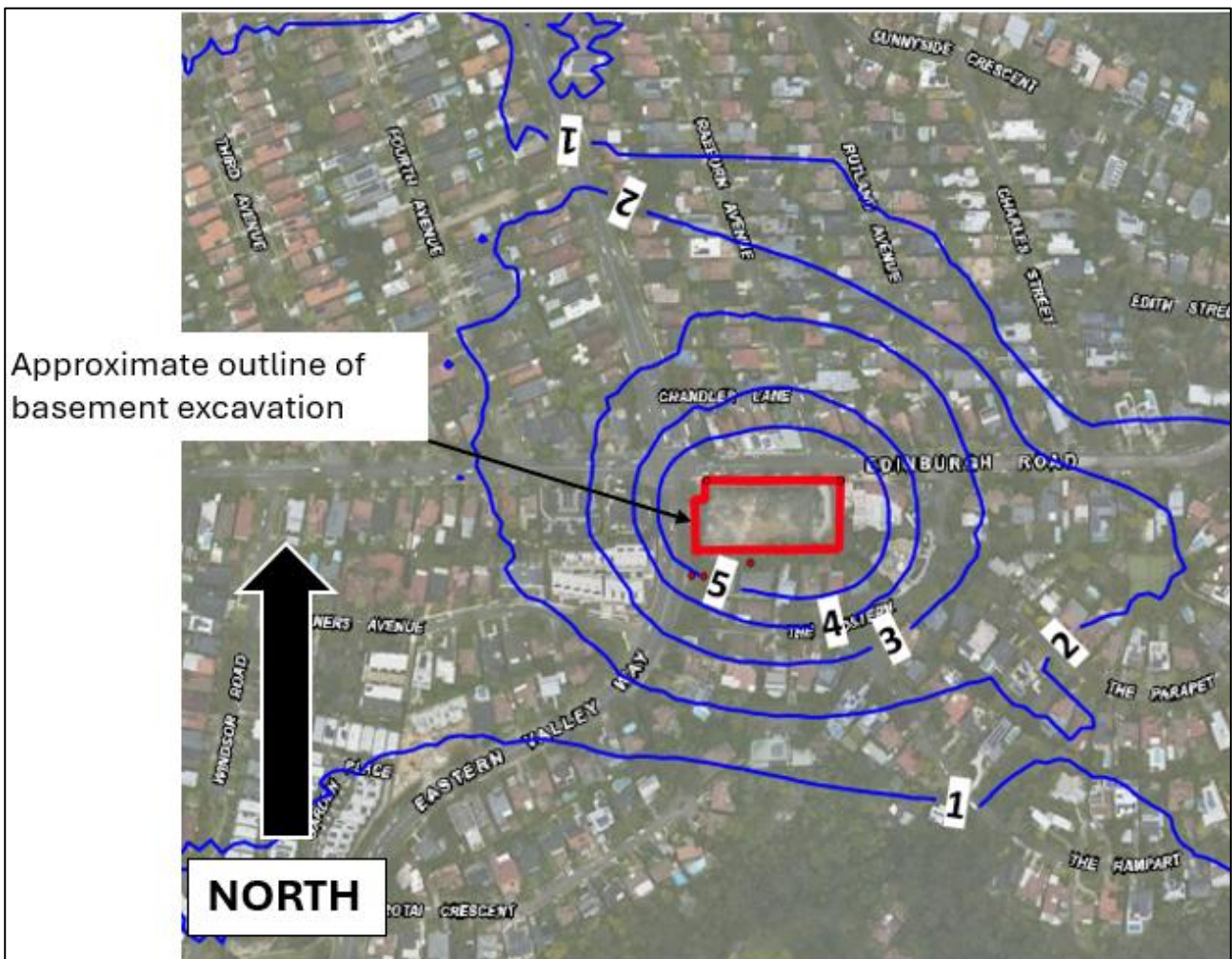


Figure 8: Predicted groundwater drawdown contour lines during long-term dewatering (m)

8. Impact assessment

8.1 Aquifer Interference Policy consideration

The NSW Aquifer Interference Policy (AIP) indicates that the term “aquifer” is commonly understood to mean a groundwater system that is sufficiently permeable to allow water to move within it, and which can yield productive volumes of groundwater. A groundwater system is defined as any type of saturated geological formation that can yield low or high volumes of water. However, for the purpose of the AIP, the term aquifer has the same meaning as groundwater system and includes low yielding and saline systems.

Table 1 in Section 3.2.1 of the AIP outlines minimal impact considerations. The AIP indicates that “if predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable”. The following minimal impact considerations are outlined for less productive porous and fractured rock groundwater sources:

- Less than or equal to 10% cumulative variation in water table 40 m from any high priority GDE or high priority culturally significant site;

- A cumulative pressure head decline of no more than a 2 m at any water supply work.

8.1 Environmental risk assessment

An assessment of the potential effects of dewatering on neighbouring properties, public infrastructure and groundwater receptors has been summarised in Table 7.

Table 7: Assessment of Potential Effects of Dewatering

Item	Comment
Impacts on potential GDEs	There are no GDEs within 500 m of the site (Section 4.5).
Water supply losses by neighbouring groundwater users	No water bores were located within 500 m of the site (Section 4.5).
Potential subsidence of neighbouring structures	Groundwater drawdown is predicted to mostly occur within the bedrock with high deformation moduli. Therefore, risk of subsidence due to lowering of the water table is expected to be negligible.
Mounding of water upgradient of structure	As the basement is proposed to be drained, mounding of groundwater is not expected upgradient of the site.
Acid Sulphate Soil	<u>On-site</u> Acid Sulphate Soils (ASS) is not considered to be present on the site. As such no further on-site assessment or management is considered warranted. <u>Off-site</u> For Class 5 land, development consent is required for 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 RL 1 mAHD on adjacent Class 1, 2, 3 or 4 land. The predicted groundwater drawdown (Section 7.7.2) indicates that the drawdown will be in bedrock and that the 1 m drawdown level will not extend to lands below RL 5 mAHD. As such, no management is considered warranted for off-site ASS.
Salinity	Salinity is not a concern and thus further assessment, or management is not required.

9. Approvals and licensing

This section outlines the approvals, licences and other authorisations required for the proposed dewatering activities, consistent with the *Water Management Act 2000*, WaterNSW requirements, and any relevant local council or EPA obligations.

9.1 Water Access Licence (WAL) and entitlements

Dewatering of groundwater for construction purposes constitutes an aquifer interference activity under the *Water Management Act 2000* and may require a Water Access Licence (WAL) and appropriate water entitlement units (share and extraction components), depending on the water source and proposed take.

In accordance with the Water Management (General) Regulation Act 2018, extraction of water from the greater metropolitan region groundwater source for the purpose of construction dewatering are currently exempt from requiring a Water Access License (WAL) under the coastal construction of infrastructure exemption clause.

For long-term, continuous dewatering of the basement, the predicted groundwater inflows into the proposed basement in the base case are less than 3 ML per year, therefore the development is highly likely not to require a WAL as it meets exemption under Clause 21(2) of the Water Management (General) Regulation 2018. Should the monitoring of the actual inflow volume during the construction suggest it is likely to exceed 3 ML, a Water Access Licence would be required with appropriate groundwater share allocation from NRAR (1 water share per 1 ML).

Actual inflow volumes will only be known at the time of excavation and allowances for variation in the inflow rate should be made. In this regard, inflow volume records during construction when actual inflows are known should be maintained and reported to DCCEE within 28 days of the water year finishing (i.e. Before 28 July).

9.2 Water Supply Works Approval (WSWA)

As the project is for an SSDA it is exempt from a water supply work approval (WSWA, under the *Water Management Act 2000*). The exemption is typically granted through the DCCEE for SSDA projects.

10. Conclusion

The proposed development is expected to have a lowest basement FFL of RL 68.9 mAHD which will require excavations of up to 17 m below existing surface levels with deeper localised excavations required for service trenches and lift cores. The basement of the proposed building is expected to be designed as drained during construction and in the long term.

The maximum recorded groundwater levels and the geometric mean horizontal permeability values have been adopted in a 3D groundwater modelling for the proposed development. The results of the base case analysis indicate that the predicted annual inflow into the drained basement is 2.6 ML for long-term dewatering. As the predicted inflow rate (base case) is less than 3 ML per year, a WAL is unlikely to be required, unless the monitoring of the actual inflow during construction suggests otherwise.

A sensitivity case was also considered for a more conservative scenario, where the horizontal permeability value was assumed as 3 times the base-case value. The results of the sensitivity case indicates that inflows into the basement for continuous long-term dewatering could exceed 3 ML per annum with an estimated inflow of approximately 9.6 ML per year. Despite this simulated increase of volume, the assessed impact remains within the 'Level 1 Minimal Impact Considerations' as defined by the AIP.

As any drawdown is predicted to be within the rock profile, the risk of subsidence in neighbouring structures and public infrastructure is expected to be negligible.

From a hydrogeological viewpoint, it is considered that a drained basement is feasible without significant impacts on surrounding groundwater systems or property, subject to review and approval from DCCEEW and other relevant authorities.

It should be noted that if there are changes to the current basement design or water levels are found to be higher than assumed, there may be an increase in groundwater inflows which should be considered for basement design.

This report does not constitute a dewatering management plan or include commentary on groundwater quality, treatment and disposal requirements.

11. References

El Australia. (EI 2023). Geotechnical investigation report.

Katarina David (2025). Dewatering Management Plan.

NSW DPE. (2021). *Minimum requirements for building site groundwater investigations and reporting*.

NSW DPI – Office of Water. (2012). *NSW Aquifer Interference Policy*.

NSW DPI – Water. (2013). *Aquifer Interference Policy: NSW Policy for Managing the Impacts of Groundwater Extraction*.

WaterNSW. Fact Sheet – *Construction dewatering – Information for councils and applicants*.

WaterNSW. Fact Sheet – *Construction dewatering – General terms of approval*.

12. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 100 Edinburgh Road, Castlecrag NSW in line with Douglas' proposal dated 8 August 2025 and acceptance received from Charline Song of Conquest. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Edinburgh Development Group Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after previous field testing has been completed.

Douglas' advice is based upon the conditions encountered during previous investigations by others. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical / groundwater components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

This report provides specialist advice only and no part of it is considered a Regulated Design under the Design and Building Practitioner Act 2020 (NSW).

Appendix A

About this Report

Introduction

These notes have been provided to amplify Douglas' report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Douglas' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Engagement Terms for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather

changes. They may not be the same at the time of construction as are indicated in the report; and

- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, Douglas cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, Douglas requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

intentionally blank

Appendix B

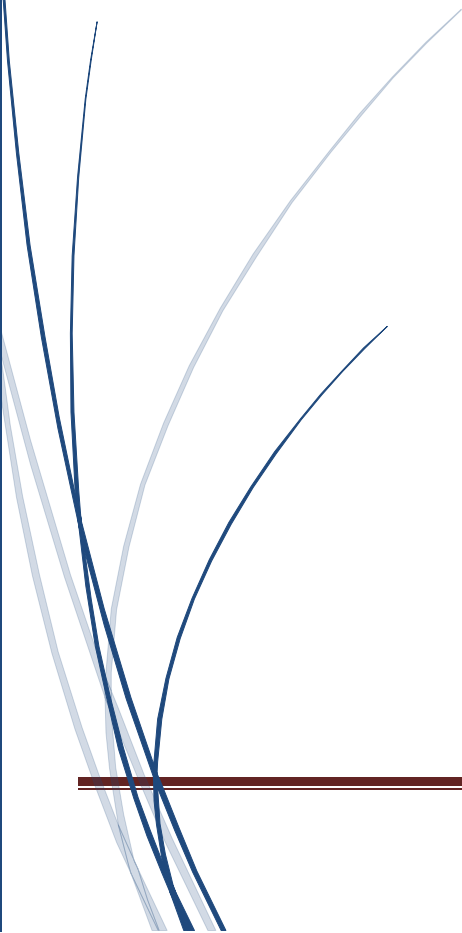
Dewatering Management Plan (KD2026/03)



September 2025

Dewatering Management Plan – 100 Edinburgh Rd., Castlecrag, NSW

Report prepared for Bulitcom Pty Ltd
KD2026/03



Katarina David
RPGeo (HYDROGEOLOGY) 10060

DOCUMENT REGISTER

Revision	Status	Date	Comments/Review
A	Draft	19/09/2025	
B	Final	25/09/2025	



TABLE OF CONTENTS

1 INTRODUCTION	5
1.1 Background	5
1.2 Scope of work	6
2 EXISTING ENVIRONMENT	6
2.1 Site description.....	6
2.2 Geology and hydrogeology	7
2.3 Requirements for proposed development	8
3.0 FIELD INVESTIGATION AND RESULTS	8
3.1 Groundwater monitoring.....	10
3.2 Groundwater fluctuation	10
3.3 Groundwater flow direction	12
3.4 Aquifer hydraulic testing	13
3.5 Groundwater quality	14
3.6 Groundwater conceptual model	16
4.0 MANAGEMENT OF INFLOW AND DISCHARGE.....	17
4.1 Predicted groundwater inflow during construction.....	17
4.2 Predicted groundwater inflow post construction.....	18
4.3 Drawdown extent and impact on groundwater users, ecosystems and structures during construction.....	21
4.4 Drawdown extent and impact post construction	23
4.5 Dewatering methodology	24
4.6 Ongoing long term groundwater inflow management	26
4.4 Groundwater disposal during construction	26
4.8 Groundwater disposal post construction	27
4.9 Assumptions.....	27
5.0 AQUIFER INTERFERENCE POLICY	28
5.1 AIP Assessment framework.....	28
5.2 Minimal impact consideration	29
6.0 DEWATERING MONITORING PLAN.....	30
6.1 Groundwater monitoring.....	31
6.2 Groundwater monitoring and water take measurement post construction	32
6.3 Settlement monitoring during construction.....	32
6.4 Management of noise, vibration and odour during dewatering	32

6.5 Management during construction dewatering , triggers and emergency plan.....	33
6.6 Responsibility during construction	33
7.0 SUMMARY AND CONCLUSIONS	33
7.0 REFERENCES	35
LIMITATIONS.....	36

TABLE OF FIGURES

Figure 1 Site location map (Source SDT Explorer, 2025).....	7
Figure 2 Geology map and Site location.....	8
Figure 3 Monitoring bore location map	10
Figure 4 Hydrographs (depth to water) for shallower Site monitoring bores for a period from 27 th May 2025 to 24 th August 2025 plotted with rainfall	11
Figure 5 Hydrographs (mAHD) for shallower Site monitoring bores for a period from 27 th May 2025 to 24 th August 2025 plotted with rainfall	12
Figure 6 Interpreted groundwater flow direction - dashed lines represent interpreted piezometric level (mAHD) for August 2025 and arrows represent groundwater flow direction	13
Figure 7 Schematic north-south hydrogeology cross section with outline of the proposed basement and piezometric level shown (blue line) prior to excavation (not to scale)	17
Figure 8 Conceptual model for drained basement (not to scale).....	19
Figure 9 Schematic Dupuit-Forchheimer approximation	21
Figure 10 Predicted change in drawdown with distance from the centre of excavation (using Theis, 1935).....	22
Figure 11 GDE proximity to the Site (marked in blue)	22
Figure 12 Registered groundwater bores in proximity to the Site	23
Figure 13 Predicted change in long term drawdown with distance from the centre of excavation (using Theis, 1935)	24
Figure 14 Location of collection sump , sediment pond location of closest stormwater pit.....	25
Figure 15 Sediment dam details.....	25
Figure 16 Proposed long term location of the pit on site and Council stormwater pit.....	26

LIST OF TABLES

Table 1 Summary of monitoring bore installation.....	9
Table 2 Groundwater level fluctuation (mAHD).....	12
Table 3 Summary of hydraulic conductivity results for monitoring bores	14
Table 4 Hydrogeochemical analytes	14
Table 5 Summary of physicochemical measured parameters	15
Table 6 Summary of water quality results and comparison with ANZG (2018) guidelines.....	15
Table 7 Criteria for discharge of water into the stormwater system	27
Table 7 AIP Assessment Framework Considerations.....	28
Table 8 Minimal Impact Considerations – Less Productive Fracture Rock Water Source.....	30
Table 8 List of responsible personnel	33

LIST OF APPENDICES

Appendix A Architectural plans and survey

Appendix B Monitoring bore logs

Appendix C Analytical lab results

Appendix D Hydraulic testing analysis

1 INTRODUCTION

1.1 Background

This report presents the dewatering management plan (DMP) for the proposed basement to be constructed at 100 Edinburgh Road, Castlecrag, NSW. The DMP was commissioned by Mr Roger Wang and Mr Andrew Bishay of Builtcom Pty Ltd presents the results of the hydrogeological investigation carried out for the proposed residential basement during and post construction.

This DMP was prepared to satisfy development approval for proposed development (DA-2024/13), Council's discharge water requirements and WaterNSW requirements for water supply works approval. The DMP is prepared in accordance with the Willoughby City Council application for discharge to stormwater system and the Minimum requirements for building site groundwater investigation and reporting (DPIE, 2021).

The report outlines the groundwater conditions beneath the Site, the need for dewatering (during the construction) of a basement below ground level, potential impact on the neighbouring properties and groundwater system and any water treatment related to groundwater disposal. This investigation follows a geotechnical investigation at this Site carried out by EI Australia Pty Ltd in 2023.

Based on the information and plans supplied by the client, it is understood that the proposed development comprises the construction of mixed-use building with development of three level basement below the current ground level. The plans provided indicate that the excavation is to extend to a depth of approximately RL76.09 m. Groundwater level is above the proposed basement; therefore, the proposed basement will require dewatering.

The purpose of this investigation is to prepare a DMP that will evaluate the inflows into the basement during construction, assess and provide an indication of options for groundwater disposal, treatment and monitoring should this be required. Therefore, this DMP will address both, groundwater conditions during construction and post construction.

1.2 Scope of work

The following scope of works is required based on the Minimum requirements for building site groundwater investigation and reporting (DPIE, 2021) in accordance with the DA-2024/13 requirements in preparation of the DMP:

- Provide reason for dewatering and show the footprint of the area;
- Understand the groundwater level and its fluctuation over a minimum of 3-month period using at least 3 site bores;
- Undertake hydraulic testing to determine aquifer properties and estimate groundwater inflow into the basement and the period of discharge during basement construction and during operation and seepage post construction;
- Discuss dewatering techniques and options for discharge and treatment of groundwater and stormwater discharge point
- Assess drawdown resulting from the proposed development and impact on the neighbouring properties and groundwater system during and after construction period
- Describe the monitoring program to manage any impacts during construction and after completion.

2 EXISTING ENVIRONMENT

2.1 Site description

The subject Site is located at 100 Edinburgh Street, Castlecrag, NSW as shown in **Figure 1**. Excavation which is discussed in this report is almost rectangular and elongated (**Appendix A**), and is located between Edinburgh Road to the north, Eastern Valley Way to the west and residences to the south and east (**Figure 1**). Sailors Creek runs west east about 200 m south of the development and discharges to the Ocean at approximately 500 m to the southeast.

The site covers an area of 5,100 m² (proposed basement area approximately 4,300 m² in size) and slopes to the south and southeast. The elevations across the Site range from 86.5 mAHD in the north to 80 mAHD in the south and southeast.



Figure 1 Site location map (Source [SDT Explorer](#), 2025)

2.2 Geology and hydrogeology

According to 1:100,000 Sydney Geological Series, Map Sheet 9130 (Herbert, 1983), by the New South Wales, Department of Mineral Resources, the site is located within an area underlain by a Hawkesbury Sandstone (Rh) formed in the Triassic period. The sandstone is medium to coarse-grained with minor shale and laminate lenses. When fresh it has massive and cross bedded units, and weathers with iron staining common in the upper zone.

Based on the site investigation drilling (EI Australia, 2023), the upper geological profile includes the fill and residual soils comprising gravelly sand and grading into weathered sandstone at a depth of around 2- 2.5 m. Hawkesbury sandstone (weathered) underlies the unconsolidated strata and ranges from extremely weathered to fresh at depths from 0.5 m to 5.8 m. Based on the drill logs sandstone is at less than 0.5 depth along the northern boundary and at around 2.5 m along the southern boundary.

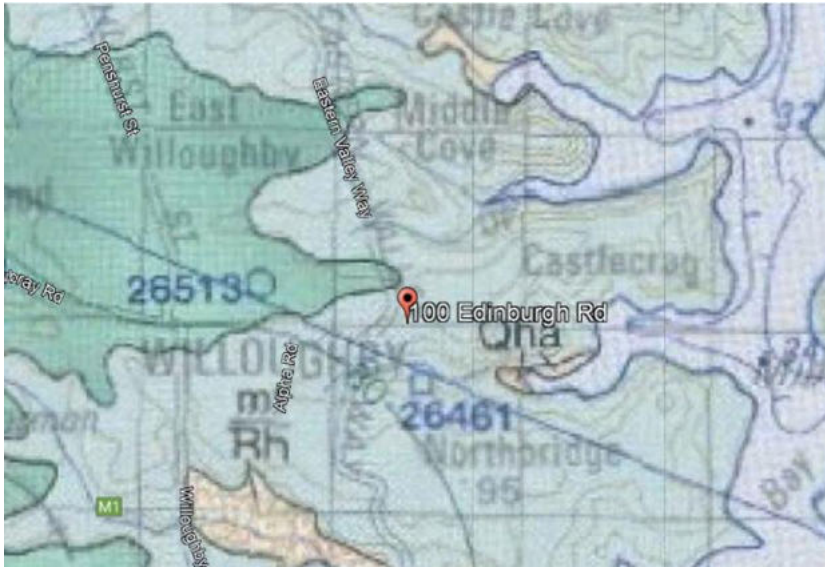


Figure 2 Geology map and Site location

2.3 Requirements for proposed development

The proposed development requires the basement to be excavated to RL 76.09 m (about 4 to 10 m below ground level) with 0.5 m allowance for the concrete slab. During geotechnical testing and drilling in 2023 (EI Asutrialia, 2023) groundwater was encountered at a depth ranging from 76.5 mAHD in the north to 75.5 mAHD in the south. The proposed excavation will therefore intercept groundwater and will need to be dewatered.

Proposed drained basement construction

The drained basement is proposed to be completed using natural sandstone walls with strip drains along the outside of the wall to allow drainage. The base of the basement is proposed to be a concrete structure. The strip drains will allow any water that reaches the basement walls to flow vertically down where it will be collected in the drain and discharged to the Council stormwater system.

3.0 FIELD INVESTIGATION AND RESULTS

Geotechnical investigation in 2023 (EI Australia, 2023) included installation of 3 monitoring bores in accordance with the standards (ADIA, 2020). Bores were installed in sandstone and water levels recorded during investigation works. One of the bores could not be used as it formed a line across the northern part of the area (BH4M), however it was useful for hydraulic testing.

Further field investigations were carried out in the period from May 2025 to August 2025 as part of this report. This included the following:

- Installation of an additional monitoring bore in accordance with the Minimum Construction Requirements for Water Bores Australia (ADIA, 2020);
- Installation of dataloggers to measure daily groundwater level fluctuation in three bores with three months of monitoring in bores BH101 and BH5M, one month in BH2M (bore was mainly dry);
- Hydraulic testing of three bores (3 tests per bore) to assess permeability; and
- Collection of two groundwater samples from BH101 and BH5M.

All monitoring bores are constructed in accordance with the standards and minimum requirements (ADIA, 2020). The location of monitoring bores is provided in **Figure 3**. The summary of monitoring bore construction is given in **Table 1** and logs are given in **Appendix B**.

Table 1 Summary of monitoring bore installation

<i>Bore ID</i>	<i>Total depth (m)</i>	<i>Surface elevation (mAHD)</i>	<i>Screened section (m below ground)</i>	<i>Screened lithology</i>
<i>BH101</i>	11	85.7	5-11	Sandstone
<i>BH2M</i>	10.2	82.1	7.1 to 10.1	Sandstone
<i>BH5M</i>	10	82.7	7-10	Sandstone

3.1 Groundwater monitoring

Groundwater monitoring included:

- monitoring of daily groundwater level fluctuation;
- manual readings on 3 occasions;
- hydraulic testing; and
- groundwater quality sampling.

Groundwater samples were collected from two site bores and hydraulic testing undertaken on all bores (3 tests per bore).

