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Project 225758.00
13 May 2024
JCP:cj

This Report on Geotechnical Investigation is submitted to the Department of Planning, Infrastructure and Housing (DPIH) in support of a State Significant Development Application (SSDA) (SSD-61000021) for a new build-to-rent housing (BTR) development at 146 Arthur Street, North Sydney, NSW. DP confirm this Report on Geotechnical Investigation in part addresses the requirement of SEAR No.13 (limited to acid sulphate soils). A number of comments that address specific state and local legislation, policies, and guidelines are outlined within the relevant sections of the report.

It should be noted that Douglas' advice is based upon the conditions encountered during this investigation. 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. Considering this, DP confirm that none of the information contained in the Report on Geotechnical Investigation is intentionally false or misleading.

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Report on Geotechnical Investigation

Proposed Mixed Use Build-To-Rent Development

146 Arthur Street, North Sydney NSW

Prepared for The Trustee for JW Argyle Trust

Project 225758.00

26 April 2024

Douglas Partners
GROUNDED EXPERTISE

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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	Jean-Christo Pyper	26 April 2024
Reviewer	Charles Marais Peter Hunt	26 April 2024

Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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Report on geotechnical investigation
Proposed Mixed Use Build-To-Rent Development
146 Arthur Street, North Sydney NSW

1. Introduction

This report presents the results of a geotechnical investigation undertaken for a Proposed Mixed Use Build-To-Rent (BTR) Development at 146 Arthur Street, North Sydney NSW. The geotechnical investigation was carried out for the Development Application (DA) stage and to provide information for concept design. The works was commissioned in an email dated 26 October 2023 by Aqualand on behalf of The Trustee for JW Argyle Trust.

It is understood that the proposed development of the site includes the demolition of the existing structure with four basement levels and the construction of a high-rise 53-level residential, build-to-rent tower (refer Appendix C and D). It is further understood that the proposed development includes an additional ~7.4 m of excavation below the existing basement level (Finish Floor Level (FFL) at RL 46.3 m) down to a new Bulk Excavation Level (BEL) at ~RL 38.95 m.

The aim of the geotechnical investigation was to provide preliminary geotechnical advice, comprising the following:

- Method and results of the field work and laboratory tests.
- Description of the subsurface conditions and groundwater.
- Geotechnical Model.
- Excavation characteristics.
- Comments on vibration and vibration monitoring.
- Suitable shoring options and retaining structures.
- Ground Anchors.
- Suitable foundation systems and design parameters.
- Comment on settlement.
- Other anticipated geotechnical issues, including comments relating to developments near Transport for New South Wales (TfNSW) assets.
- Inspection requirements
- Additional geotechnical services required.

The geotechnical investigation included the drilling of two boreholes and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

2. Site Description

The site is located at 146 Arthur Street, North Sydney, and comprises an approximately rectangular lot over 1,600 m^2 (refer Figure 1 below and survey drawings provided in Appendix B). The site is bounded between Little Walker Street to the west and Arthur Street to the east (and beyond that, Warringah Freeway), Dorris Fitton Park to the north and a multi-storey building to the south (140 Arthur Street). There are two street frontages, approximately 54 m long along Little Walker Street and 49 m long along Arthur Street. The site slopes from northwest to southeast with approximately 8 m difference between the street frontages of Little Walker Street RL[1] 56.7 m) and Arthur Street (~RL 48.5 m), based the survey drawing prepared by Veris Australia Pty Ltd.

It is understood from the technical due diligence report prepared by Knight Frank (refer Appendix C) that the existing building on site comprise three basement levels with some of the B3 level sandstone faces still exposed. This was confirmed by the site visit during the geotechnical investigation.

Both Arthur Street and the Warringah Freeway are listed as a State-owned roads (refer to Road Network Classifications (nsw.gov.au)).

The closest body of water to the site is Neutral Bay which is located approximately 600 m towards the south east.