3.2 Groundwater fluctuation

The dataloggers have continuously monitored water level in piezometers for a period of three months in each bore (BH2M one month due to datalogger failure and dry bore) and has captured six rainfall events over 30 mm (May to August 2025). **Figure 4** shows the hydrographs for all

bores with measured water levels as depth to water and plotted along with the rainfall data (closest BOM station SN66214). The relationship between rainfall and groundwater can be observed. **Figure 5** shows hydrographs for all bores presented in mAHD to allow comparison with the proposed basement depth. Bore BH2M was mainly dry throughout the monitoring period. Where manual readings of piezometric level were obtained for this bore they were plotted on the hydrograph.

Figure 4 and **Figure 5** show that groundwater level in all bores fluctuated <0.1 m over the monitoring period (**Table 2**). This response is observed following an extremely wet period in May, below average rainfall in June and above average rainfall in July and August 2025. Hydrographs show that a stable (BH5M) or a slow declining trend is observed to the end of July (BH101) in spite of twice the average rainfall for the month. Bore BH2M was dry in mid-August. A slight rise is observed following 144 mm rain in late July/early August 2025.

Stable conditions, slow drainage in the absence of above average rainfall and limited response to rainfall are typical of deeper strata.

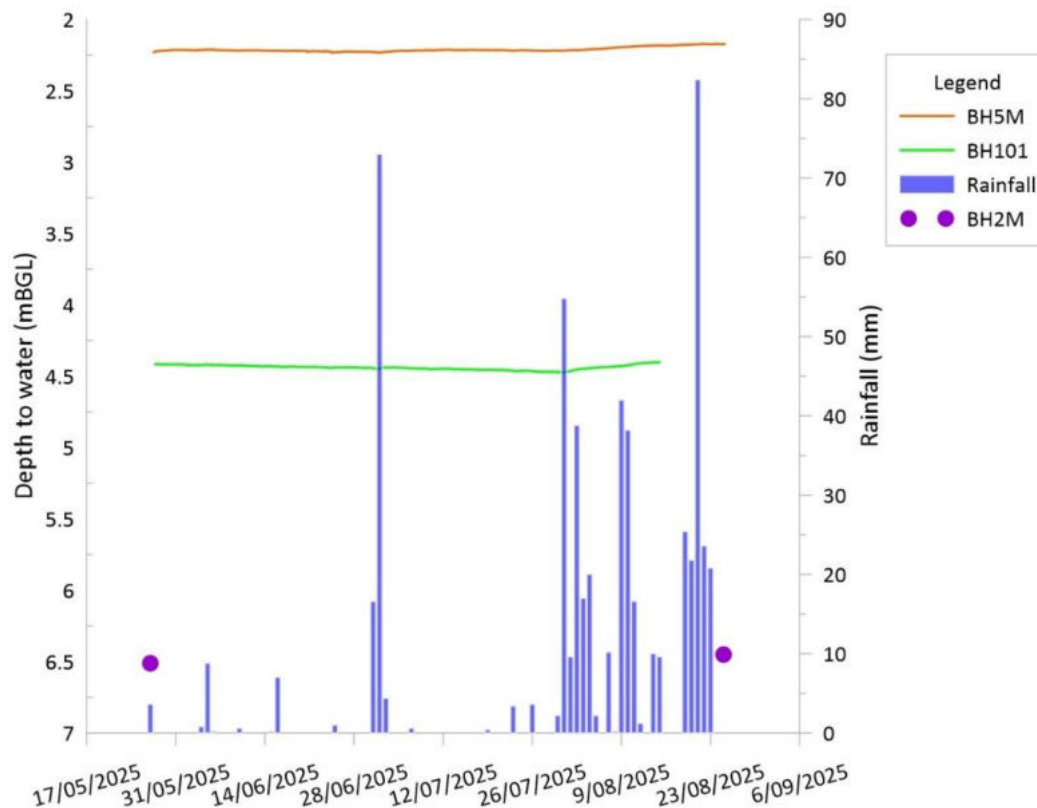


Figure 4 Hydrographs (depth to water) for shallower Site monitoring bores for a period from 27th May 2025 to 24th August 2025 plotted with rainfall

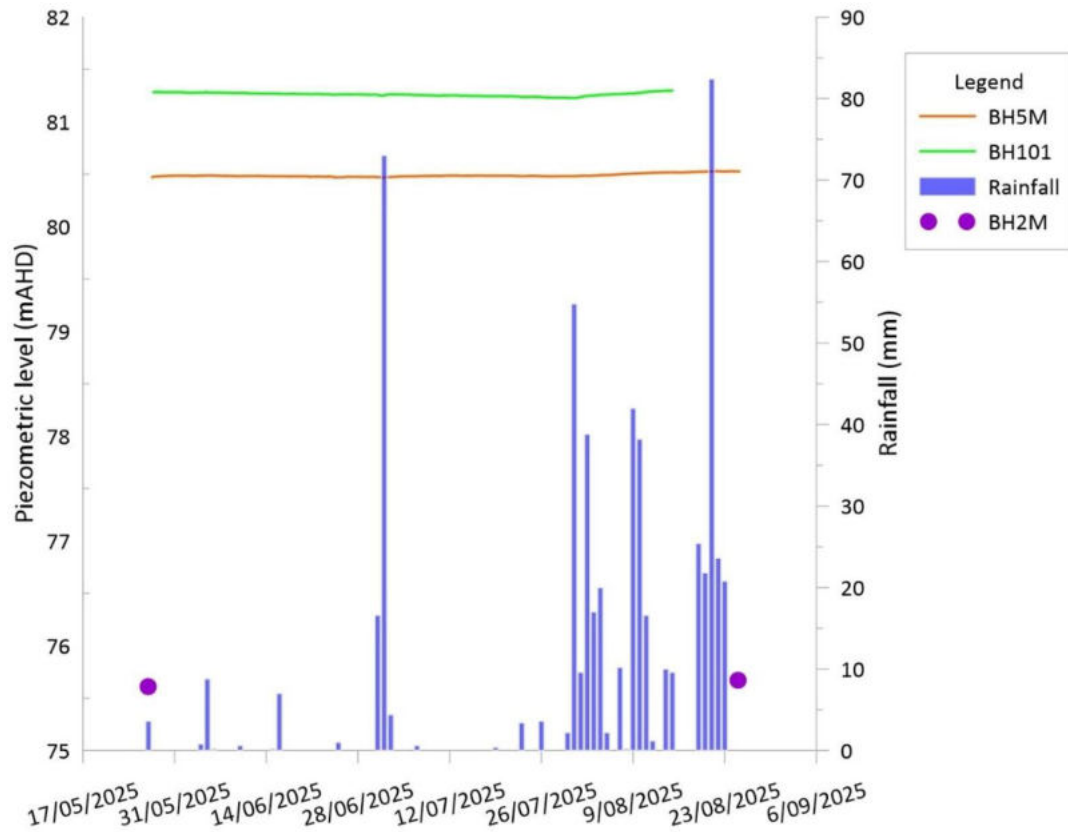


Figure 5 Hydrographs (mAHd) for shallower Site monitoring bores for a period from 27th May 2025 to 24th August 2025 plotted with rainfall

Based on the results and similar behaviour and response to rainfall in bores installed across sandstone, it is considered that one hydrostratigraphic unit exists across the site which includes the weathered sandstone.

Table 2 Groundwater level fluctuation (mAHd)

<i>Bore ID</i>	<i>Minimum level</i>	<i>Maximum level</i>	<i>Average water level</i>	<i>Standard deviation</i>
<i>BH101</i>	81.22	81.3	81.26	0.02
<i>BH2M</i>	75.61	75.67	NA	NA
<i>BH5M</i>	80.46	80.52	80.48	0.009

3.3 Groundwater flow direction

Based on the groundwater level readings in monitoring bores and hydrographs with response to rainfall, it is considered that sandstone represents one hydrostratigraphic unit although it is more weathered at surface. A potentiometric map was prepared considering all groundwater bores (**Figure 6**).

Piezometric data collected in August 2025 was plotted indicating that the interpreted groundwater flow direction is to the south and southeast (**Figure 6**) and follows the topography and the dip of sandstone.

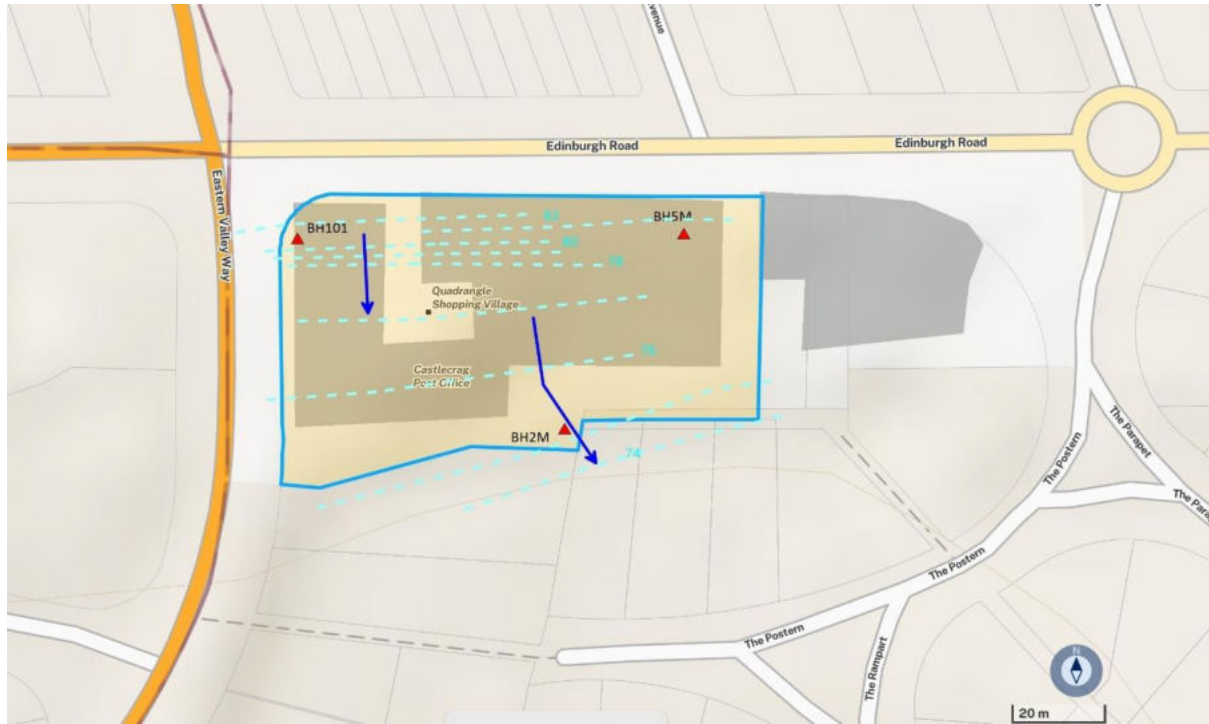


Figure 6 Interpreted groundwater flow direction - dashed lines represent interpreted piezometric level (mAHD) for August 2025 and arrows represent groundwater flow direction

3.4 Aquifer hydraulic testing

In-situ hydraulic conductivity data were obtained from hydraulic testing in May and August 2025. Rising head tests were undertaken where water was removed from the well and the recovery monitored. Three tests were undertaken on each bore to ensure higher certainty in the results and are in accordance with the Minimum requirements for building site groundwater investigation and reporting (DPIE, 2021).

In addition, two set of tests were undertaken by EI Australia (2023) and analysed using Hvorslev (Hvorslev, 1951) solution. All other hydraulic tests (18 tests) were analysed using Bower and Rice (1989) method. The hydraulic conductivity results are presented in **Table 3 and Appendix D**. The results obtained from hydraulic testing are within the hydraulic conductivity range for weathered sandstone (Domenico and Schwartz, 1990). EI Australia (2023) testing indicated results for hydraulic conductivity for BH2M are 2.4×10^{-7} m/s and BH4M are 5.3×10^{-8} m/s. This is within the range of values obtained by testing in 2025. Hydraulic conductivity across the site appears to be relatively uniform ranging from 3.2×10^{-2} to 1.9×10^{-3} m/d.

Table 3 Summary of hydraulic conductivity results for monitoring bores

<i>Tested bore</i>	<i>Hydraulic conductivity test results (m/day)</i>
<i>BH101</i>	1.5×10^{-2} to 3.4×10^{-3}
<i>BH5M</i>	1.8×10^{-2} to 2×10^{-2}
<i>BH4M</i>	1.3×10^{-2} to 5.3×10^{-3}

3.5 Groundwater quality

EI Australia (2024) collected 3 samples from each of the monitoring bores (BH2M, BH4M and BH5M) and two groundwater quality samples were collected in May 2025 from bores BH101 and BH5M. EI Australia collected samples using micro-purge system. Samples collected in May 2025 were collected using the Hydrasleeve (low disturbance sampling technique). Samples were field filtered using 45-micron filter for heavy metals. Samples were collected in appropriate sample containers, with sample preservation where required. The samples were transported under chain-of-custody protocols in an ice-filled storage container and were analysed at NATA-certified ALS laboratory, Sydney. Samples analysis details for EI Australia sampling are presented in EI Australia 2024.

Samples in May 2025 were analysed for the species listed in **Table 4**. All analyses were conducted within the required holding times for analytes. Chain-of-custody records and laboratory analytical reports are provided in **Appendix C**.

Table 4 Hydrogeochemical analytes

<i>Sample Type</i>	<i>Analytes</i>
<i>Physical parameters</i>	pH, EC, temp, turbidity, TSS
<i>Metals</i>	Al, As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Fe and Hg
<i>Major ions</i>	Ca, Mg, Na, K, Cl, SO ₄ , Alkalinity, Fluoride
<i>Nutrients</i>	TP, TN, nitrate, nitrite, ammonia
<i>Hydrocarbons</i>	TRH, PAH, BTEX

The ANZG (2018) guidelines for protection of aquatic ecosystems (marine water) have been adopted as the main Site assessment criteria and the groundwater sample were compared

against those, given that the any potential discharge to the stormwater system and interaction with the seawater is ultimate discharge point. The 95 % level of protection of marine ecosystems is considered the most appropriate for this ecosystem.

The measured physicochemical parameters (all samples) (**Table 5**) indicate that groundwater is fresh to slightly brackish and neutral to slightly acidic.

Table 5 Summary of physicochemical measured parameters

<i>Analytical Group</i>	<i>Analytes</i>	<i>ANZG 2018 Guidelines</i>	<i>BH2M</i>	<i>BH101</i>	<i>BH4M</i>	<i>BH5M</i>
<i>Physical parameters</i>	EC (µS/cm)	125-2200	286	298	200	211
	pH (units)	6.5-8*	4.5	5.48	5.1	5.3-5.7
	Redox (mV)	NA	549	100	367.6	107-265
	Dissolved oxygen mg/L)	0.85-1	0.53	0.3	0.15	0.03-0.04

Notes: * Lowland River pH values

The summary of analytical results and comparison with ANZG (2018) for 95 % protection of marine species (exceedances are marked bold) are given in **Table 6** and analytical laboratory results are presented in **Appendix C**.

Table 6 Summary of water quality results and comparison with ANZG (2018) guidelines

<i>Analytical Group</i>	<i>Analytes(mg/L)</i>	<i>ANZG 2018 Guidelines (mg/L)</i>	<i>BH2M</i>	<i>BH101</i>	<i>BH4M</i>	<i>BH5M</i>
<i>Metals</i>	Arsenic	ID	<0.001	<0.001	<0.001	<0.001
	Cadmium	0.0055	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium	0.001	<0.001	<0.001	<0.001	<0.001
	Copper	0.0013	0.008	0.011	0.005	0.01
	Lead	0.0044	<0.001	<0.001	0.002	<0.001
	Nickel	0.07	0.012	0.015	0.011	0.010
	Zinc	0.015	0.058	0.076	0.047	0.051
<i>Turbidity *</i>		50		78		26
<i>Hydrocarbons</i>	Ethylbenzene	0.08	<0.002	<0.002	<0.002	<0.002
	Toluene	0.18	<0.002	<0.002	<0.002	<0.002
	m-xylene	0.075	<0.002	<0.002	<0.002	<0.002
	o-xylene	0.075	<0.002	<0.002	<0.002	<0.002
<i>Polycyclic aromatic hydrocarbons</i>	Benzo(a)pyrene	0.0002	<0.0005	<0.0005	<0.0005	<0.0005
	Fluoranthene	0.0014	<0.001	<0.001	<0.001	<0.001
	Naphtalene	0.07	<0.001	<0.001	<0.001	<0.001
	Phenanthrene	0.002	<0.001	<0.001	<0.001	<0.001
<i>Inorganics</i>	Ammonia	0.91		0.15		0.01

<i>Analytical Group</i>	<i>Analytes(mg/L)</i>	<i>ANZG 2018 Guidelines (mg/L)</i>	<i>BH2M</i>	<i>BH101</i>	<i>BH4M</i>	<i>BH5M</i>
<i>Oil and grease</i>	Total phosphorous	0.05		0.05		0.02
	Total nitrogen	0.5		0.2		0.1
	Oil and grease			Not observed		Not observed

*units are NTU

These results indicate that:

- The measured concentrations of heavy metals were very low generally below the ANZG (2018) criteria except for copper and zinc;
- pH is slightly acidic and groundwater is fresh, and slightly oxidising;
- Turbidity was above the guidelines in upgradient BH101;
- Nutrients –ammonia, total phosphorous and nitrogen were below the guidelines in both samples collected in May2025; and
- Hydrocarbons, TRH and BTEX and inorganic compounds are all below detection limit.

3.6 Groundwater conceptual model

Figure 7 shows the schematic hydrogeology cross-section (north to south) through the Site with basement elevation and water table shown. The average thickness of saturated zone (above the proposed basement) across the Site is around 3 m , ranging from 6 m in the north to close to zero in the south.

The recharge to the groundwater system occurs by rainfall as can be observed in hydrographs, with slow groundwater response following significant rainfall events. It is not expected that groundwater fluctuations will exceed the maximum measured on Site as May and July 2025 had above average rainfall. Groundwater discharge occurs via lateral flow to the south, however this lateral flow is a minor contributor to the flow as the site is located on the top of the ridge.

The groundwater gradient across the Site is gentle at 1 m drop over approximately 10 m distance. Based on the geology conditions across the Site and measured groundwater levels, one hydrostratigraphic unit exists beneath the Site.

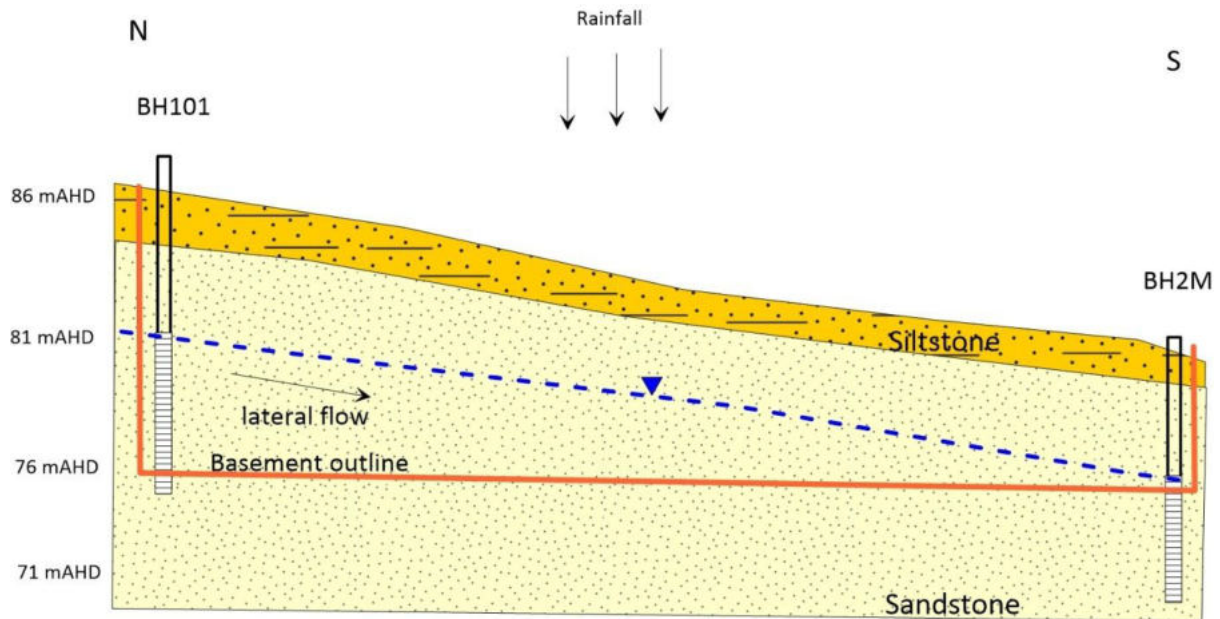


Figure 7 Schematic north-south hydrogeology cross section with outline of the proposed basement and piezometric level shown (blue line) prior to excavation (not to scale)

4.0 MANAGEMENT OF INFLOW AND DISCHARGE

4.1 Predicted groundwater inflow during construction

The plans and information provided by the client indicate the lowest level in the constructed basement will be at 76.09 mAHd with an area of around 4300 m². With allowance for the slab the lowest excavated level is anticipated at 75.5 mAHd.

Based on current conditions, the groundwater level will therefore be on average approximately 2.5 m (at high water mark) above the proposed excavation level. To maintain the site trafficability in the excavated basement, the water table will have to be lowered not taking into consideration the groundwater fluctuations resulting from prolonged rainfall events.

Analytical groundwater assessment was undertaken to estimate the inflow into the excavation. Projected dewatering rates were calculated conservatively assuming maximum 3 m saturation from the base of the excavation (allowing additional 0.5 m for high rainfall), hydraulic conductivity of 0.01 m/day (based on field obtained results). Dupuit –Thiem equation (Fetter, 1994) for unconfined aquifer was used to calculate the groundwater inflow into the excavation as follows:

$$Q = \frac{\pi K (H^2 - h_w^2)}{\ln \frac{R_o}{r_w}}$$

Where R_o is equivalent radius of influence calculated using Kruseman and De Ridder (1994) approximation

$$R_o = \sqrt{2.25k h_o \frac{t}{S_y}}$$

Where k is hydraulic conductivity, h_o is standing water table, t is time and S_y is specific yield.

It was assumed that the excavation would take 120 days to complete. Projected short term groundwater inflow is thus calculated at 24 m³/day (0.27 L/s) for the proposed basement area. Pumping at this rate should be sufficient to maintain the water level below the excavation during construction. The value provides the estimated inflow for static conditions and does not include prolonged high rainfall periods. However, high water levels have already been considered following the review of water levels and it is not expected that temporary excavation will occur over the extremely wet period. Total predicted inflow during construction is not predicted to exceed 2.9 ML during construction.

4.2 Predicted groundwater inflow post construction

Groundwater modelling was undertaken to understand the long-term impact from drained basement and satisfy the WaterNSW requirements under the Water Management Act 2000.

The following models are prepared:

- Conceptual long term groundwater model (**Figure 8**); and
- Analytical long term (steady state) groundwater model (this section).

The data and information used to prepare the groundwater model are provided in the main report and include the following:

- Three months of water level monitoring in three bores across the site
- Hydraulic testing of site bores to understand the hydraulic conductivity
- Geochemical data analysis

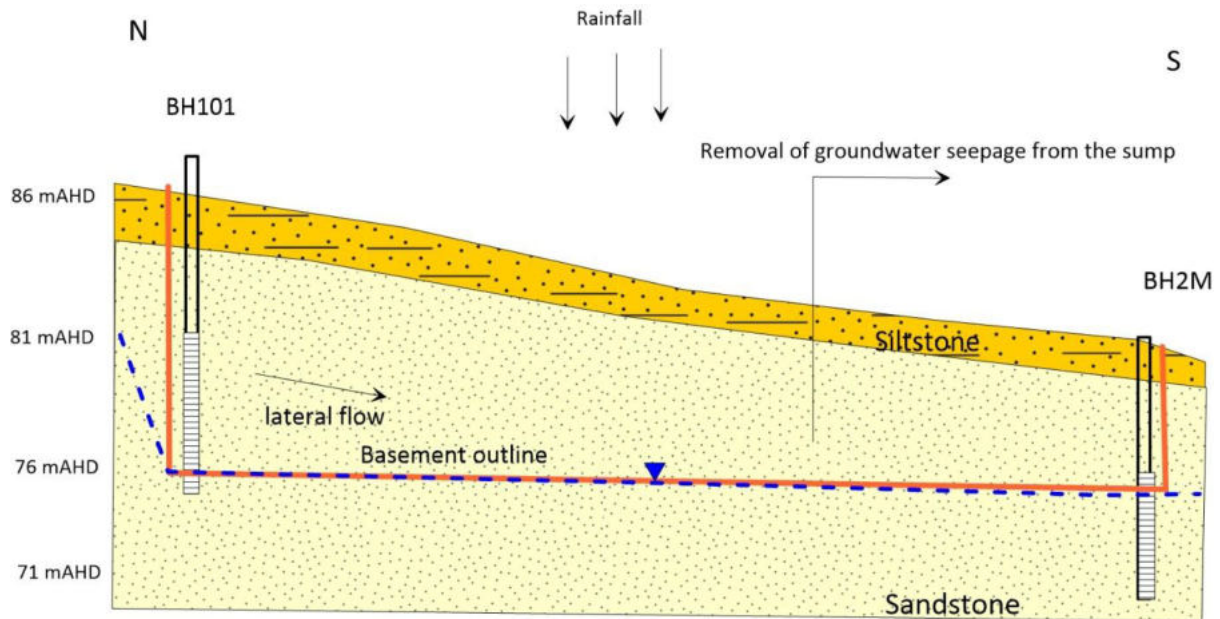


Figure 8 Conceptual model for drained basement (not to scale)

Conceptual model shows the recharge and discharge to the system, with groundwater being directed towards the south. The water would collect in the sump located at the lowest point in the basement, and removal of groundwater is proposed to occur by pumping from this point. This is the major difference from the current conceptual model.

Potential inflow into the basement following the construction has been assessed by analytical model. The model is based on the site collected data as described above and in the Section 3. Groundwater seepage/take will collect at the bottom of the basement and will be pumped to OSD tank containing water treatment quality filters.

The analytical solution used is Dupuit solution as presented in Mansur and Kaufman (1962) and Bear (1979), similar to the adapted Marinelli and Niccoli (2000) solution without recharge. The solution for head profile is derived with Dupuit-Forchheimer approximation. The assumptions made using analytical modelling are:

- Infinite horizontal extent of the aquifer
- Homogenous and isotropic hydraulic conductivity distribution
- Simple boundary conditions
- Steady state groundwater flow
- Pre-construction condition assume approximately horizontal water table
- Unconfined condition

Inflow to the bottom of the basement is not considered (there is no upward pressure from sandstone as recorded) because the analytical solution is used only to calculate hydraulic head at the water table, which is independent of groundwater flow through the basement base in the solution. In this solution the basement is assumed to be a large diameter well with circumference similar to the average perimeter of the basement.

The equation (Kruseman and De Ridder, 1990) used is shown below and **Figure 9** shows the schematic conceptual model.

$$Q = \pi K \frac{(H_2^2 - H_1^2)}{\ln(r_2/r_1)}$$

Where

Q- inflow from large diameter area

k- hydraulic conductivity

h₀ height of water table above base of the aquifer , 4 m assumed maximum based on the observed fluctuation

h_w water depressed at the base of the basement

r_w radius of the well equivalent to the radius of the basement

r_o radius of maximum extent of cone of drawdown ($\text{SQRT}(2.25 \times k \times H_0 \times t/Sy)$)

t time since pumping started

S_y specific yield

The resulting inflows are predicted at 3.5 m³/day (total of 1.3 ML/year). This is based on the assumptions that on average 3 m of head is permanently above the basement elevation along all boundaries, which is within the observed level based on 3 months of monitoring. This is a very conservative approach as there is almost no saturation at the southern side. The higher end of range is very conservative and allows for wetter weather. However, it is considered that a maximum of <0.1 m fluctuation will occur across the site based on the observed data.

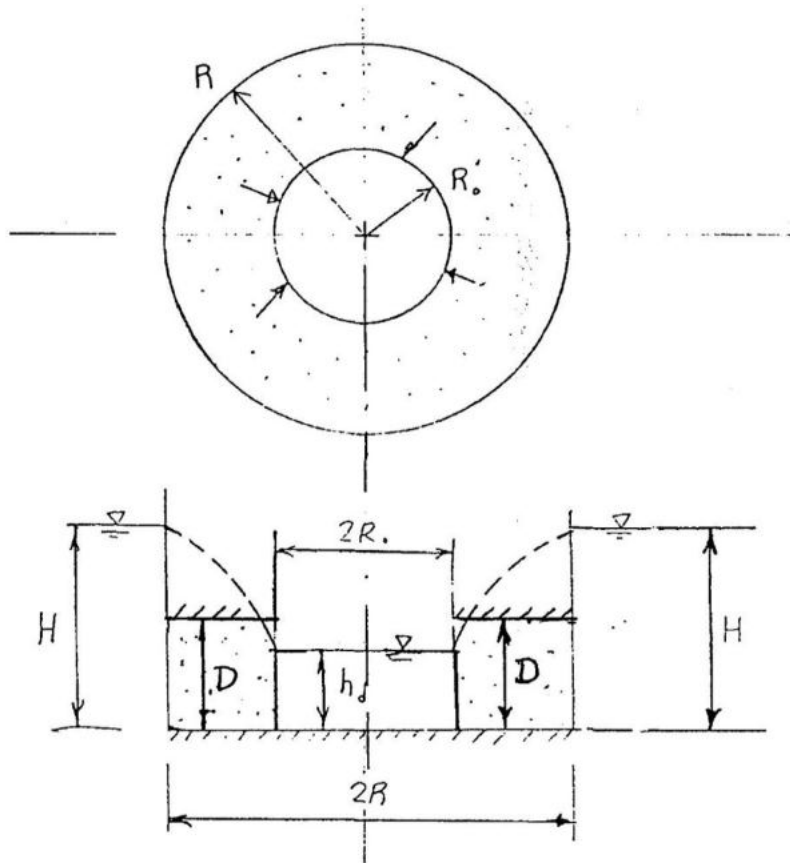


Figure 9 Schematic Dupuit-Forchheimer approximation

4.3 Drawdown extent and impact on groundwater users, ecosystems and structures during construction

Using Theis analytical solution (Theis, 1935) drawdown was calculated for known discharge. Given predicted inflow of $24 \text{ m}^3/\text{day}$ in the basement, permeability of 0.01 m/day , and aquifer storage of 0.02 for sandstone (Heath, 1983), it is predicted that after 120 days of continuous pumping, the drawdown at 45 m distance (at the property boundary) is predicted to be a maximum of 1.9 m below current water levels (in the north mainly), at 70 m it is predicted at 0.22 m and at 80 m approaches zero (**Figure 10**). This calculation assumes that groundwater is not allowed to recover at any point in time for 120 days. The estimate assumes that any surface water will be diverted off Site and will not directly contribute to groundwater.

Most conservative option is provided here where it is assumed that basement will be dewatered in an instant i.e. material is removed at the start of the excavation. However, in reality the excavation is assumed to occur within 120 days where reduced inflow rate will occur into the basement.

The closest residential property is located approximately 60 m distance from the centre of the basement, however only the property in the north are discussed given the gradient to the south. At that distance the maximum predicted drawdown will be around 0.5 m after 120 days of

pumping, which is outside of the natural groundwater level fluctuation in sandstone (as observed during 3 months of monitoring).

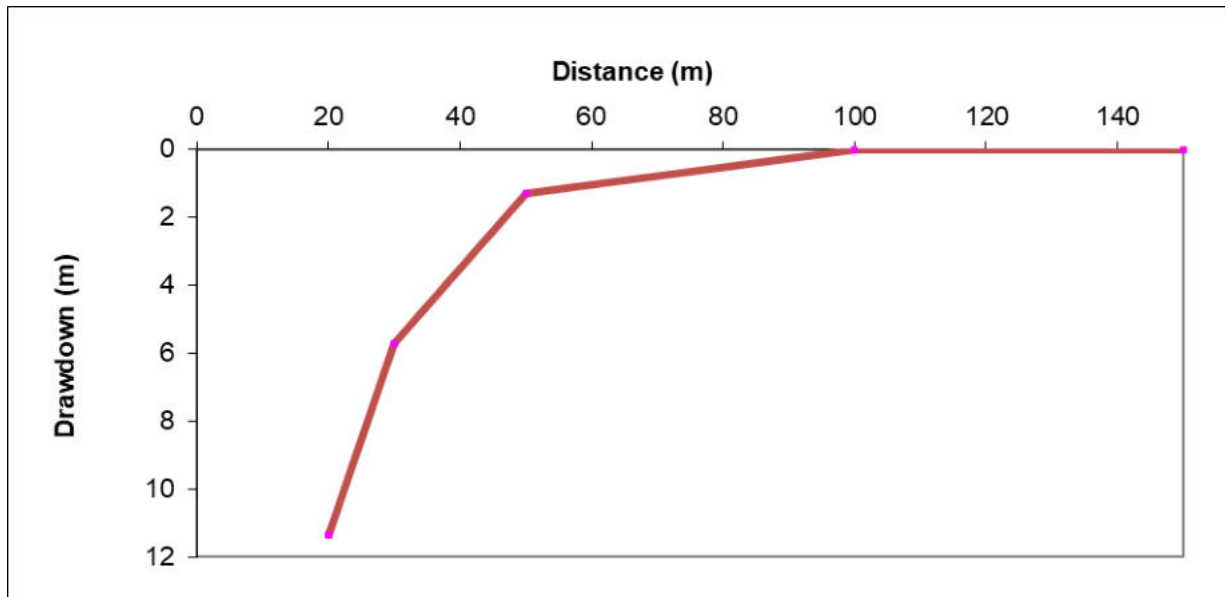


Figure 10 Predicted change in drawdown with distance from the centre of excavation (using Theis, 1935)

A map of High Ecological Values Aquatic Ecosystems (HEVAE) is shown in **Figure 11**. A medium probability HEVAE is located approximately 1 km to the northeast of the proposed development. At this distance the drawdown is predicted to be negligible. Based on the predicted drawdown, no impact is predicted from proposed basement construction.

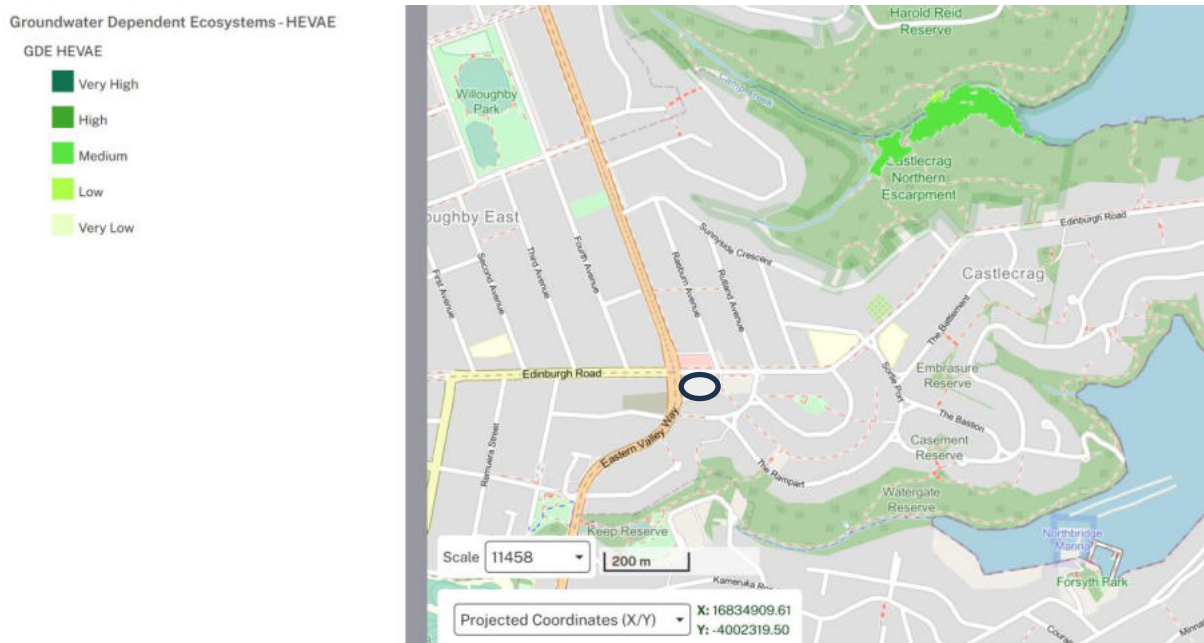


Figure 11 GDE proximity to the Site (marked in blue)

Review of WaterNSW database (**Figure 12**) indicates that there is one registered groundwater bore located >700 m to the northwest of the Site. Based on the predicted drawdown becoming negligible at 100 m distance from the Site, this bore will not be impacted by site activities.

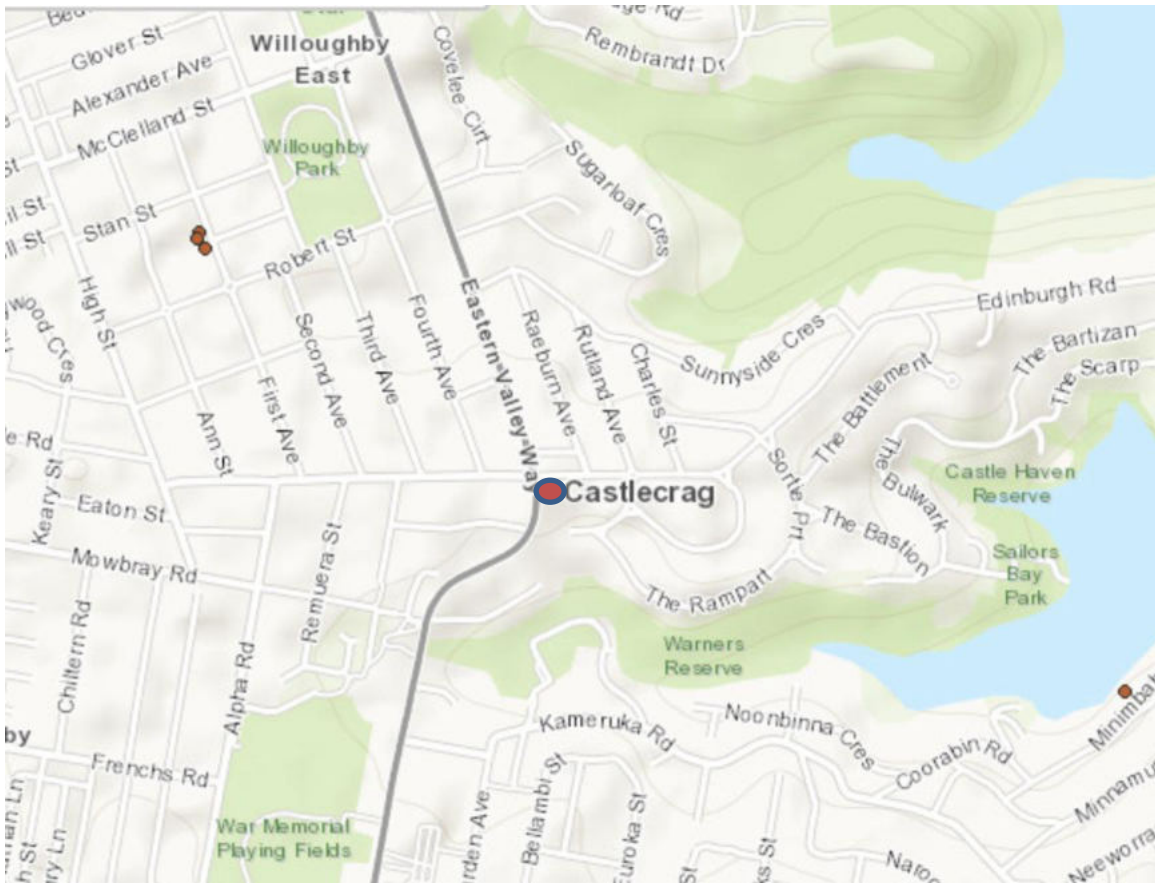


Figure 12 Registered groundwater bores in proximity to the Site

4.4 Drawdown extent and impact post construction

Using Theis analytical solution (Theis, 1935) drawdown was calculated for known discharge. Given long term average discharge of $3.5 \text{ m}^3/\text{day}$, permeability of 0.01 m/day , and aquifer storage of 0.05 for (weathered) sandstone (Heath, 1983), it is predicted that after 360 days of continuous groundwater seepage, the drawdown at (**Figure 13**) 50 m distance from the centre of the basement (property boundary) is predicted to be 0.9 m . At the distance 80 m from the centre of the basement the drawdown is predicted to be around 0.26 m . This level of drawdown is slightly above the observed natural fluctuation as observed during monitoring. At 120 m distance the drawdown becomes negligible. This calculation assumes that groundwater is not allowed to recover at any point in time during 360 days.

No impacts are predicted on GDEs and registered groundwater bores post construction, as these receptors are at a distance of over 120 m from the basement.

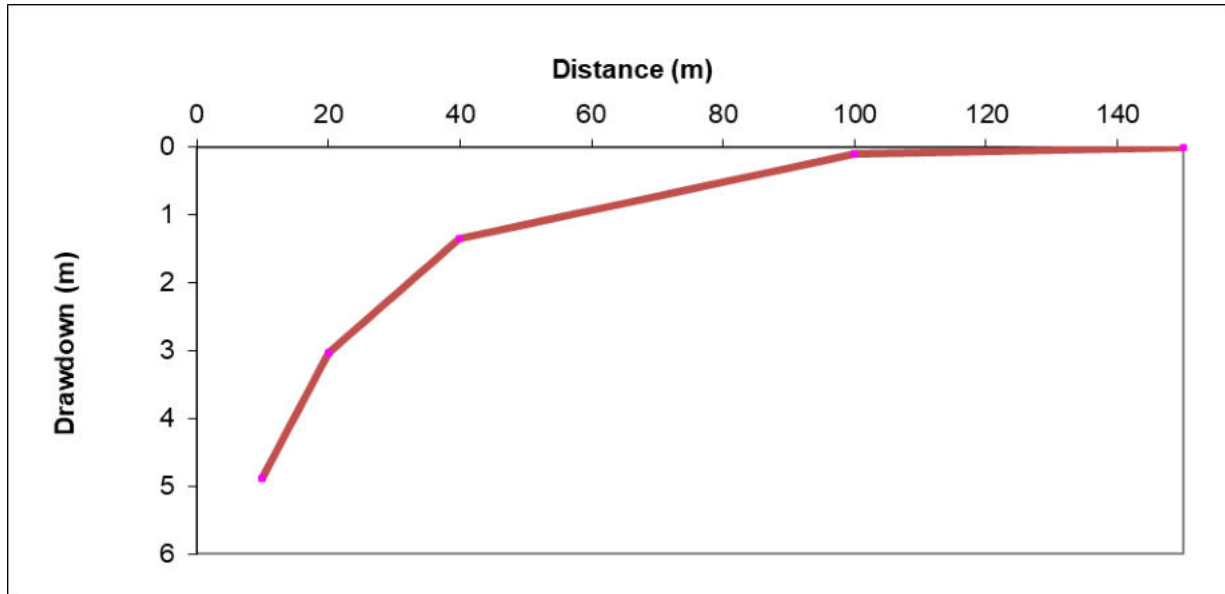


Figure 13 Predicted change in long term drawdown with distance from the centre of excavation (using Theis, 1935)

4.5 Dewatering methodology

Given that total predicted groundwater inflow during construction could be managed (24 m³/day for a period of 120 days), it is recommended that in-pit sumps and pumps are used to collect the groundwater inflows at the lowest point within the excavation. Groundwater would be pumped from a sump to a sediment lined pond to be installed by licensed personnel (**Figure 14**).

The water is proposed to be stored in the sump and pumped out of the sump on a regular basis using the pumps such as the submersible dewatering pumps (200 mm diameter pump and three are likely to be required) or firefighter pumps with likely three pumping locations within the proposed excavation. From the sediment pond (**Figure 15**) (required to settle the sediment) water would be discharged via pipes to the closest stormwater discharge point along the Eastern Valley Way (**Figure 14**).

It is proposed that water be discharged directly to the curb pit inlet and not to gutter. The pump capacity and operating hours or flow rate need to be recorded on a daily basis as per DPI (2021) guidelines.

03:43 PM



4.6 Ongoing long term groundwater inflow management

Given the proposed drained basement design, groundwater is proposed to be directed to the pit on site. The discharge from the site pit is proposed to connected stormwater system via closest pit along the Eastern Valley Way (**Figure 16**).

Approval will need to be sought from the Council for long term discharge to stormwater system. The occupational certificate for the building will include management practice for discharge and water quality information.

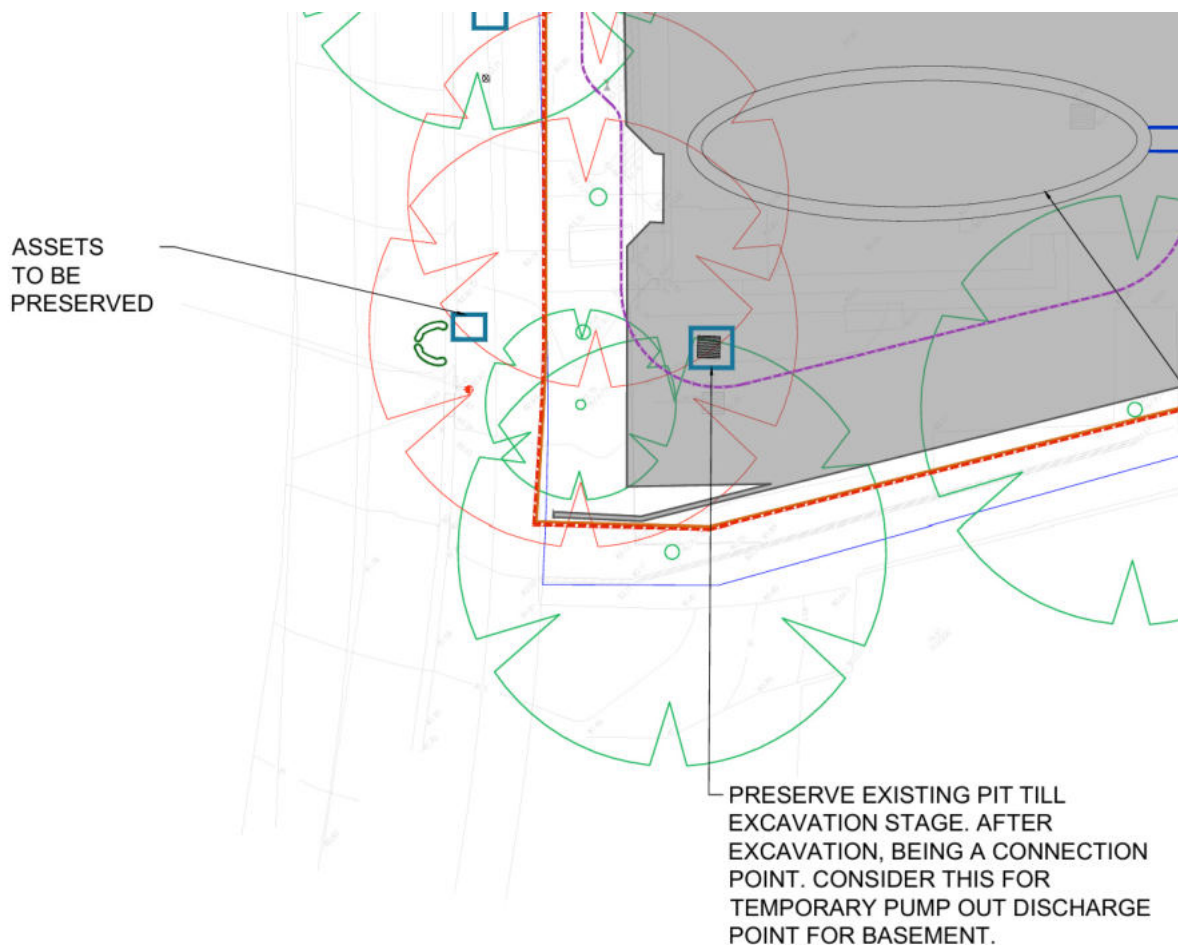


Figure 16 Proposed long term location of the pit on site and Council stormwater pit

4.4 Groundwater disposal during construction

The groundwater analytical results collected during this investigation indicate that groundwater is fresh, with slightly acidic pH and has low levels of elevated metals with the exception of Cu and Zn, and no hydrocarbons and nutrients above the guidelines. Turbidity for sample BH5M is outside the ANZG (2018) guidelines and Blue Book (Managing Urban Stormwater, Soils

and Construction, Volume 1, 4th Edition, 2004, Landcom). However, this will be managed by sediments dam which will allow settlement of silt.

Based on the groundwater quality and total predicted inflow of 24 m³/day during construction, it is recommended that groundwater be discharged into the stormwater system. Regular monitoring would need to be undertaken to ensure that none of the parameters are exceeded (pH, EC and TSS/turbidity, oil and grease). If this does occur, water would need to be managed by treatment. Turbidity levels and pH need to be measured before disposal into the stormwater system.