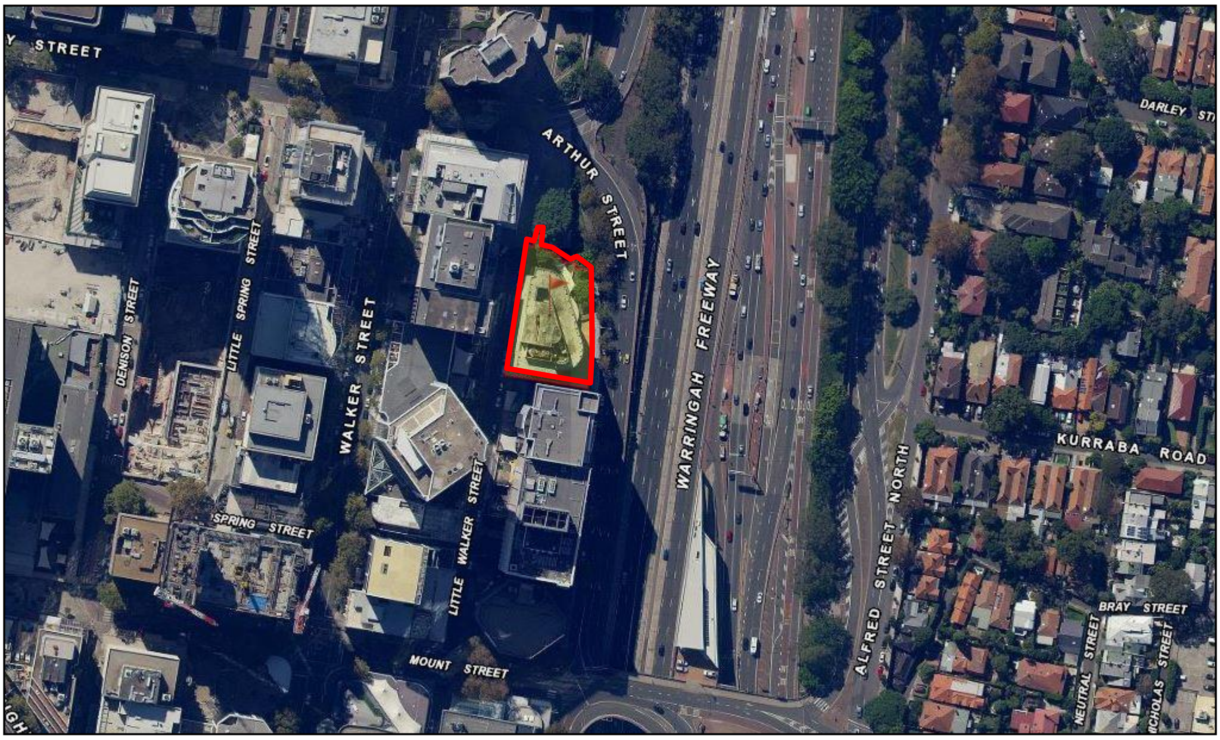

Figure 1: Aerial Photograph of Site

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[1] Reduced Level (RL) in metres (m) relative to the Australian Height Datum (AHD).

3. Review of Published Data

3.1 Geology

Reference to the Sydney 1:100 000 Series Geological Sheet 9130 indicates that the site is underlain by the Triassic Aged Hawkesbury Sandstone (see Figure 2). Hawkesbury Sandstone typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses. The Hawkesbury Sandstone typically contains orthogonal joint sets:

- Set 1 – NNE striking joints dipping 75° to 90° to the west and east, spaced between 1 to 10 m, but can be spaced closer in the joint swarms. These joints are very prominent and are persistent over many metres, both horizontally and vertically.
- Set 2 – ESE striking joints dipping 75° to 90° to the north and south. These joints are less common, generally strata bound (discontinuous).

Low angle (25° to 30°) thrust faults, commonly dipping to the north and south, are also relatively common. It is noted that the site is orientated sub-parallel to north and therefore the eastern and western site boundaries are orientated sub-parallel to Joint Set 1.