Water treatment and removal of copper and zinc could be undertaken in small treatment plants using methods such as DMI-65 water filtration media, modified clay sorbent, or reactive filter. Given low levels of Cu and Zn, discharge water could also be diluted prior to discharge.

The proposal is for discharge of water into the stormwater system. Water quality criteria for disposal to the Stormwater system need to satisfy the ANZG (2018) guidelines for the protection of 95% marine species. In addition, the following criteria may also apply as per **Table 7**.

Water quality criteria for disposal to the Stormwater system need to satisfy the ANZG (2018) guidelines as per **Table 7** for the protection of 95% marine species. In addition, the following criteria will apply as per **Table 6**.

Table 7 Criteria for discharge of water into the stormwater system

<i>Parameter</i>	<i>Criteria</i>	<i>Method</i>
<i>Oil and grease</i>	Not visible	Visual
<i>pH</i>	6.5- 8.5	Meter
<i>Total suspended solids</i>	<50 mg/L	Meter/grab sample

4.8 Groundwater disposal post construction

Post construction the occupational certificate will require the operation plan to be developed to manage the water discharge and quality. Approval to discharge long term will sought from the Council into the stormwater drain.

4.9 Assumptions

The following assumptions were made in the calculation of the inflow and drawdown:

- The properties of hydrostratigraphic unit within which the basement will be completed (sand, fill and mainly weathered sandstone) do not change across the Site and are based on the testing results from three bores and 9 hydraulic tests;

- The radius of basement equivalent for the purpose of this inflow estimate is 37 m;
- Aquifer storage has been estimated at 0.02 based on material encountered in boreholes and recorded drill logs information;
- Any rainfall directly onto the basement footprint will be diverted and no allowance was made for wet weather conditions;
- Groundwater levels across the Site do not change during dewatering period and are assumed to be highest as recorded during monitoring.

5.0 AQUIFER INTERFERENCE POLICY

5.1 AIP Assessment framework

Groundwater within the Project Area is regulated by the Sydney Basin Central Groundwater Source under the Greater Metropolitan Region Groundwater Sources 2023 WSP and is classified as ‘Less Productive’ under the AIP (based on yield).

The proposed excavation is below the water table, therefore, incidental take of groundwater during the extraction will occur. Responses to requirements stipulated under Section 2 of the NSW AIP (NOW, 2012) and the AIP Assessment Framework for the extraction are included in **Table 8** based on the groundwater assessment.

During construction the project will be exempt from WAL requirement as the volume of water is below 3 ML/year, and the site is located within Coastal aquifer that is being exempt from WAL requirement (temporary groundwater licensing exemption under the Water Management (General) Regulation 2018).

As discussed in Section 4.2, approximately 1.3 ML/year is predicted to seep into the basement on an ongoing basis. Water taken after completion of construction is not exempt from licensing, however this water take may be exempt under the 3 ML/year licence exemption depending on specific circumstances. There are sufficient shares available in Sydney Basin Central Groundwater Source to enable this trade.

Table 8 AIP Assessment Framework Considerations

<i>Requirements</i>	<i>Findings</i>
<i>Described the water source(s) the activity will take water from?</i>	Section 5.1
<i>Predicted the total amount of water that will be taken from each connected groundwater or surface water source on an annual basis as a result of the activity?</i>	Section 4.2

Requirements	Findings
<i>Predicted the total amount of water that will be taken from each connected groundwater or surface water source after the closure of the activity?</i>	Section 4.2
<i>Made these predictions in accordance with Section 3.2.3 of the AIP? (refer to Table 3, below)</i>	Yes, Section 3 and 4.2 to 4.4
<i>Described how and in what proportions this take will be assigned to the affected aquifers and connected surface water sources?</i>	Yes, Section 5.1
<i>Described how any licence exemptions might apply?</i>	Yes, Section 5.1
<i>Described the characteristics of the water requirements?</i>	Section 3 and 4
<i>Determined if there are sufficient water entitlements and water allocations that are able to be obtained for the activity?</i>	Yes, but below 3 ML/year , no water allocations required during construction and 1. 4 ML/year WAL may need to be obtained.
<i>Considered the rules of the relevant water sharing plan and if it can meet these rules?</i>	Yes, the requirement meets the water sharing plan rules. There are no cultural, ecosystem, surface water or private bores in the vicinity as defined in the plan that would be impacted by the activity.
<i>Determined how it will obtain the required water?</i>	Yes, water will be traded on the open market. 1 share will be required in the water source, if licensing is required.
<i>Considered the effect that activation of existing entitlement may have on future available water determinations?</i>	NA , no existing entitlement
<i>Considered actions required both during and post-closure to minimize the risk of inflows to a mine void as a result of flooding?</i>	Yes, any surface water will be diverted and managed by the stormwater system.
<i>Developed a strategy to account for any water taken beyond the life of the operation of the project?</i>	Yes, Section 4.4 and 5.1
<i>Will uncertainty in the predicted inflows have a significant impact on the environment or other authorised water users?</i>	No, discussed in Section 4.4

5.2 Minimal impact consideration

This section provides discussion of potential impacts of the Project in terms of the AIP minimal impact considerations for the Sydney Basin Central Groundwater Source of the Greater Metropolitan Region Groundwater Sources 2023 WSP Water Sharing Plan for the Less Productive Fractured Rock groundwater source.

As outlined in **Table 9**, the predicted impacts are Level 1 minimal impact considerations based on the water table reduction within the proximity of terrestrial GDEs and at any water supply bore. Monitoring would ensure that any impacts will be considered as acceptable under the AIP framework.

Table 9 Minimal Impact Considerations – Less Productive Fracture Rock Water Source

Minimal Impact Considerations	Assessment
Water Table Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic “post-water sharing plan”⁽²⁾ variations, 40m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan; or A maximum of a 2m decline cumulatively at any water supply work unless make good provisions should apply.	Level 1 – acceptable Water table reduction is predicted at 1.9 m within 50 m from the centre of the basement and 0 m within 80 m ie at over 40 m distance from high potential terrestrial GDE. This is considered to present negligible impact on GDEs as the distance from the basement is over 500 m and the predicted drawdown does not extend to GDEs or water supply bores. There are no water supply works in the vicinity and maximum decline is below <2 m.
Water Pressure A cumulative pressure head decline of not more than 40% of the “post-water sharing plan”⁽²⁾ pressure head above the base of the water source to a maximum of a 2m decline, at any water supply work.	Level 1 – acceptable The pressure decline is expected at 1.9 m at the site boundary and zero at 80 m distance during construction. Post construction 0.9 m drawdown is predicted at the site boundary reducing to zero at 120 m long term. .
Water quality 1. (a) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity; and (b) No increase of more than 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity. Redesign of a highly connected⁽³⁾ surface water source that is defined as a “reliable water supply”⁽⁴⁾ is not an appropriate mitigation measure to meet considerations 1.(a) and 1.(b) above. (c) No mining activity to be below the natural ground surface within 200m laterally from the top of high bank or 100m vertically beneath (or the three dimensional extent of the alluvial material - whichever is the lesser distance) of a highly connected surface water source that is defined as a “reliable water supply”.	Level 1 – acceptable Given that the site is located on the top of the ridge , saturated in the north and mainly unsaturated at the southern boundary , it is not expected that removal of small volumes would change groundwater quality. Groundwater will be drawn from the top of the ridge and not expected to cause any change in water quality and salinity. In addition, current water quality is fresh and given the location on the ridge, it is typically flushed resulting in maintenance of freshwater conditions. No change in groundwater quality is expected.

6.0 DEWATERING MONITORING PLAN

Temporary groundwater pumping for dewatering the site is predicted to have a minor effect on groundwater levels in the area, with minor predicted impact to the closest nearby residential properties (0. 2 m above the observed fluctuation). Geotechnical engineer would need to assess

the settlement impact on the nearby buildings to ensure that no damage occurs from the proposal.

Groundwater levels and outflow volume would, however, need to be monitored outside the excavation (using piezometers), and the pumping rate can be adjusted to maintain groundwater levels at sufficient depth (not more than 0.5 m) below bulk excavation level. Sump pump out pits will be designed with appropriate volume capacity and monitoring of groundwater quality will be undertaken at the point where the water is transferred to the Council's stormwater system. Monitoring of groundwater in boreholes is related to water level only not quality.

Long term proposed pumping from the sump will have limited impact on the drawdown (0.26 m at 80 m distance) and total inflow is predicted around 1.3 ML/year.

6.1 Groundwater monitoring

A groundwater level, water quality and dewatering rate monitoring program must be implemented.

The following program is proposed:

- Groundwater levels need to be monitored continuously on a daily basis 2 weeks prior to, during the construction and one month following the completion of the basement in monitoring bores installed outside of the excavation. Dataloggers need to be installed and maintained during construction as per General terms of conditions issued by WaterNSW.
- Daily pumping records and/or pump capacity and operational hours need to be maintained until the end of dewatering and volume of water removed needs to be reported to the WaterNSW. The measurements need to be undertaken by flowmeter, details of pump operational hours kept along with the pump capacity to allow the calculation and the volume of water disposed of. The lowest level of dewatering is 88.8 mAHD.
- Water quality sampling needs to be undertaken prior to discharge and on a weekly basis during dewatering. Water samples need to be tested for pH, EC, turbidity/TSS and oil and grease as a minimum.
- The monitoring results must be reviewed weekly during construction by an experienced hydrogeologist to ensure that the predicted volumes, quality and levels are not exceeded. Monitoring of discharge water quality to be undertaken weekly during dewatering. The analytical suite should include as a minimum, Total Suspended Solids (TSS), EC, temperature, turbidity, pH, oil and grease as per **Table 7** and DPIE (2021) requirements.
- Final dewatering report needs to be completed and sent to WaterNSW following the completion of dewatering as per General terms and conditions issued by WaterNSW and prior to Operation Certificate being issued.

6.2 Groundwater monitoring and water take measurement post construction

Ongoing groundwater monitoring, water take reporting and water quality measurement will be undertaken in accordance with the Operational plan for the building.

Water take will need to be reported annually to WaterNSW under the WAL approval (if required).

6.3 Settlement monitoring during construction

Based on the predicted groundwater drawdown in particular related to the closest neighbouring property, a settlement monitoring program may need to be designed and implemented by a geotechnical engineer and survey results provided on an ongoing basis. The location, monitoring frequency of survey points monitoring and the need for monitoring will be addressed by geotechnical engineer. A survey monitoring program may need to be designed and implemented by a geotechnical engineer.

6.4 Management of noise, vibration and odour during dewatering

The sensitive receptors that may be impacted by the noise, vibration and odour during dewatering are the residential buildings neighbouring the site.

The dewatering system is expected to create low levels of noise, with the only noise being generated by the firefighter pumps or submersible pumps. The pumping from the sump will occur during the daylight hours, and the level of noise that the pump generates is typically up to 50-60 dB. If pumping is required overnight, and to limit the noise during operation, noise reducing barriers can be installed if the pump will result in higher noise levels. Equipment will be selected for pumping that is quieter and less vibration emitting where reasonable and feasible.

Notification of work activities and hours of work including the contact telephone number will need to be provided on notification to residents in the nearby buildings at least 7 days prior to start of dewatering.

It is expected that firefighter and/or submersible pumps will create low levels of vibration, and this is found to be excessive then vibration damping device could be used. The linking of the pump body to water supply pipe can be undertaken such that soft joints are used therefore reducing vibration caused by friction, which in turn also reduces noise.

Based on the groundwater samples collected across the Site, no odour was detected during sampling. Therefore, no odour will need to be managed during dewatering.

6.5 Management during construction dewatering , triggers and emergency plan

Should the groundwater level monitoring indicate that the groundwater level external to the basement is decreasing more than predicted (0.1 m below predicted), or if it should exceed significantly below the lowest predicted level at any time, the hydrogeologist/geotechnical engineer must be informed. If the triggers are exceeded, they need to be investigated and should unforeseen impact occur they need to be reported to WaterNSW.

Should the water discharge criteria be exceeded (**Table 6 and 7**), the discharge to stormwater needs to cease immediately and the Council needs to be notified within 24 hours. The reason for exceedance needs to be investigated by a hydrogeologist and results reported to the Council.

Geotechnical engineer would manage the investigation into the need for and level of settlement based on their professional opinion.

6.6 Responsibility during construction

Table 8 lists the responsible personnel in relation to site activities and their roles.

Table 10 List of responsible personnel

<i>Task</i>	<i>Person responsible</i>	<i>Contact details</i>
<i>Responsibility for legislative compliance and accountability for ensuring the discharge water quality complies with the requirements listed above</i>	Proponent	Andrew Bishay (Builtcom)
<i>Routine emergency contact</i>	Site manager	TBC

7.0 SUMMARY AND CONCLUSIONS

This groundwater assessment has been compiled to assess the groundwater inflow rates into the basement during construction, assess the impact of groundwater drawdown and look at the options for discharge of groundwater.

The following is the summary of findings:

- The Site is underlain by thin fill and silt layer to a maximum of 2.5 m depth and is underlain by weathered sandstone;
- Measurement of groundwater level beneath Site was undertaken in Site bores installed in the residential soil and weathered rock, with groundwater table ranging from 75.6 to 81.3 mAHD. Dewatering will be required as the excavation for the basement will be at 75.5 mAHD (with allowance for slab);

- Groundwater inflow into the proposed basement was estimated based on the 9 hydraulic tests of three site bores, groundwater level fluctuation as monitored over three months and planned size and depth of the basement. The short-term groundwater inflows are estimated at 24 m³/day; for the duration of 120 days with total not expected to exceed 2.9 ML during excavation.
- Drawdown during construction assuming 120 days dewatering is predicted to be 0.26 m at 80 m distance from the centre of the basement (distance to neighbouring property). This is above the observed groundwater level fluctuation and may need to be managed;
- Long term inflow into the basement is predicted at 3.5 m³/day (1.3 ML/year). No impact to ecosystems, creeks and groundwater system is predicted long term.
- It is recommended that inflow be managed by sumps with water pumped to a sediment settling pond/tank prior to discharge;
- Given the predicted inflow of less than 3 ML/year and exemption for coastal aquifers no water access licence is required from WaterNSW during construction. Water supply works approval needs to be obtained prior to dewatering. Post construction WAL will need to be applied for 1.4 ML/year;
- Natural water level fluctuations are slightly below the predicted drawdown during construction on the nearby building, therefore some impact may occur, and this can be managed by installation of settlement monitoring points by a geotechnical engineer. The installation and monitoring to address potential settlement would be managed by the geotechnical engineer based on their professional opinion;
- Groundwater quality testing indicates that water is fresh to slightly brackish and acidic to neutral. The heavy metals concentration is below detection limits., with the exception of copper and zinc which are slightly above the ANZG (2018) guidelines. Turbidity, was above the guidelines, and organic compounds and nutrients were not detected;
- The most suitable water disposal option is considered to be discharge to stormwater. Regular monitoring of discharge water needs to be undertaken on a weekly basis during construction. If pH, EC, TSS/turbidity and oil and grease are exceeded then settlement in sediment pond on site will be required before discharge to stormwater;
- Water treatment and removal of copper if required, can be undertaken by either dilution or in small treatment plants using methods such as DMI-65 water filtration media, modified clay sorbent, or reactive filter;
- Monitoring of groundwater level outside of the basement (on a daily basis using dataloggers), daily pumped water volume records (pump capacity/operational hours or flowmeter records), discharge water quality (weekly during discharge) are required to ensure that drawdown does not exceed the predicted, and that discharge complies with

Council approval. Geotechnical engineer will determine the need for installation of survey points on nearby buildings such that no impact is caused by potential settlement.

- Any exceedance of drawdown, water quality and settlement should be investigated and Council notified.;
- Final dewatering report needs to be completed and submitted to WaterNSW on basement completion; and
- Prior to occupational certificate, a program needs to be designed to manage the water quality and monitor volumes being discharged on an ongoing basis.

7.0 REFERENCES

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

Douglas Partners, 2024. Report on Geotechnical Investigation , The Alexander Twilight Aged Care, 2B Alexander Avenue , Mosman, report prepared for Linear Project Management, ref no 227054.00

Fetter, C.W. (1994) Applied Hydrogeology. 3rd Edition, Macmillan College Publishing Company, New York.

Herbert, C. 1983. Sydney 1:100 000 Geological Sheet 9130, 1st edition. Geological Survey of New South Wales, Sydney.

National Environment Protection (Assessment of site contamination) Measure. 2013. Schedule B, Guideline on Investigation levels for soil and groundwater.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

LIMITATIONS

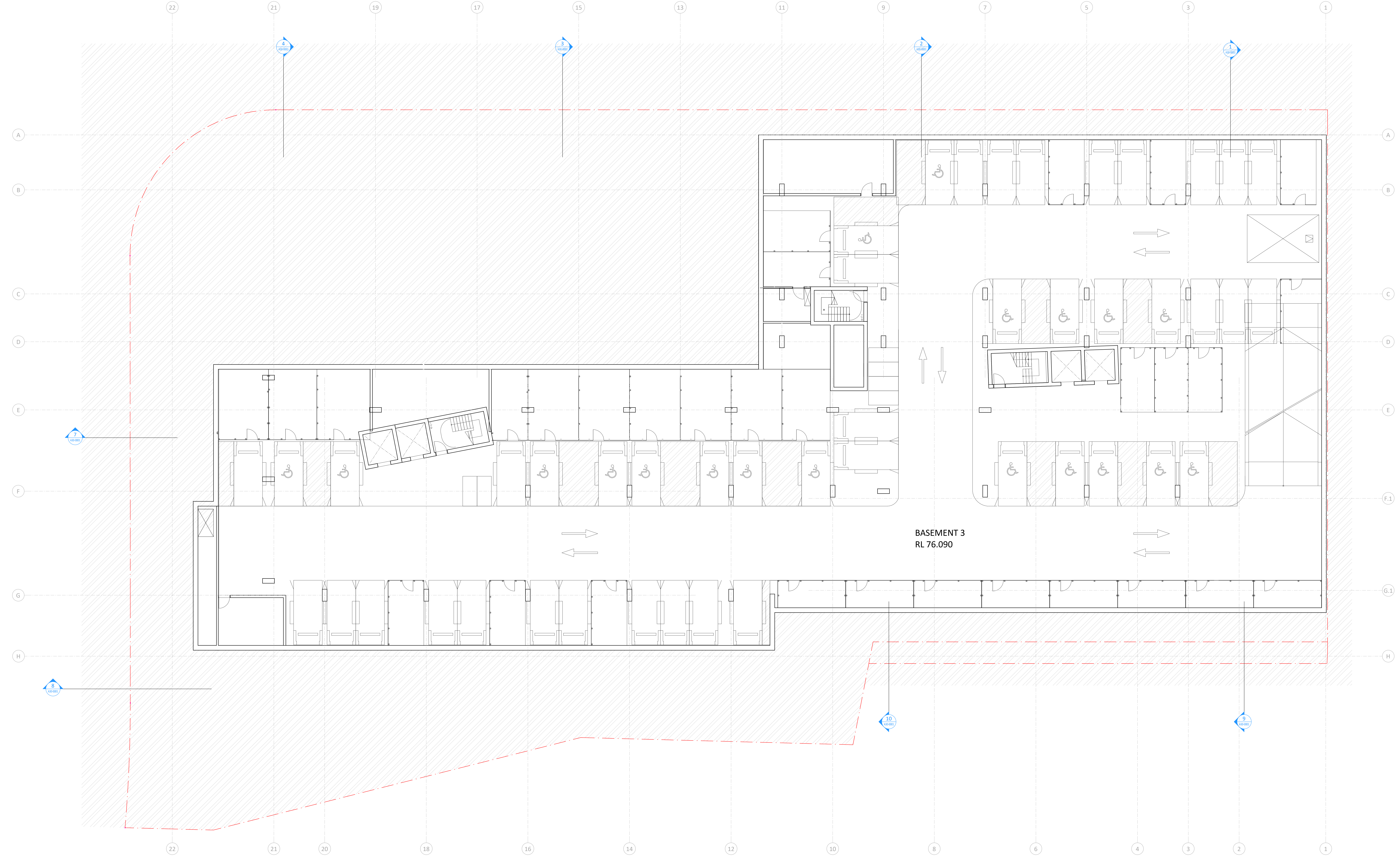
This report has been prepared for Linear Project Management Pty Ltd and for the specific purpose to which it refers. No responsibility is accepted to any third party and neither the whole of the report or any part or reference thereto may be published in any document, statement or circular nor in any communication with third parties without our prior written approval of the form and context in which it will appear.

Dr Katarina David has used a degree of skill and care ordinarily exercised by reputable members of our profession practicing in the same or similar locality. The conclusions presented in this report are relevant to the conditions of the Site and the state of legislation currently enacted as at the date of this report. I do not make any representation or warranty that the conclusions in this report were applicable in the future as there may be changes in the condition of the Site, applicable legislation or other factors that would affect the conclusions contained in this report.

In making this assessment from a limited number of boreholes there is possibility that variations may occur between test locations. Site information is specific only at those points from which samples have been taken. The data derived from Site investigation programme are extrapolated across the Site to form an inferred geological and hydrogeological model about subsurface conditions at the proposed Site. Therefore, the actual conditions at the Site might differ from those inferred to exist, since no groundwater exploration program no matter how comprehensive can reveal all subsurface details. This program provides the professional estimate of the scope of investigation and general information of the subsurface conditions.