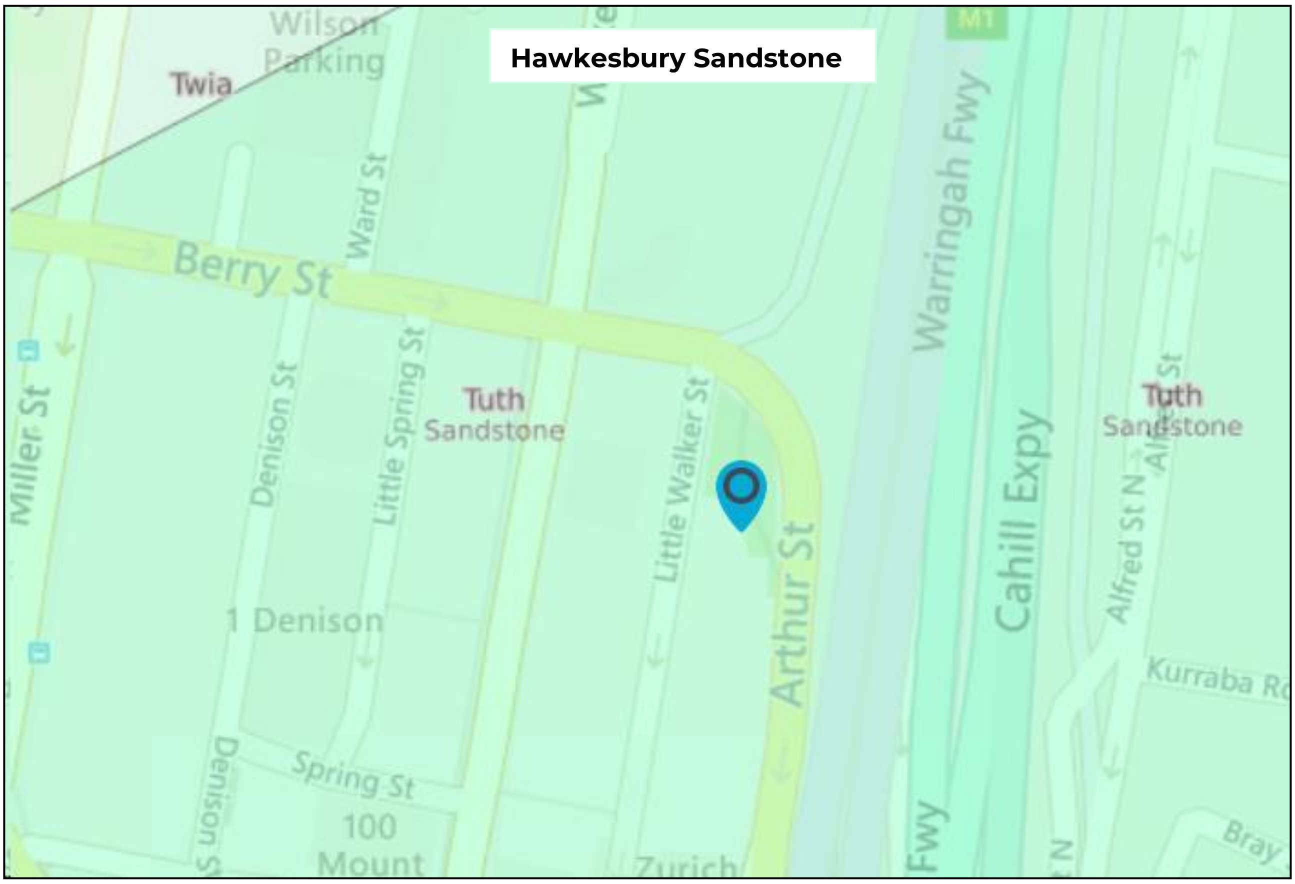

Figure 2: Extract from Sydney 1:100,000 Geological Series Sheet 9130

3.2 Hydrogeology

No registered groundwater bores are located within 500 m of the site that provide useful information on groundwater levels. DP's groundwater observations from previous projects in the area is summarised in DP's desktop report (ref: 225758.00.R.002.Rev0).

It is noted that groundwater levels vary over time due to climatic and human influences and will temporarily rise following periods of prolonged rainfall.

3.3 Acid Sulphate Soils

Reference to the regional Acid Sulphate Soils (ASS) Risk map indicates that the site is located within an area that is considered not likely to contain ASS.

4. Fieldwork Methods

Field work comprised the drilling two of the five proposed boreholes (BH1 and BH2) at the locations shown on DP Drawing 1 in Appendix E using hand-portable drilling equipment. Detailed borehole logs and core photographs are provided in Appendix F. BH1 and BH2 was drilled to depths of 7.6 m and 9.2 m, respectively.

Boreholes commenced using concrete coring equipment and hand tools to remove the existing concrete slab and sub-slab filling. Boreholes were cased and continued into the underlying rock using diamond drilling to obtain NMLC sized core samples of the bedrock for geotechnical logging and strength testing.

Point Load Strength Index (Is(50)) tests were conducted in cores at approximately 1 m depths, where the rock core was suitable for testing. Selected rock core samples were sent to a laboratory for Uniaxial Compressive Strength (UCS) testing and aggressivity testing.

The ground surface levels at the boreholes were inferred from the survey drawings provided (refer Appendix B for survey drawings). The ground surfaces were provided as Reduced Levels (RL) in metres relative to Australian Height Datum. The locations of the boreholes were estimated from existing site features.

The boreholes were reinstated with a concrete topping layer.