APPENDIX A

Excavation (footprint) plan



Client:

Built Contracting Pty Ltd

Rev.	Amendment	By	Chk*	Date
1	ISSUED FOR CO-ORD	JH	CQS	05.06.2025

General Notes:

Consultants:

-
-
-

Project Name:

Edinburgh Road Castlecrag

Project Address:

100 Edinburgh Road, Castlecrag, NSW 2068

Drawing Title:

BASEMENT 03 PLAN

Revision:

1

Drawn by:

CQS

Project No:

2513

Drawing No:

A10-0701

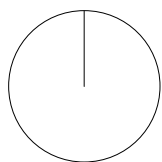
Scale:

1 : 100

Date:

30/05/25

North:



Architect:

CQ.Studio

CQ STUDIO- SYDNEY

Level 1, 15 George St, Burwod,
NSW 2134, Australia
P (02) 8212 5592

APPENDIX B

Monitoring bore logs



GROUNDWATER LOG BH101

PROJECT NUMBER	DRILLING DATE 16 May 2025	COORDINATES
PROJECT NAME 100 Edinburgh Rd, Castlecrag	TOTAL DEPTH 11m	COORD SYS
CLIENT Built Contracting Pty Ltd	DIAMETER	COMPLETION
ADDRESS	CASING	SURFACE ELEVATION 85.7 mAHD
LICENCE NO.	SCREEN 5-11m	WELL TOC

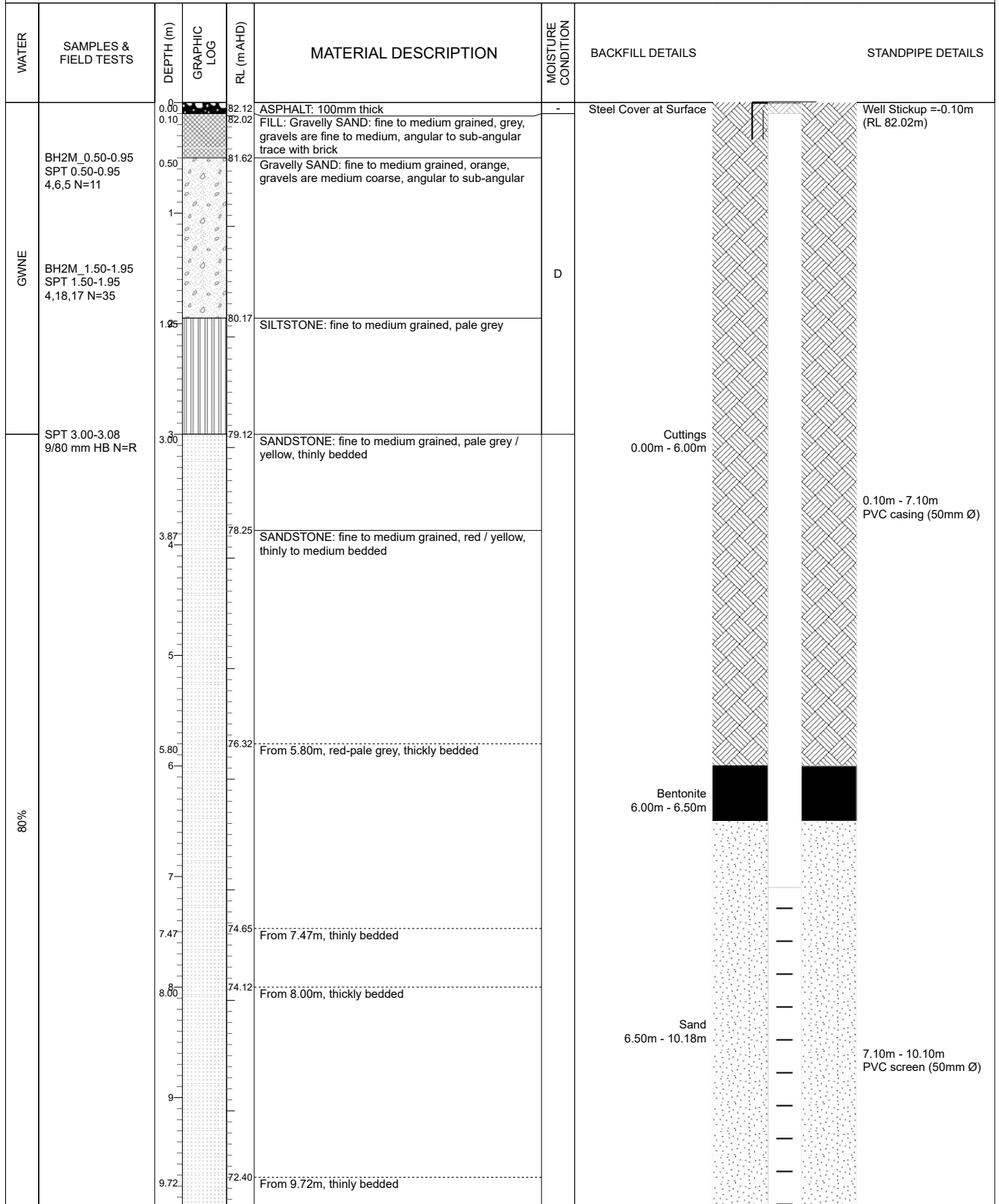
COMMENTS	LOGGED BY
	CHECKED BY

	Graphic log	Analysed	% Recovery	Depth (m)	Graphic Log	Moisture	Material Description	Well Diagram	Elevation (m)
				0.5			Topsoil		85.5
				1			Silty soil, dry , brown		85
				1.5			Silt , white, fine grained		84.5
				2					84
				2.5					83.5
				3			sand , becoming wet		83
				3.5		✓			82.5
				4					82
				4.5			Sand, silty sand , wet, very fine, yellow to brown colour		81.5
				5					81
				5.5					80.5
				6					80
				6.5					79.5
				7					79
				7.5					78.5
				8					78
				8.5					77.5
				9					77
				9.5			Sand, fine grained , yellow		76.5
				10					76
				10.5					75.5
									75

Location 100 Edinburgh Road, Castlecrag, NSW
Client Project Edinburgh Pty Ltd
Job No. E26044.G03
Sheets 1 of 2

Started 06 June 2023
Completed 06 June 2023
Logged By KP **Date** 06 June 2023
Review By ML **Date** 14 September 2023

Drilling Contractor Geosense Drilling and Engineering Pty Ltd **Surface RL** ≈82.12 m (AHD) **Northing** 6258275.5577 (MGA 2020 Zone 56)
Plant Comacchio Geo 205 **Inclination** 90° **Easting** 334512.6660 (MGA 2020 Zone 56)



This log should be read in conjunction with EI Australia's accompanying explanatory notes.



BOREHOLE LOG

BH ID: BH2M

Location 100 Edinburgh Road, Castlecrag, NSW
Client Project Edinburgh Pty Ltd
Job No. E26044.G03
Sheets 2 of 2

Started 06 June 2023
Completed 06 June 2023
Logged By KP **Date** 06 June 2023
Review By ML **Date** 14 September 2023

Drilling Contractor Geosense Drilling and Engineering Pty Ltd **Surface RL** ≈82.12 m (AHD) **Northing** 6258275.5577 (MGA 2020 Zone 56)
Plant Comacchio Geo 205 **Inclination** 90° **Easting** 334512.6660 (MGA 2020 Zone 56)

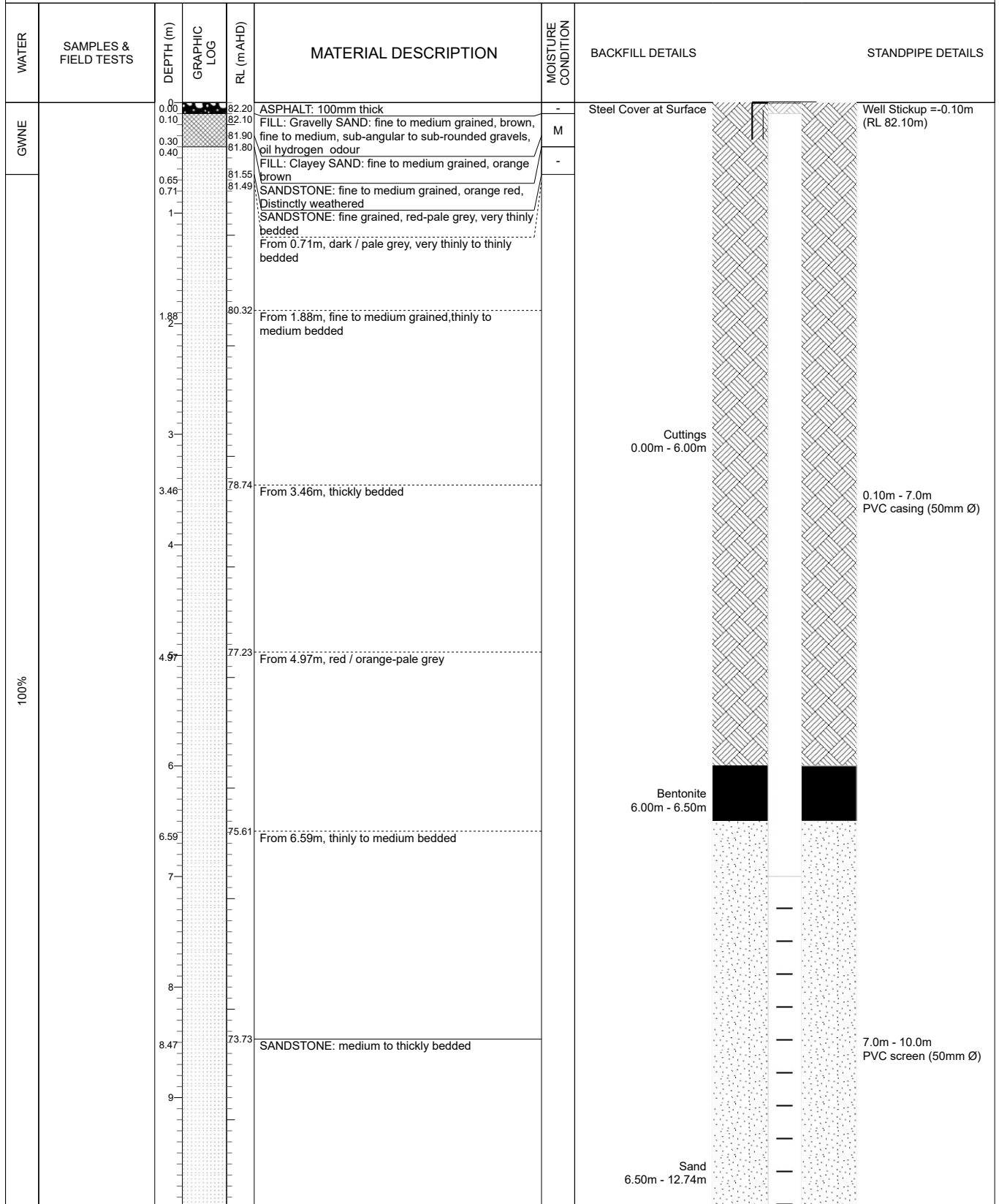
WATER	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	BACKFILL DETAILS	STANDPIPE DETAILS
80 %				71.94	From 9.72m, thinly bedded Terminated at 10.18m. Target Depth Reached.			
		11						
		12						
		13						
		14						
		15						
		16						
		17						
		18						
		19						
		20						

This log should be read in conjunction with EI Australia's accompanying explanatory notes.

Location 100 Edinburgh Road, Castlecrag, NSW
Client Project Edinburgh Pty Ltd
Job No. E26044.G03
Sheets 1 of 2

Started 19 June 2023
Completed 19 June 2023
Logged By KP **Date** 19 June 2023
Review By ML **Date** 14 September 2023

Drilling Contractor Tightsite Geotechnical & Environmental Drilling
Plant Hand Portable Rig
Surface RL ≈82.20 m (AHD)
Inclination 90°
Northing 6258308.2081 (MGA 2020 Zone 56)
Easting 334511.6267 (MGA 2020 Zone 56)



This log should be read in conjunction with EI Australia's accompanying explanatory notes.

MONITORING WELL LOG

BH ID: BH4M

Location	100 Edinburgh Road, Castlecrag, NSW	Started	19 June 2023		
Client	Project Edinburgh Pty Ltd	Completed	19 June 2023		
Job No.	E26044.G03	Logged By	KP	Date	19 June 2023
Sheets	2 of 2	Review By	ML	Date	14 September 2023

Drilling Contractor	Tightsite Geotechnical & Environmental Drilling	Surface RL	≈82.20 m (AHD)	Northing	6258308.2081 (MGA 2020 Zone 56)
Plant	Hand Portable Rig	Inclination	90°	Easting	334511.6267 (MGA 2020 Zone 56)

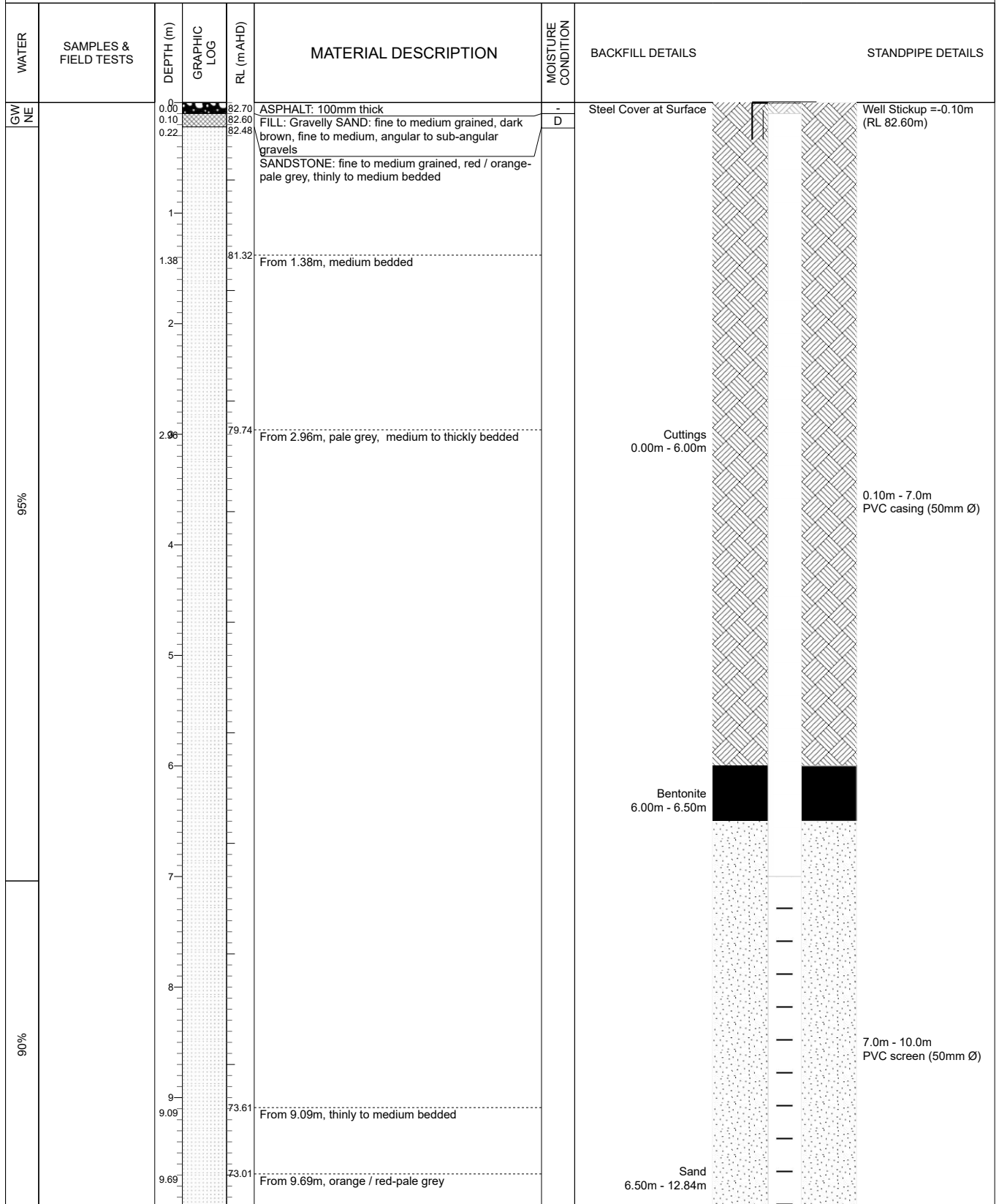
WATER	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	BACKFILL DETAILS	STANDPIPE DETAILS
100%		11			SANDSTONE: medium to thickly bedded			
		12						
		13		69.46	Terminated at 12.74m. Target Depth Reached.			
		14						
		15						
		16						
		17						
		18						
		19						
		20						

This log should be read in conjunction with EI Australia's accompanying explanatory notes.

Location 100 Edinburgh Road, Castlecrag, NSW
Client Project Edinburgh Pty Ltd
Job No. E26044.G03
Sheets 1 of 2

Started 20 June 2023
Completed 20 June 2023
Logged By KP **Date** 20 June 2023
Review By ML **Date** 14 September 2023

Drilling Contractor Tightsite Geotechnical & Environmental Drilling
Plant Hand Portable Rig
Surface RL ≈82.70 m (AHD)
Inclination 90°
Northing 6258303.2089 (MGA 2020 Zone 56)
Easting 334569.9813 (MGA 2020 Zone 56)



This log should be read in conjunction with EI Australia's accompanying explanatory notes.

MONITORING WELL LOG

BH ID: BH5M

Location	100 Edinburgh Road, Castlecrag, NSW	Started	20 June 2023
Client	Project Edinburgh Pty Ltd	Completed	20 June 2023
Job No.	E26044.G03	Logged By	KP Date 20 June 2023
Sheets	2 of 2	Review By	ML Date 14 September 2023

Drilling Contractor	Tightsite Geotechnical & Environmental Drilling	Surface RL	≈82.70 m (AHD)	Northing	6258303.2089 (MGA 2020 Zone 56)
Plant	Hand Portable Rig	Inclination	90°	Easting	334569.9813 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	BACKFILL DETAILS	STANDPIPE DETAILS
9.06%					From 9.69m, orange / red-pale grey			
75%		11						
		12						
		13		69.83	Terminated at 12.87m. Target Depth Reached.			
		14						
		15						
		16						
		17						
		18						
		19						
		20						

This log should be read in conjunction with EI Australia's accompanying explanatory notes.

APPENDIX C

Analytical lab results and COC



CERTIFICATE OF ANALYSIS

Work Order : **ES2515610**
Client : **KATARINA DAVID**
Contact : **MS KATARINA DAVID**
Address : **6 Lawrence Street**
Blackheath 2785
Telephone : **----**
Project : **Castl**
Order number : **----**
C-O-C number : **----**
Sampler : **----**
Site : **----**
Quote number : **ES24KATDAV0001 V2**
No. of samples received : **2**
No. of samples analysed : **2**

Page : **1 of 7**
Laboratory : **Environmental Division Sydney**
Contact : **Customer Services ES**
Address : **277-289 Woodpark Road Smithfield NSW Australia 2164**
Telephone : **+61-2-8784 8555**
Date Samples Received : **27-May-2025 15:10**
Date Analysis Commenced : **28-May-2025**
Issue Date : **05-Jun-2025 09:18**



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenzo(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH101	BH5M	----	----	----
Sampling date / time					27-May-2025 10:00	27-May-2025 10:30	----	----	----
Compound	CAS Number	LOR	Unit		ES2515610-001	ES2515610-002	-----	-----	-----
					Result	Result	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		202	61	----	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		78.1	26.7	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L		7	7	----	----	----
Total Alkalinity as CaCO ₃	----	1	mg/L		7	7	----	----	----
ED041G: Sulfate (Turbidimetric) as SO₄ 2- by DA									
Sulfate as SO ₄ - Turbidimetric	14808-79-8	1	mg/L		75	2	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		76	51	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		16	2	----	----	----
Magnesium	7439-95-4	1	mg/L		6	4	----	----	----
Sodium	7440-23-5	1	mg/L		48	26	----	----	----
Potassium	7440-09-7	1	mg/L		6	<1	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		0.011	0.010	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L		0.015	0.010	----	----	----
Zinc	7440-66-6	0.005	mg/L		0.076	0.051	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH101	BH5M	----	----	----
Sampling date / time					27-May-2025 10:00	27-May-2025 10:30	----	----	----
Compound	CAS Number	LOR	Unit		ES2515610-001	ES2515610-002	-----	-----	-----
					Result	Result	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.15	0.01	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.02	0.02	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.02	0.02	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.2	0.1	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.2	0.1	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.05	0.02	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		3.84	1.62	----	----	----
ø Total Cations	----	0.01	meq/L		3.53	1.56	----	----	----
ø Ionic Balance	----	0.01	%		4.22	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				BH101	BH5M	----	----	----
Sampling date / time				27-May-2025 10:00	27-May-2025 10:30	----	----	----
Compound	CAS Number	LOR	Unit	ES2515610-001	ES2515610-002	-----	-----	-----
				Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----
Dibenz(a,h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(g,h,i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----
Toluene	108-88-3	2	µg/L	<2	<2	----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				BH101	BH5M	----	----	----
Sampling date / time				27-May-2025 10:00	27-May-2025 10:30	----	----	----
Compound	CAS Number	LOR	Unit	ES2515610-001	ES2515610-002	-----	-----	-----
				Result	Result	----	----	----
EP080: BTEXN - Continued								
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----
^ Total Xylenes	-----	2	µg/L	<2	<2	----	----	----
^ Sum of BTEX	-----	1	µg/L	<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	26.4	26.7	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%	50.8	55.6	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%	55.2	47.9	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1.0	%	68.7	68.6	----	----	----
Anthracene-d10	1719-06-8	1.0	%	77.1	81.5	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	80.3	88.0	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	2	%	113	122	----	----	----
Toluene-D8	2037-26-5	2	%	100	104	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	104	107	----	----	----



Surrogate Control Limits

Sub-Matrix: **WATER**

		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	72	143
Toluene-D8	2037-26-5	75	131
4-Bromofluorobenzene	460-00-4	73	137

APPENDIX D

Hydraulic testing analysis

Project Name:

Client:

Well No. / Name:

Type of test:

100 Edinburgh Rd, Castlecrag
Built Contracting Pty Ltd

MW3C_3

Falling head

Rising head

Date:

30-Jul-25
9am

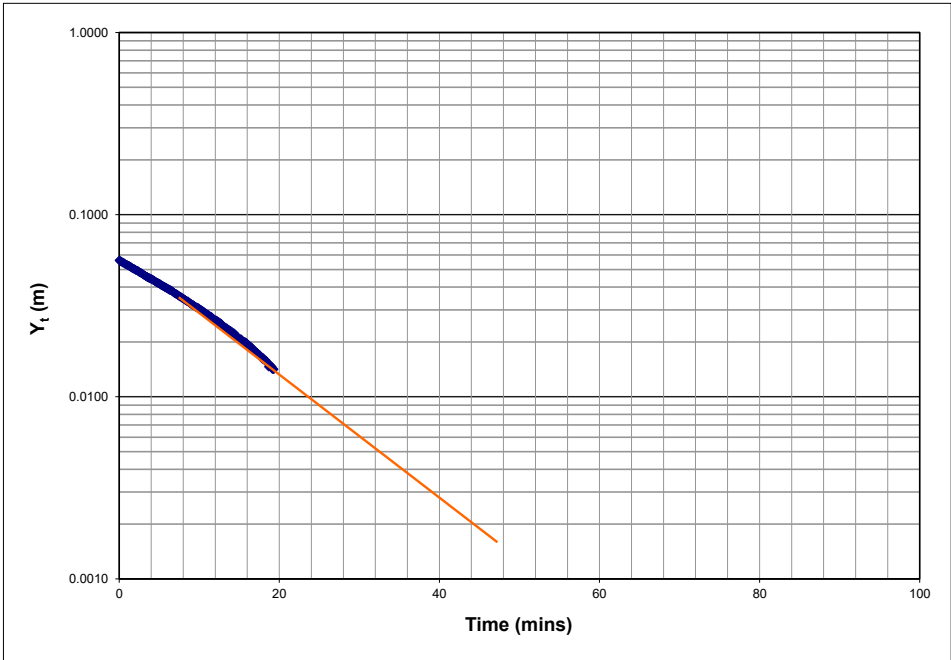
Depth to equilibrium water level (m bgl):

5.96 m

Well Completion:

Fully Penetrating

Partially Penetrating



r_c =	casing radius	0.025	If $L_w < H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.12 \text{ m}$
r_w =	radial distance between undisturbed aquifer and well centre	0.051	
L_e =	length of intake	5	If $L_w = H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
H =	saturated thickness of aquifer	30	
L_w =	distance b/n water table and bottom of intake	8.5	
R_e =	effective well radius	1.16	
t =	time	44	
Y_o =	initial drawdown	0.05	
Y_t =	vertical distance between the water level in well at time t and equilibrium level	0.002	
L_e/r_w =		98.03921569	
A =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	4.25	
B =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1	
C =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	4	

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$
$$= 1.43E-05 \text{ m/min}$$
$$= 2.06E-02 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Aquifer Test Solutions:

Slug Tests

Bouwer Rice

Project Name: 100 Edinburgh Rd, Castlecrag
Client: Built Contracting Pty Ltd

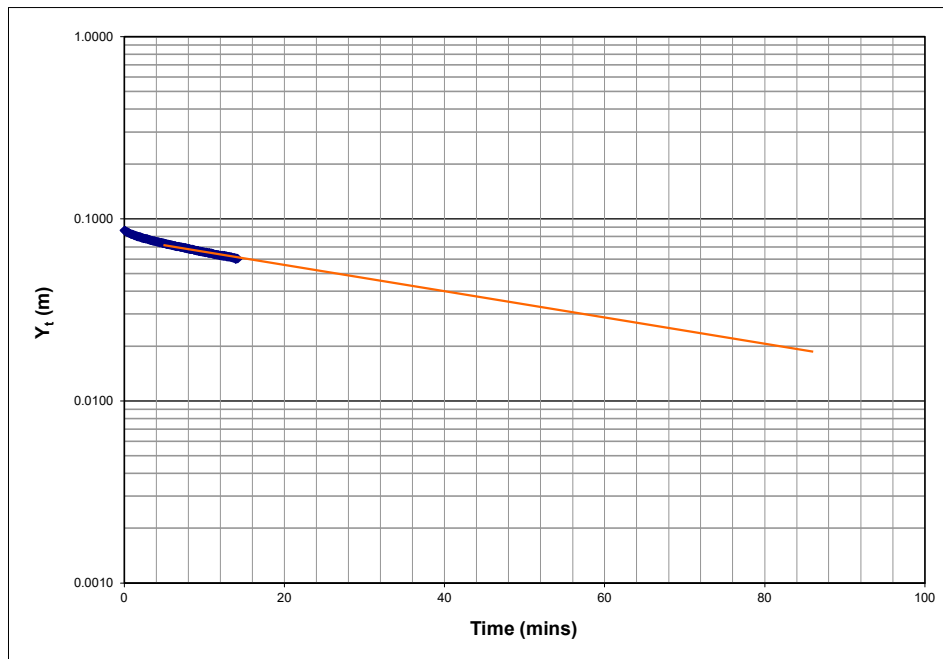
Date: 30-Jul-25
 9am

Well No. / Name: MW1C_2

Depth to equilibrium water level (m bgl): 8.85 m

Type of test: Falling head
Rising head

Well Completion: Fully Penetrating
 Partially Penetrating



r_c = casing radius	0.025	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A + B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$
r_w = radial distance between undisturbed aquifer and well centre	0.051		
L_e = length of intake	12.2	If $L_w = H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
H = saturated thickness of aquifer	30		
L_w = distance b/n water table and bottom of intake	14.5	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A + B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$
R_e = effective well radius	2.39		
t = time	82	If $L_w = H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
Y_o = initial drawdown	0.08		
Y_t = vertical distance between the water level in well at time t and equilibrium level	0.02	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A + B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$
L_e/r_w =	239.2156863		
A = dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	7	If $L_w = H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
B = dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1.5		
C = dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	8.5	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A + B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$

$$= 1.67E-06 \text{ m/min}$$

$$= 2.40E-03 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
 Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Project Name: 100 Edinburgh Rd, Castlecrag
Client: Built Contracting Pty Ltd