Dataloggers were also installed in the two water collection sumps (refer Appendix E for locations of sumps) which forms part of the building's existing sump and pump groundwater dewatering system.

5. Field Work Results

5.1 Subsurface Conditions and Ground Model

Details of the subsurface conditions encountered are given in the borehole logs included in Appendix F, with notes defining classification methods and descriptive terms. Photographs of the rock cores were taken and are presented with the relevant borehole logs.

The sequence of subsurface materials encountered within the boreholes, in increasing depth order, may be summarised as follows:

Pavement / Fill:	Generally, 110-120 mm thick reinforced concrete overlying 130 mm - 160 mm thick sand filling, with sandstone gravel to depths of 240 mm to 290 mm.
Sandstone (Hawkesbury Sandstone):	Medium and high strength with very low and low strength bands, slightly weathered with moderately weathered band then fresh, slightly fractured to unbroken sandstone.

5.2 Groundwater Readings

No free groundwater was observed during auger drilling to depths of up to 0.29 m. The use of water for rotary drilling and coring prevented observation of groundwater within the rock.

5.3 Basement Inflow Monitoring

The manual water level readings taken in the two sumps are outlined in Table 1.

Table 1: Standing Water Levels in Sump

Sump No.	Dimensions (Length x Width x Depth, m)	Date	Surface RL (m, AHD)	Manual Water Level Measurements in Sumps	
				Depth below FFL (m, bgl)	Reduced Level (m, AHD)
Sump 1*	0.5 x 0.5 x 1.15	20/12/2023	46.3	Dry	-
		10/01/2024		Dry	-
Sump 2*	0.5 x 0.5 x 0.75	20/12/2023	46.3	0.73	RL 45.57 m
		10/01/2024		Dry	-

* Data loggers installed in sumps 100 mm above the base of the sump

Dataloggers were also installed in the two water collection sumps after the initial reading to allow long-term monitoring. This report will be updated after six months of continuous monitoring.

6. Laboratory Testing

6.1 Aggressivity Testing

Laboratory testing was carried out on two rock samples to determine aggressiveness for exposure classification of buried concrete and steel elements.

The results of the laboratory testing are summarised in Table 2. The detailed laboratory test reports are given in Appendix G.

Table 2: Summary of Chemical Laboratory Test Results

Borehole	Material	Depth (m)	Conductivity (µS/cm)	pH	Cl (mg/L or mg/kg)	SO_4 (mg/L or mg/kg)
BH1	Sandstone	0.9	23	5.4	<10	21
BH2	Sandstone	1.51	18	5.3	<10	20

Notes: Cl = Chloride ion concentration, SO4 = Sulphate ion concentration, PPM = Parts Per Million

The results of the aggressivity testing have been compared with Australian Standard (AS 2159-2009), Table 6.4.2 (C): "Exposure Classification for Concrete Piles – Piles in Soil and Water". The results indicate the samples are mildly aggressive.

6.2 Point Load Index Testing

The results of point load index testing ($Is_{(50)}$), carried out at regular intervals on rock cores, are shown on the respective borehole logs in Appendix F. The results show $I_{s(50)}$ values in the range of 0.2 to 1.8 MPa, indicating that the rock tested ranged from low to high strength (refer figure 3 below). Note that point load testing can be inaccurate in weak rock.