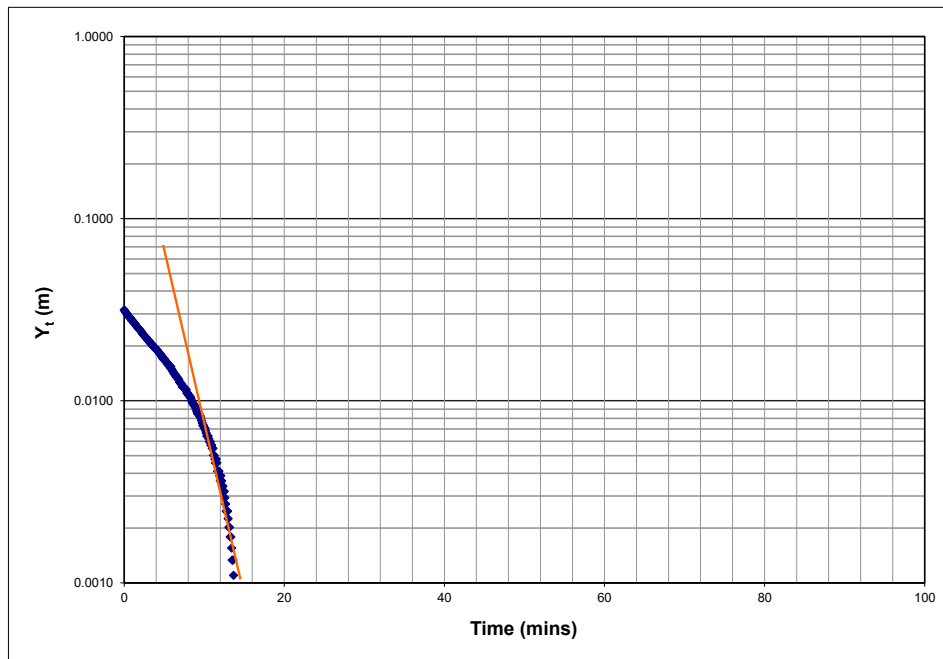
Date: 30-Jul-25
9am

Well No. / Name: MW1C_3

Depth to equilibrium water level (m bgl): 8.91 m

Type of test: Falling head
Rising head

Well Completion: Fully Penetrating
Partially Penetrating



r_c =	casing radius	0.025
r_w =	radial distance between undisturbed aquifer and well centre	0.051
L_e =	length of intake	12.2
H =	saturated thickness of aquifer	30
L_w =	distance b/n water table and bottom of intake	14.5
R_e =	effective well radius	2.39
t =	time	15
Y_o =	initial drawdown	0.03
Y_t =	vertical distance between the water level in well at time t and equilibrium level	0.001
L_e/r_w =		239.2156863
A =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	7
B =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1.5
C =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	8.5

If $L_w < H$

$$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A + B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$$

$$= 3.85 \text{ m}$$

If $L_w = H$

$$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$$

$$= L_w < H \text{ m}$$

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$

$$= 2.24E-05 \text{ m/min}$$

$$= 3.22E-02 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Project Name:

Client:

Well No. / Name:

Type of test:

100 Edinburgh Rd, Castlecrag

Built Contracting Pty Ltd

MW2C_1

Falling head

Rising head

Date:

30-Jul-25

9am

Depth to equilibrium water level (m bgl):

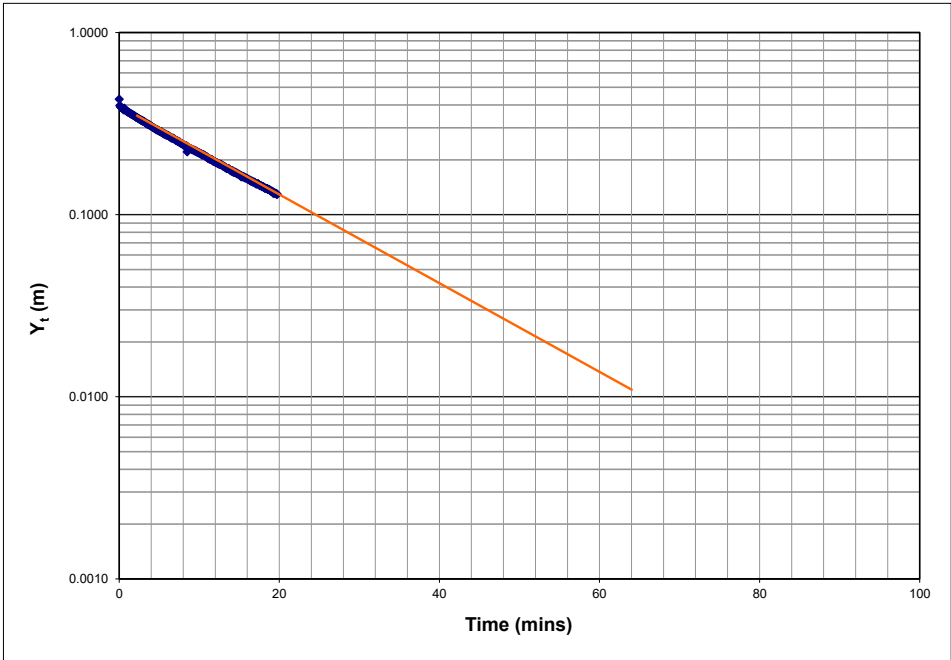
6

m

Well Completion:

Fully Penetrating

Partially Penetrating



r_c =	casing radius	0.025	If $L_w < H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$$= 3.69 \text{ m}$
r_w =	radial distance between undisturbed aquifer and well centre	0.051	
L_e =	length of intake	6.5	
H =	saturated thickness of aquifer	30	
L_w =	distance b/n water table and bottom of intake	16	
R_e =	effective well radius	2.05	If $L_w = H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$$= L_w < H \text{ m}$
t =	time	64	
Y_o =	initial drawdown	0.43	
Y_t =	vertical distance between the water level in well at time t and equilibrium level	0.01	
L_e/r_w =		127.4509804	
A =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	4.5	
B =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1	
C =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	4.5	

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$
$$= 1.04E-05 \text{ m/min}$$
$$= 1.50E-02 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Project Name:
Client:

100 Edinburgh Rd, Castlecrag
Built Contracting Pty Ltd

Date:
30-Jul-25
9am

Well No. / Name:

MW2C_2

Depth to equilibrium water level (m bgl):
6.11 m

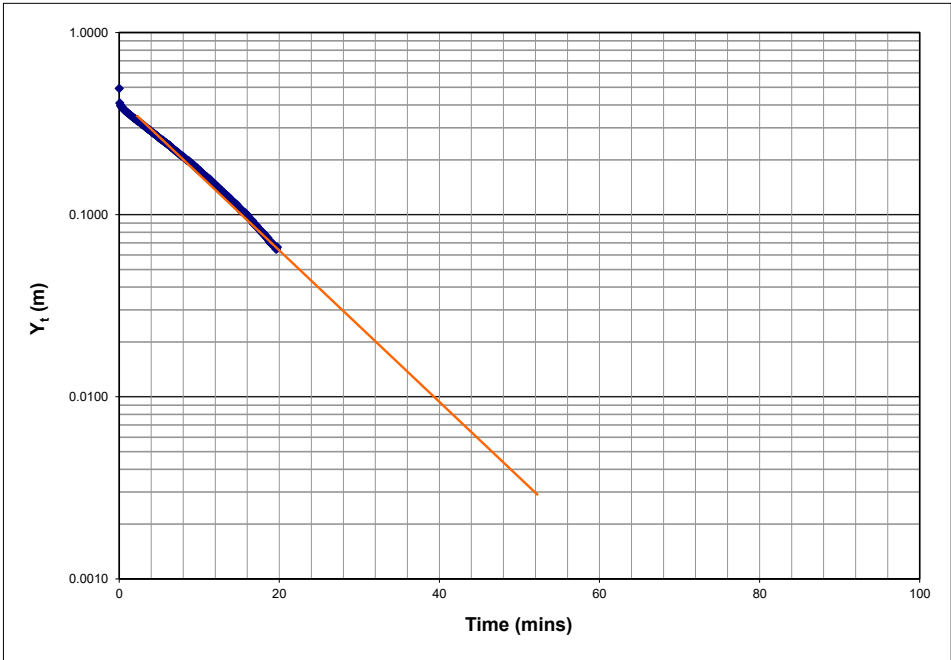
Type of test:

Falling head
Rising head

■

Well Completion:
Fully Penetrating
Partially Penetrating

■



r_c =	casing radius	0.025	If $L_w < H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.69 \text{ m}$
r_w =	radial distance between undisturbed aquifer and well centre	0.051	
L_e =	length of intake	6.5	If $L_w = H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
H =	saturated thickness of aquifer	30	
L_w =	distance b/n water table and bottom of intake	16	
R_e =	effective well radius	2.05	
t =	time	52	
Y_o =	initial drawdown	0.55	
Y_t =	vertical distance between the water level in well at time t and equilibrium level	0.003	
L_e/r_w =		127.4509804	
A =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	4.5	
B =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1	
C =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	4.5	

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$
$$= 1.78E-05 \text{ m/min}$$
$$= 2.56E-02 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Project Name:

Client:

Well No. / Name:

Type of test:

100 Edinburgh Rd, Castlecrag
Built Contracting Pty Ltd

MW2C_3

Falling head

Rising head

Date:

Depth to equilibrium water level (m bgl):

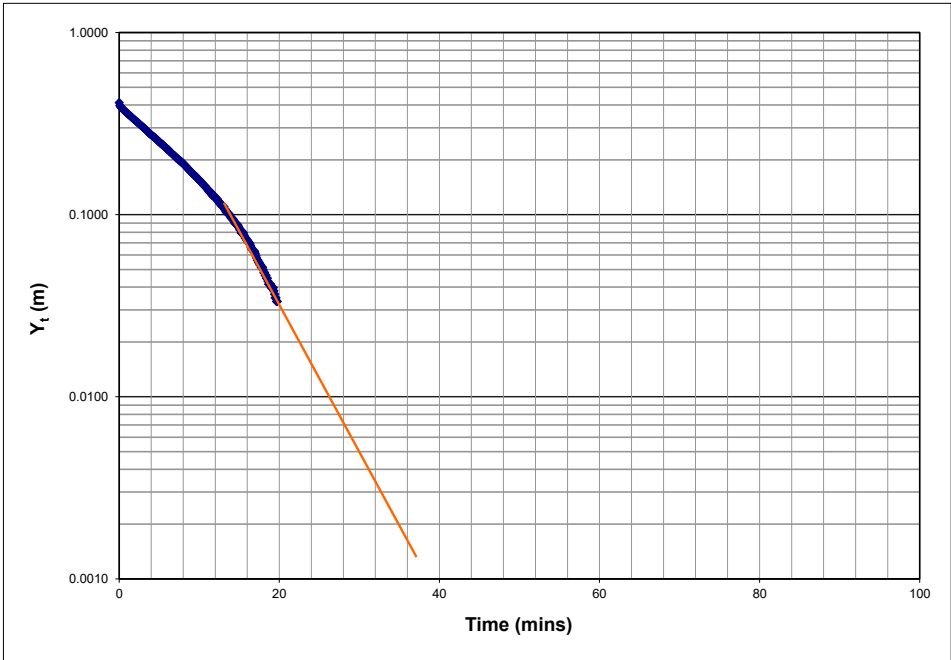
Well Completion:

30-Jul-25
9am

6.17 m

Fully Penetrating

Partially Penetrating



r_c =	casing radius	0.025	If $L_w < H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$$= 3.69 \text{ m}$
r_w =	radial distance between undisturbed aquifer and well centre	0.051	
L_e =	length of intake	6.5	
H =	saturated thickness of aquifer	30	
L_w =	distance b/n water table and bottom of intake	16	
R_e =	effective well radius	2.05	If $L_w = H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$$= L_w < H \text{ m}$
t =	time	32	
Y_o =	initial drawdown	0.41	
Y_t =	vertical distance between the water level in well at time t and equilibrium level	0.003	
L_e/r_w =		127.4509804	
A =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	4.5	
B =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1	
C =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	4.5	

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$
$$= 2.73E-05 \text{ m/min}$$
$$= 3.93E-02 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Project Name:

Client:

Well No. / Name:

Type of test:

100 Edinburgh Rd, Castlecrag

Built Contracting Pty Ltd

MW3C_1

Falling head

Rising head

Date:

30-Jul-25

9am

Depth to equilibrium water level (m bgl):

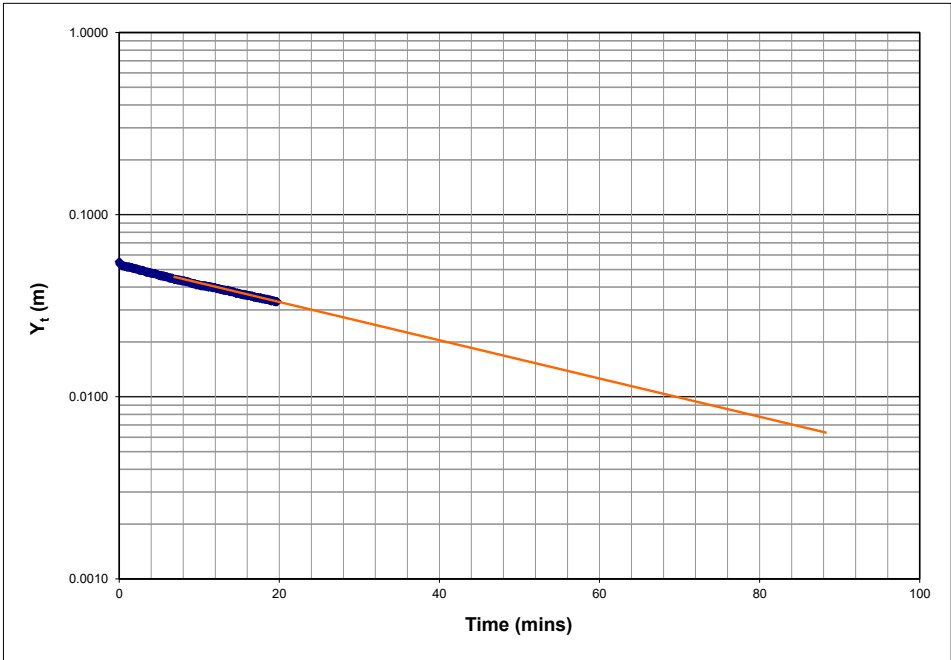
5.91

m

Well Completion:

Fully Penetrating

Partially Penetrating



r_c =	casing radius	0.025	If $L_w < H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A + B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$$= 3.12 \text{ m}$ If $L_w = H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$$= L_w < H \text{ m}$
r_w =	radial distance between undisturbed aquifer and well centre	0.051	
L_e =	length of intake	5	
H =	saturated thickness of aquifer	30	
L_w =	distance b/n water table and bottom of intake	8.5	
R_e =	effective well radius	1.16	
t =	time	68	
Y_o =	initial drawdown	0.05	
Y_t =	vertical distance between the water level in well at time t and equilibrium level	0.01	
L_e/r_w =		98.03921569	
A =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	4.25	
B =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1	
C =	dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	4	

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$
$$= 4.62E-06 \text{ m/min}$$
$$= 6.66E-03 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Project Name:

Client:

Well No. / Name:

Type of test:

100 Edinburgh Rd, Castlecrag

Built Contracting Pty Ltd

MW3C_2

Falling head

Rising head

Date:

30-Jul-25

9am

Depth to equilibrium water level (m bgl):

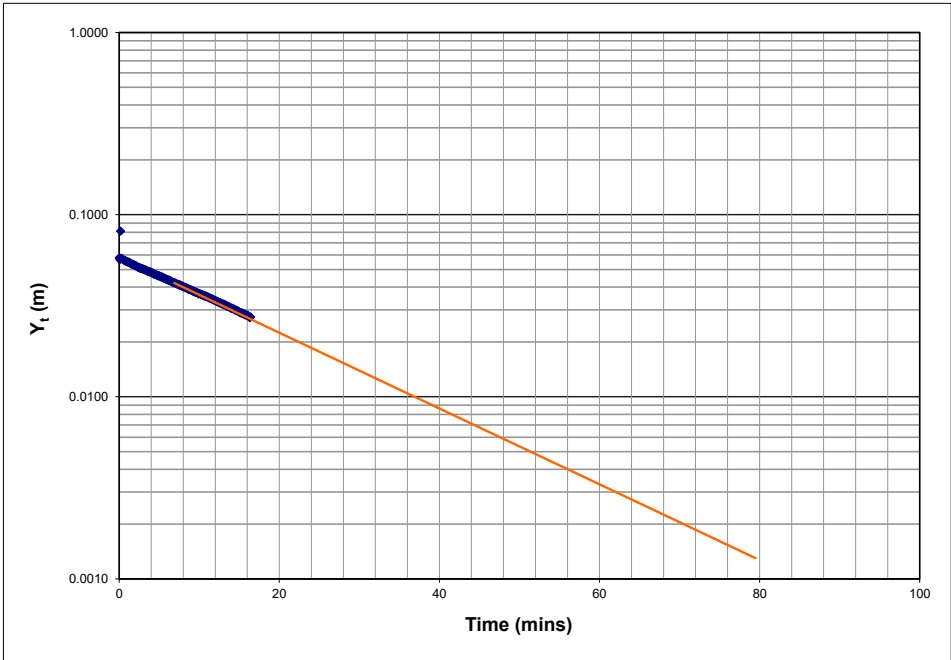
5.94

m

Well Completion:

Fully Penetrating

Partially Penetrating



r_c	= casing radius	0.025	If $L_w < H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$$= 3.12 \text{ m}$ If $L_w = H$ $\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$$= L_w < H \text{ m}$
r_w	= radial distance between undisturbed aquifer and well centre	0.051	
L_e	= length of intake	5	
H	= saturated thickness of aquifer	30	
L_w	= distance b/n water table and bottom of intake	8.5	
R_e	= effective well radius	1.16	
t	= time	56	
Y_o	= initial drawdown	0.05	
Y_t	= vertical distance between the water level in well at time t and equilibrium level	0.004	
L_e/r_w	=	98.03921569	
A	= dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	4.25	
B	= dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1	
C	= dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	4	

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$
$$= 8.81E-06 \text{ m/min}$$
$$= 1.27E-02 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Project Name: 100 Edinburgh Rd, Castlecrag
Client: Built Contracting Pty Ltd

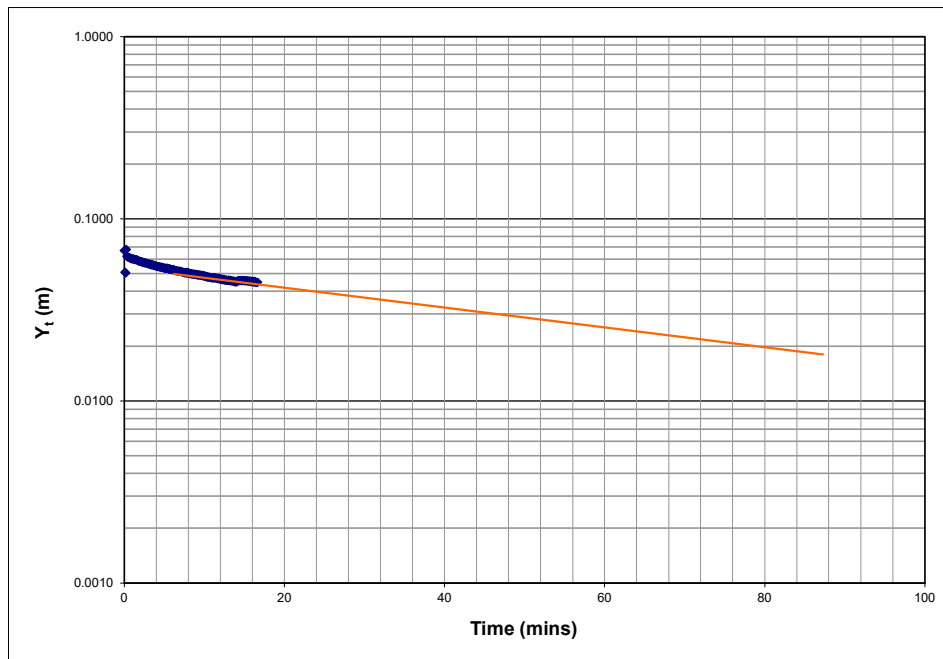
Date: 30-Jul-25
9am

Well No. / Name: MW1C_1

Depth to equilibrium water level (m bgl): 8.81 m

Type of test: Falling head
Rising head

Well Completion: Fully Penetrating
Partially Penetrating



r_c = casing radius	0.025	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$
r_w = radial distance between undisturbed aquifer and well centre	0.051		
L_e = length of intake	12.2	If $L_w = H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
H = saturated thickness of aquifer	30		
L_w = distance b/n water table and bottom of intake	14.5	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$
R_e = effective well radius	2.39		
t = time	80	If $L_w = H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
Y_o = initial drawdown	0.06		
Y_t = vertical distance between the water level in well at time t and equilibrium level	0.02	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$
L_e/r_w =	239.2156863		
A = dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	7	If $L_w = H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + C \cdot (L_e/r_w)^{-1}\}^{-1}$ $= L_w < H \text{ m}$
B = dimensionless co-efficient that is a function of L_e/r_w , and $L_w < H$	1.5		
C = dimensionless co-efficient that is a function of L_e/r_w , and $L_w = H$	8.5	If $L_w < H$	$\ln(R_e/r_w) = \{1.1 \cdot [\ln(L_w/r_w)]^{-1} + A+B \cdot \ln[(H-L_w)/r_w] \cdot (L_e/r_w)^{-1}\}^{-1}$ $= 3.85 \text{ m}$

$$K = [r_c^2 \cdot \ln(R_e/r_w)] 2L^{-1} \cdot t^{-1} \cdot \ln(Y_o/Y_t)$$

$$= 1.35E-06 \text{ m/min}$$

$$= 1.95E-03 \text{ m/d}$$

Ref. Bouwer H. 1989. *The Bouwer and Rice Slug Test - an Update*. Ground Water. Vol.27, No.3. May - June 1989.
Kruseman G.P. and N.A. de Ridder. 1991. *Analysis and Evaluation of Pumping Test Data*. 2nd Ed. Int. Inst. For Land Reclamation and Improvement. Wageningen. The Netherlands.

Appendix C

Rock Core Photographs (MW1C, MW2C and MW3C)

Approximate Borehole Location Plan (MW1C, MW2C and MW3C)

CASTLECRAG
MW1C



CASTLECRAG
MW1C

21

22



END 22.2M

MW1C

MW1C
3m Sample

MW1C
4m Sample

MW1C
5m Sample



CASTLECRAG
MW1C



CASTLECRAG
MW1C

CASTLECrag
MW2C



CASTLECRAG
MW2C

2.49 ~~ROCK~~

3m

4m

5m

6m



CASTLECrag
MW2C

7m

4m

2m

10m

11m













CASTLECRAG
MW1C

MW1C

Surface RL 86.5 m

Depth 21.5 m deoth

Screen from 10-21.5m



MW2C

Surface RL 81.5 m

Depth 16.5 m deoth

Screen from 10-16.5m

MW3C

Surface RL 80 m

Depth 14 m deoth

Screen from 9-14m

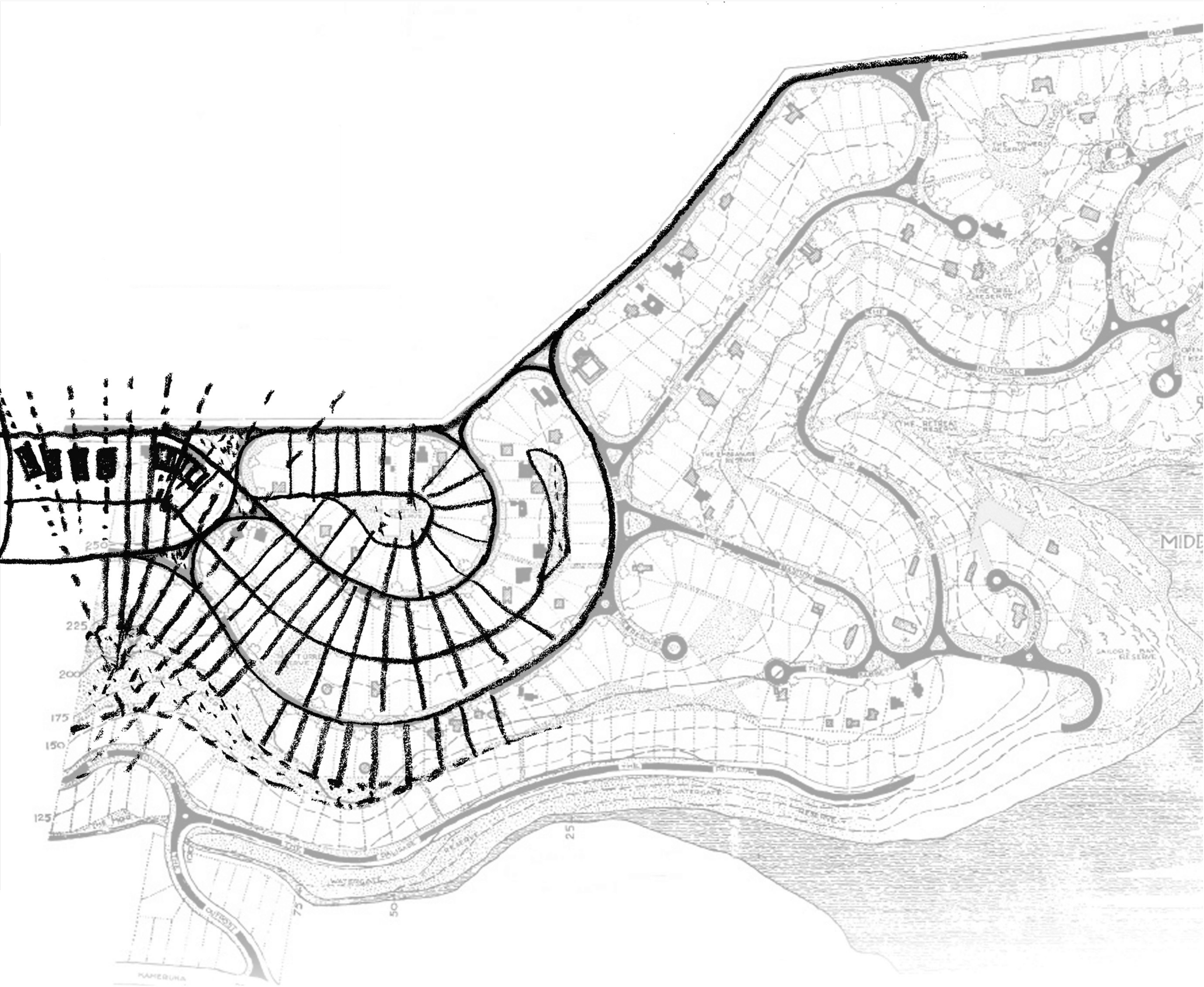
Appendix D

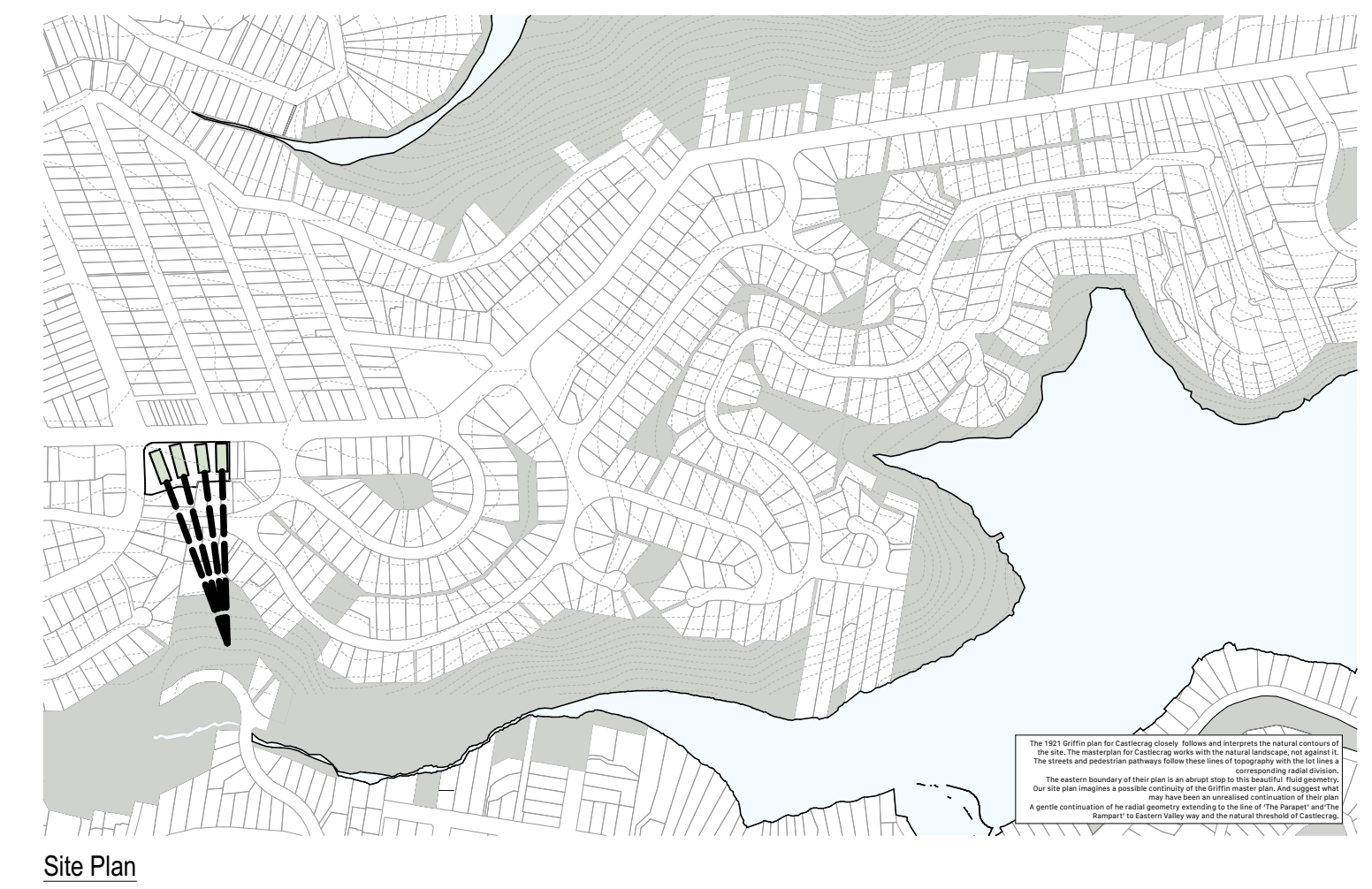
Architectural Drawings

DEVELOPMENT APPLICATION

100 Edinburgh Road, Castlecrag

Dwg No.	Title
1000 Cover Sheet	
1000	Cover Sheet
1100 General	
1100	Site Context Plan
1101	Site Survey
1102	Site Analysis Plan
1103	Site Plan
1302	Site Demolition Plan (DA2)
2000 Plans	
2000	GA Plans - Basement 4
2001	GA Plans - Basement 3
2002	GA Plans - Basement 2
2003	GA Plans - Basement 1
2004	GA Plans - Lower Ground Floor
2005	GA Plans - Ground Floor
2006	GA Plans - Mezzanine
2007	GA Plans - Level 1
2008	GA Plans - Level 2
2009	GA Plans - Level 3
2010	GA Plans - Level 4
2011	GA Plans - Level 5 - 9
2016	GA Plans - Level 10
2017	GA Plans - Level 11 Roof
3000 Elevations	
3000	Elevations - North
3001	Elevations - South
3002	Elevations - East
3003	Elevations - West
3004	Elevations - East Inner
3005	Elevations - West Inner
3006	Elevations - Materials Board
4000 Sections	
4000	Section A , D
4001	Section 3
9000 Schedules & Diagrams	
9000	GFA Plans
9001	Apt Mix / Area Schedules
9101	Adaptable Apartments
9601	Solar Analysis - Shadow Diagrams - June 21
9602	Solar Analysis - Shadow Diagrams With Trees - June 21
9603	Solar Analysis - Sun Eye - June 21
9604	Solar Access
9605	Ventilation
9606	Communal Open Space
9607	Deep Soil



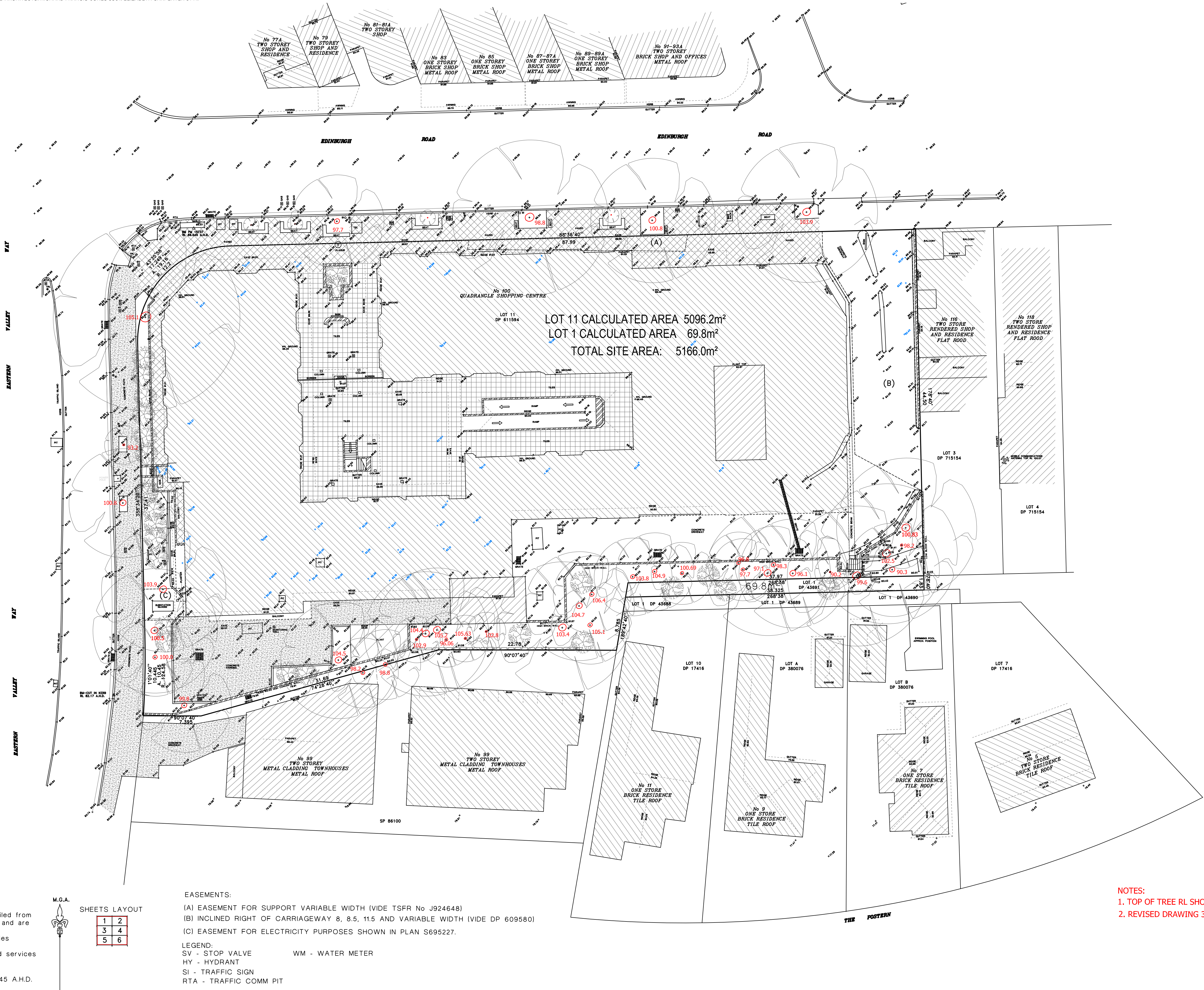


0
5/11/2025

1100 — Site Context Plan
Conquest — The Quadrangle - Castlecrag

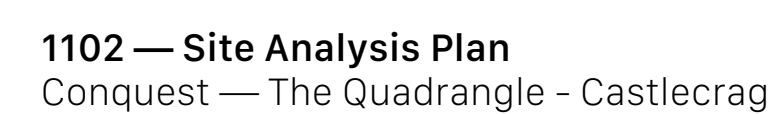
Scale
1:200 @ A1





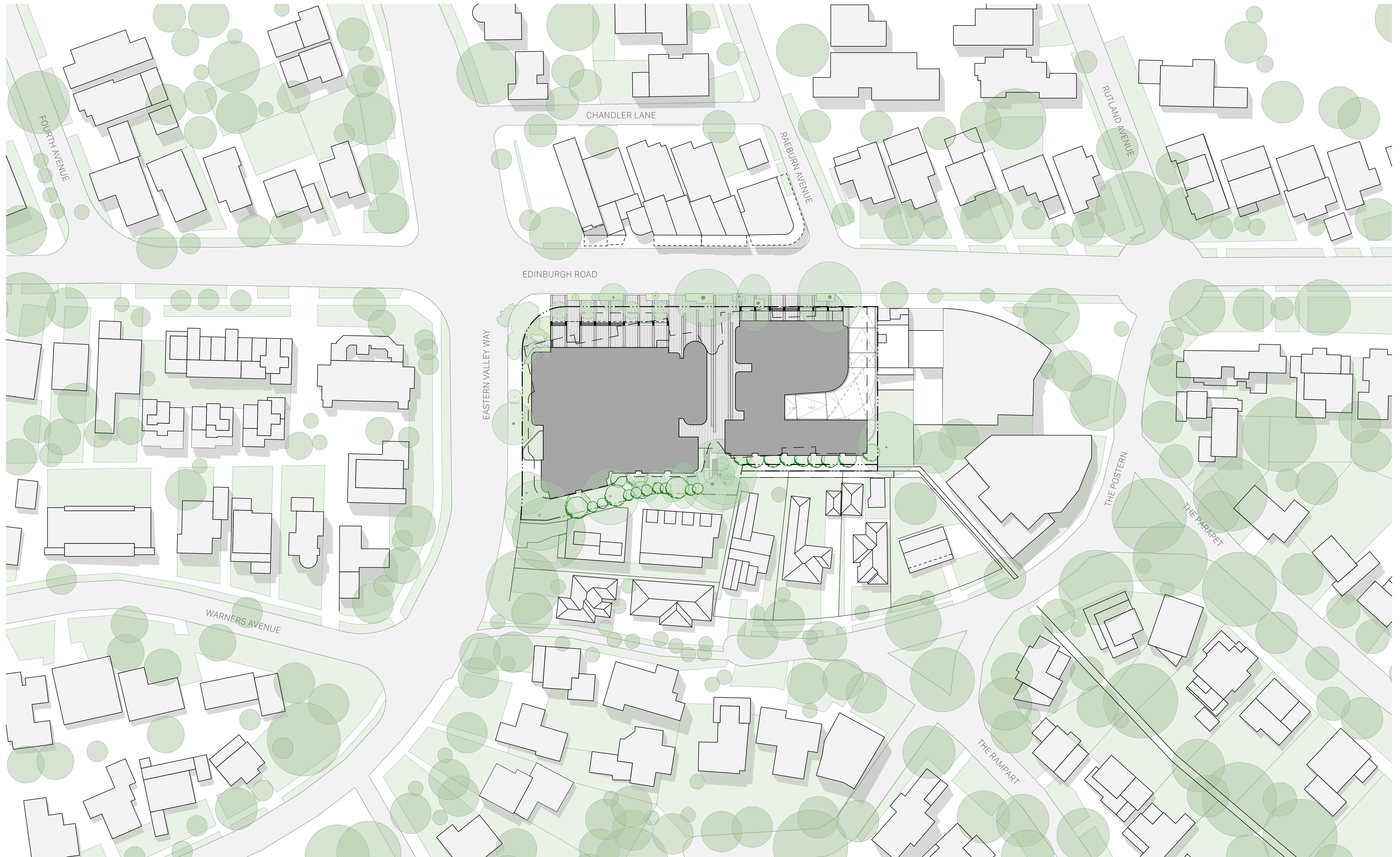
NOTES:

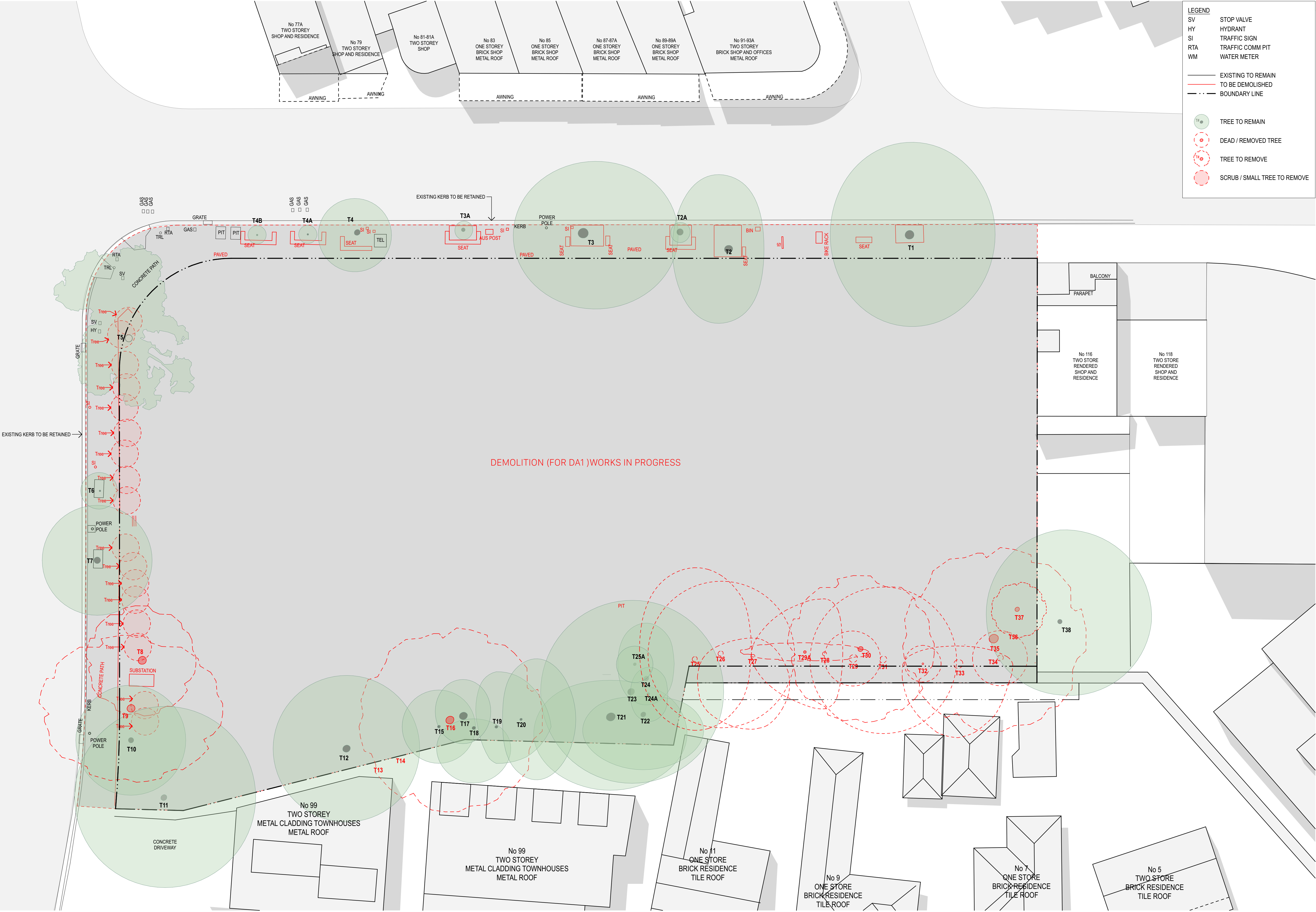
- TOP OF TREE RL SHOWN IN RED
- REVISED DRAWING 33216-03 TOP OF TREES RL'S ADDED

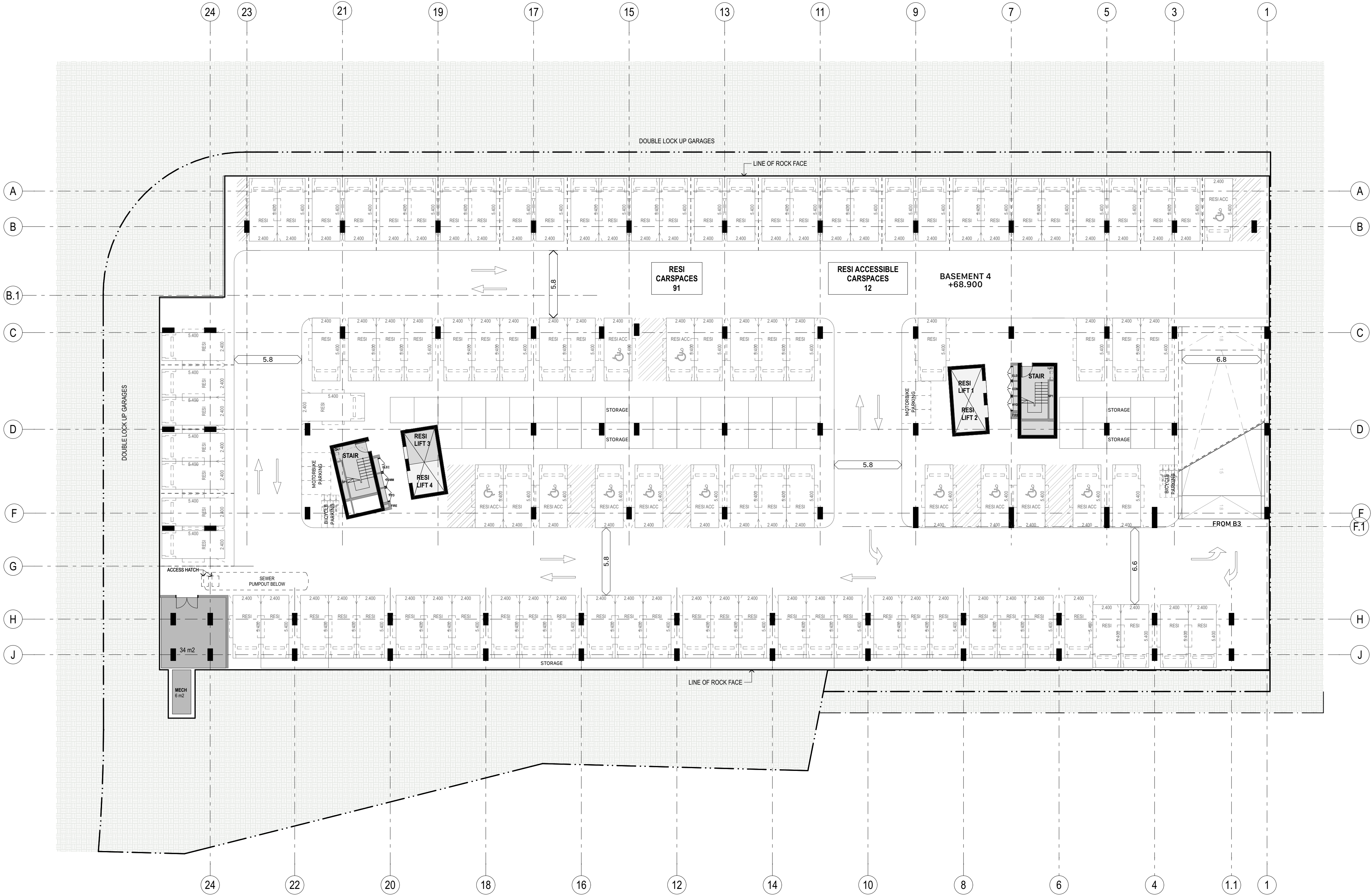


0 2.5 5 10m





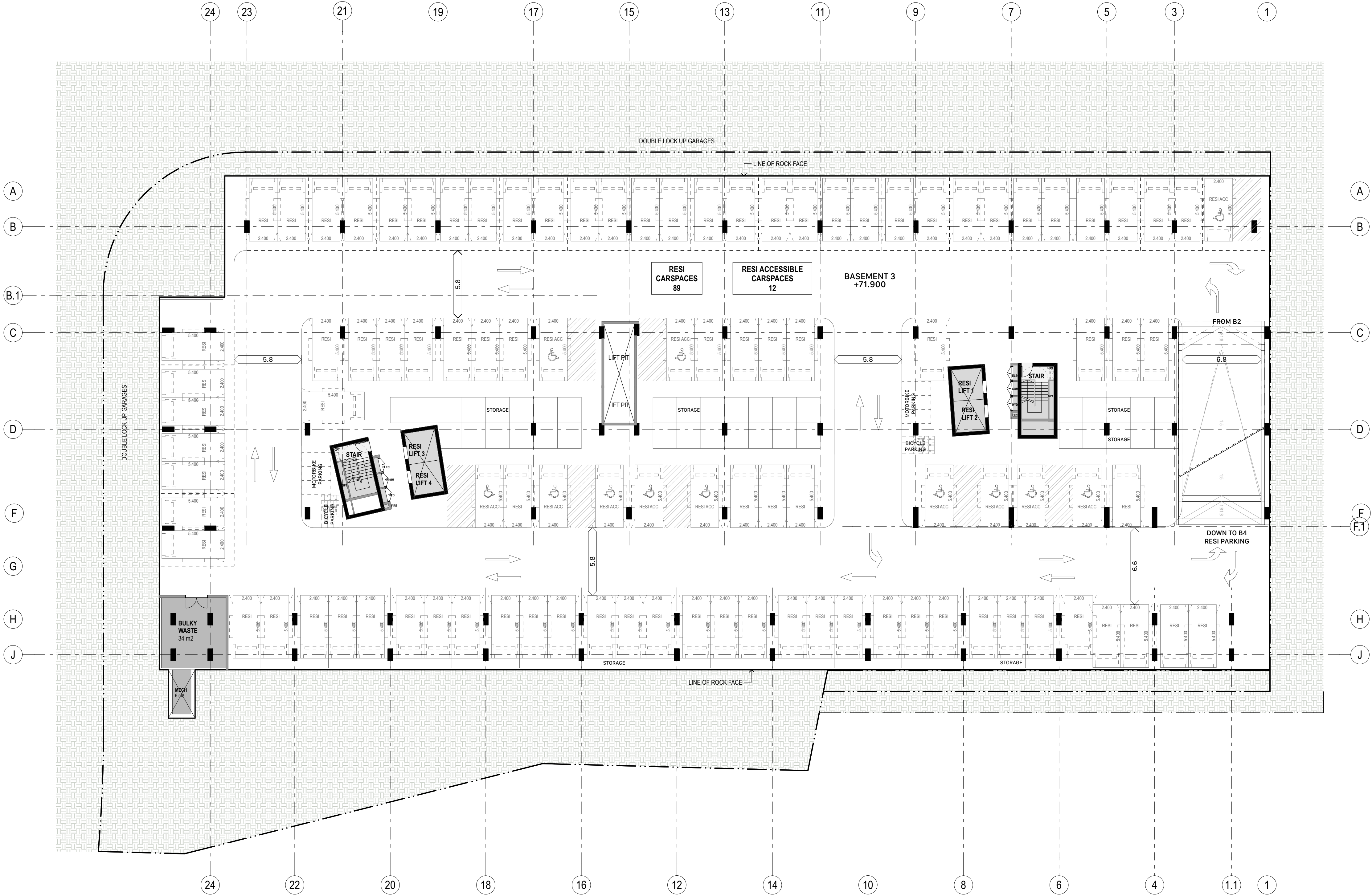




B4 PARKING SUMMARY		
Residential	103	
(includes 12 accessible parking spots)		

Motorbike	6
-----------	---

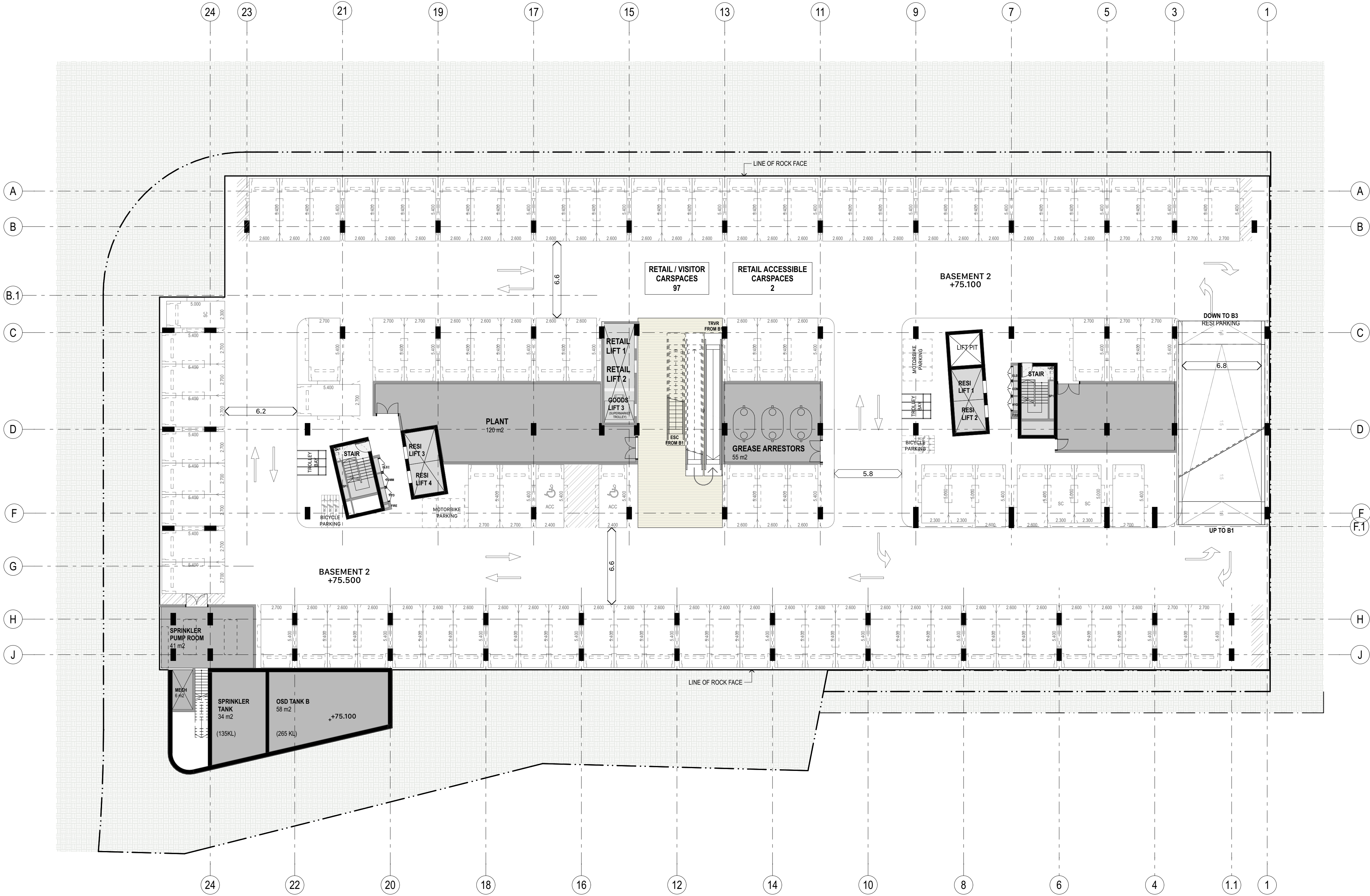




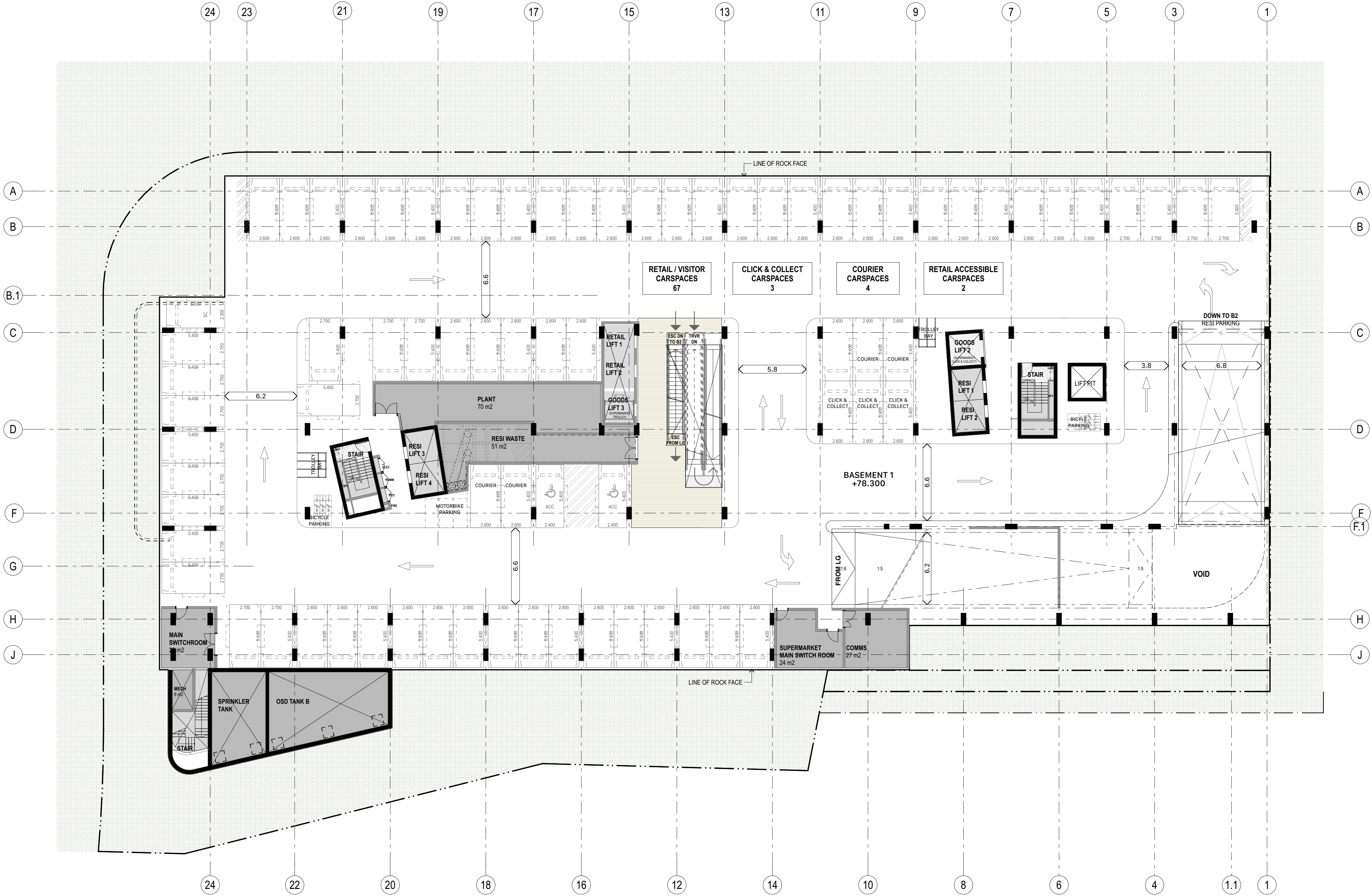
B3 PARKING SUMMARY	
Residential	101
(includes 12 accessible parking spots)	

Motorbike	6
-----------	---





B2 PARKING SUMMARY	
Retail	97
Retail - Accessible	2
Total	99
Motorbike	6



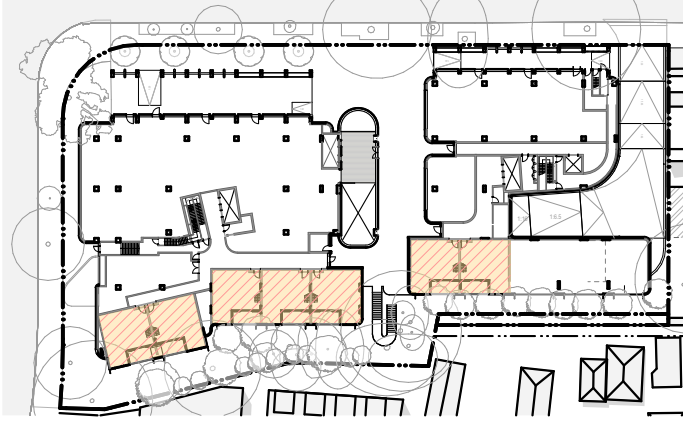
B1 PARKING SUMMARY	
Retail	67
Retail - Accessible	2
Retail - Click & Collect	3
Retail - Courier	4
Total	
76	
Motorbike	
3	

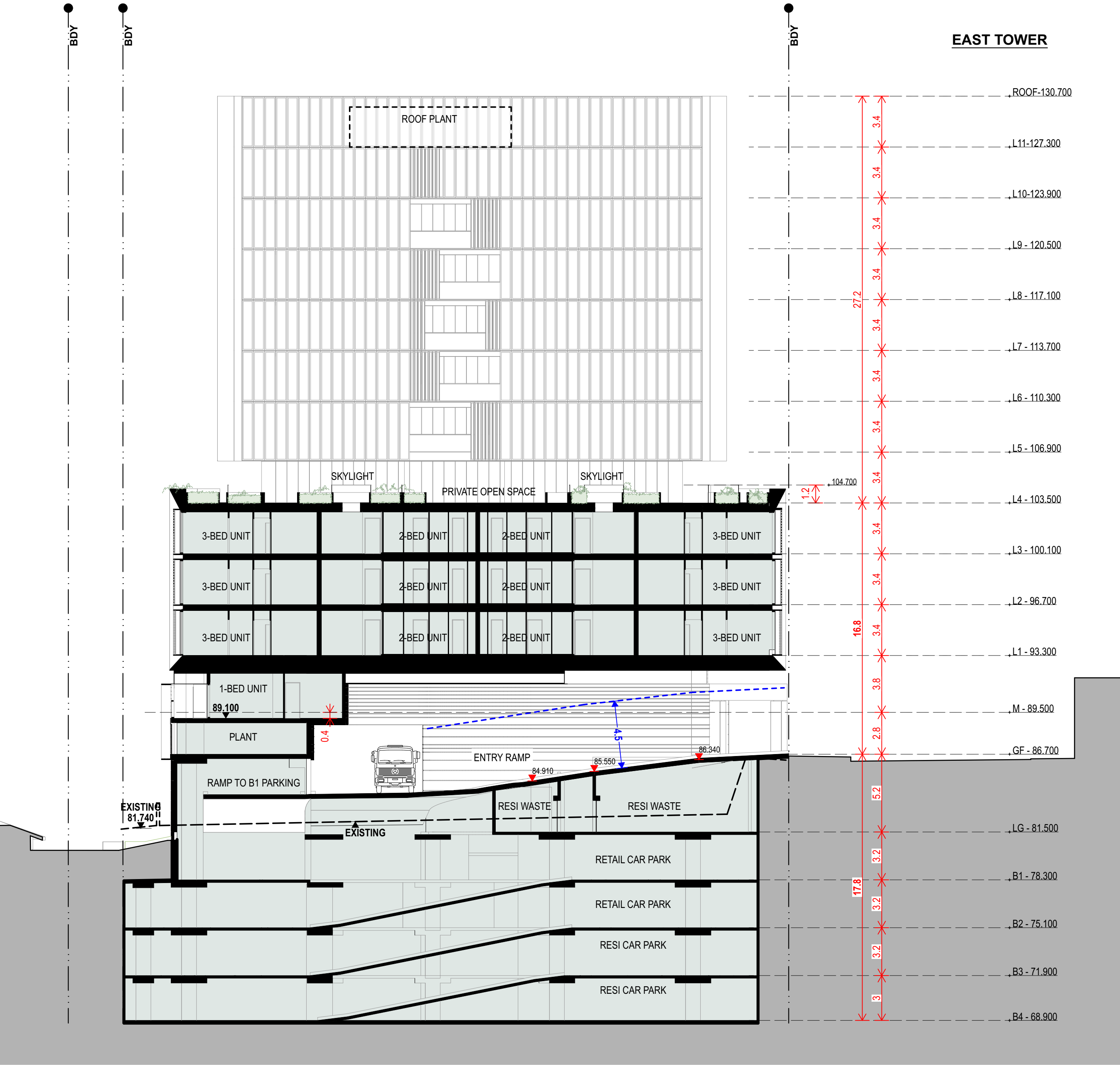
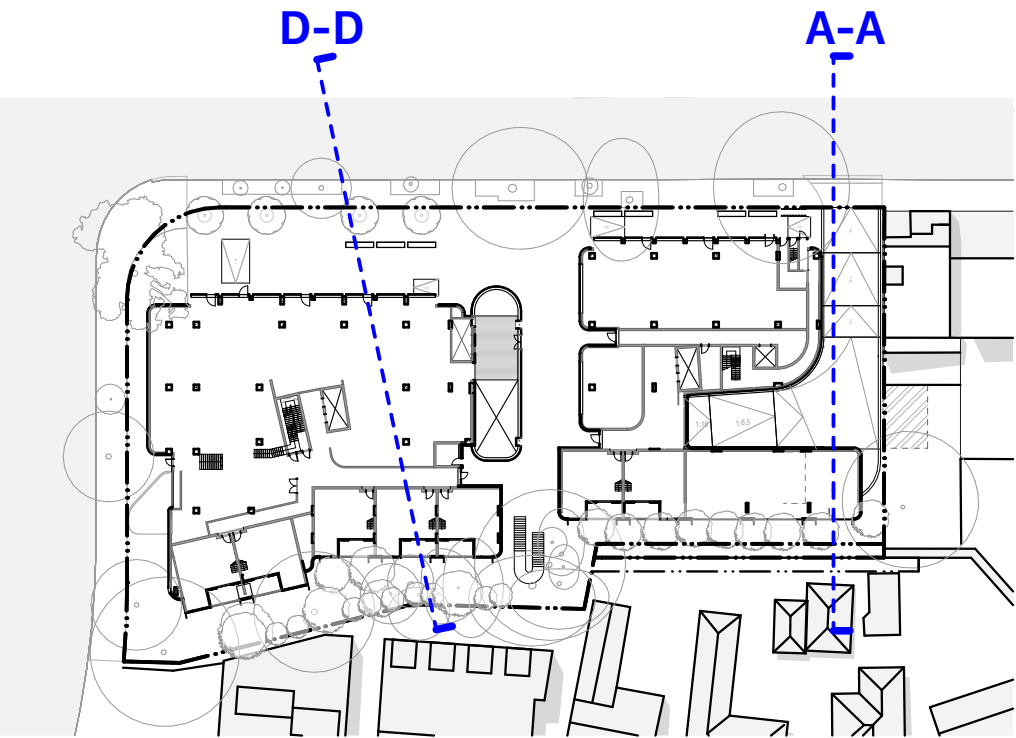




Legend

- Multi-Level Unit
- Affordable Housing

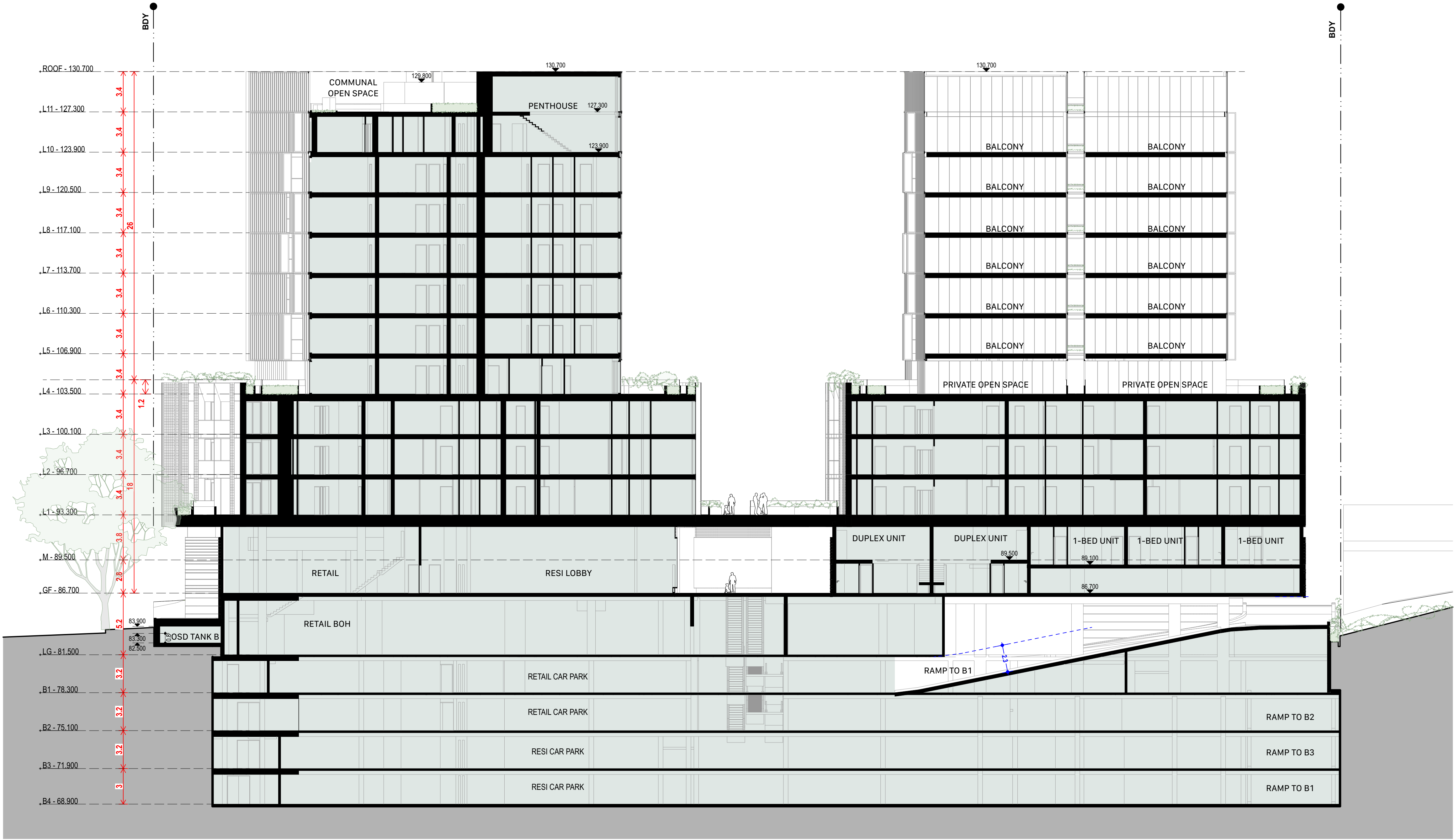
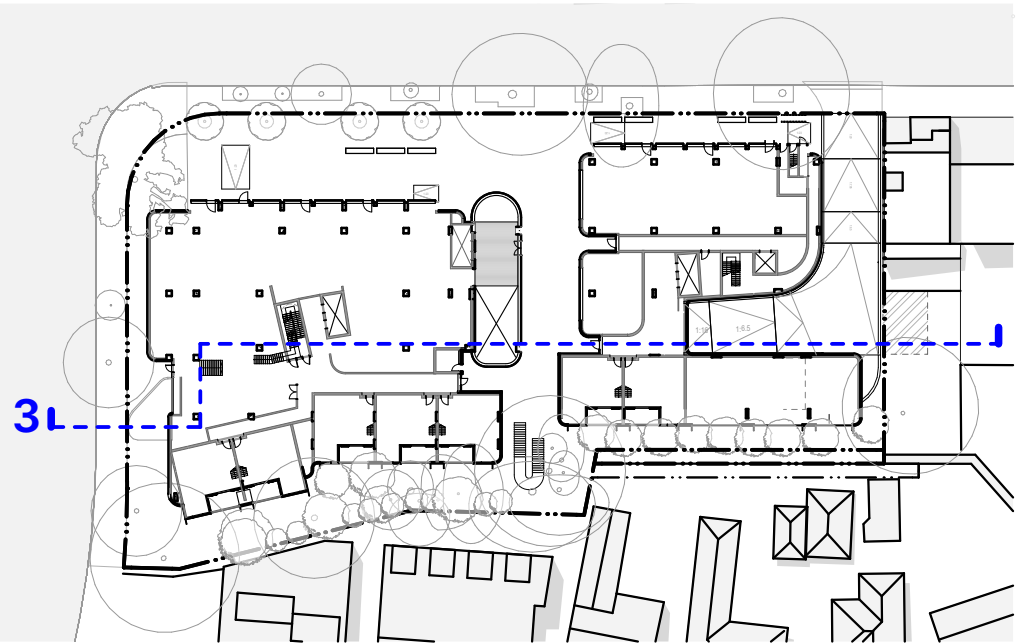




Section A



Section D



Section 3