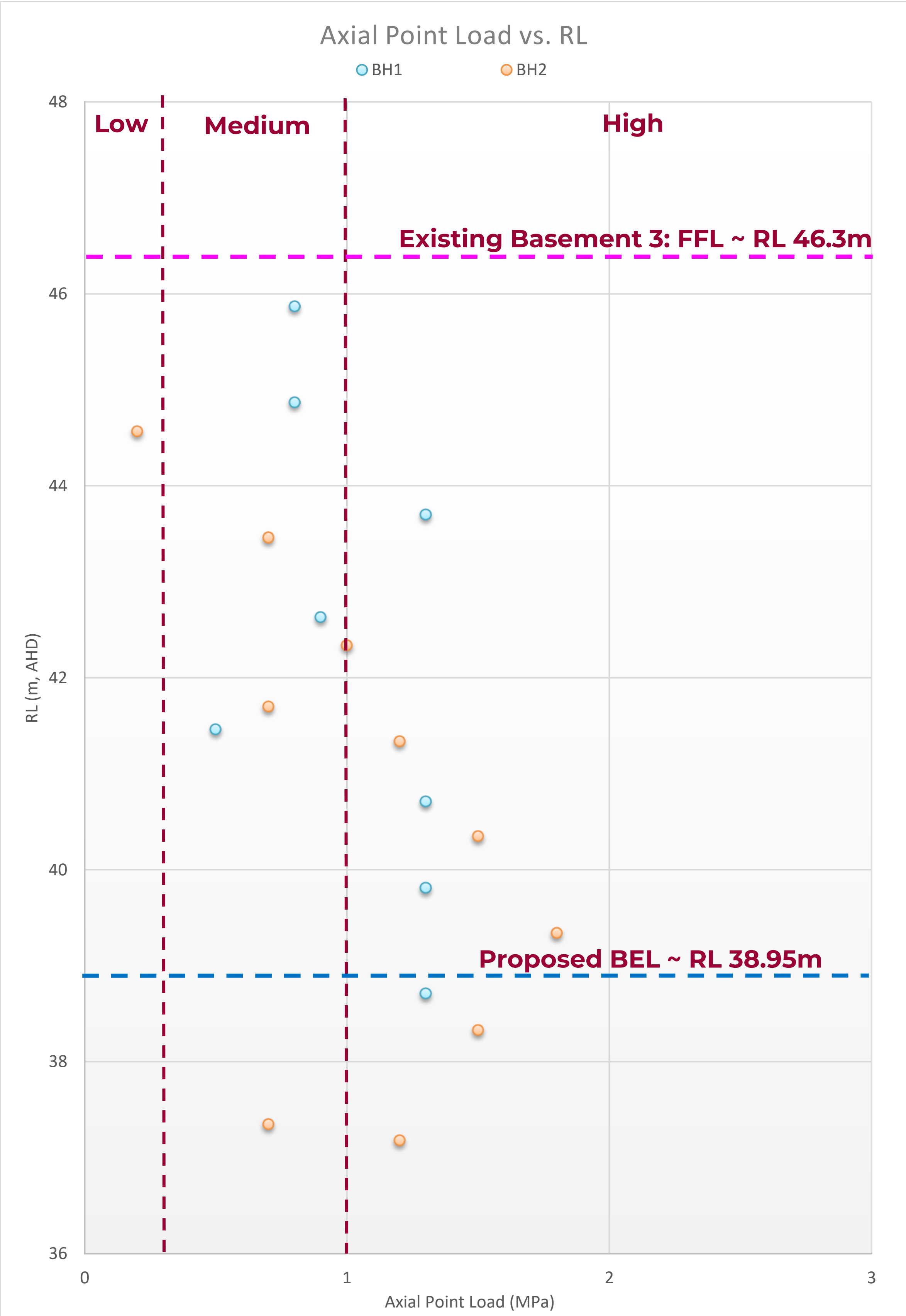

Figure 3: Axial Point Load Values Vs RL (m, AHD)

6.3 Uniaxial Compressive Strength and Deformation Tests

Uniaxial compressive strength (UCS) and deformation testing was carried out on six samples from various boreholes. The sample deformation was recorded during testing to provide data on the elastic modulus and Poisson's ratio.

The results of UCS testing are presented in Table 3 below, with the detailed reports provided in Appendix E.

Table 3: Results of UCS and Deformation Testing

Bore	Depth (m)	Uniaxial Compressive Strength (MPa)	Tangent		Secant	
			Elastic Modulus (GPa)	Poisson's Ratio	Elastic Modulus (GPa)	Poisson's Ratio
BH1	6.53	28	5.9	0.14	3.2	0.13
BH2	6.11	13	6.0	0.11	3.9	0.10

The results presented in table 3 are typical for medium to high and high strength Hawkesbury Sandstone.

7. Geotechnical Model

Geotechnical cross-sections are presented in Sections A-A' and B-B' in Drawings 2 and 3 in Appendix D. The interpreted geotechnical unit boundaries are shown between boreholes. It should be noted that the subsurface conditions are only accurate at the borehole locations. The 'dashed' lines representing the units are inferred from the borehole information, and therefore not necessarily correct.

Refer to DP Desktop Study report (225758.00.R.001.Rev) for anticipated soil levels at the site (boreholes positioned within the existing lowest basement level).

A summary of the geotechnical units is provided in Table 4.

Table 4: Summary of Geotechnical Model

Geotechnical Unit	Description	Detailed Description
Unit A	Pavement /Fill	Fill comprising sand with sandstone gravel directly below the reinforced concrete slab.
Unit B	Class III Sandstone	Sandstone bedrock of generally medium strength with very low and low strength bands, mainly slightly weathered with some moderately weathered bands, fractured to slightly fractured.
Unit C	Class I/II Sandstone	Sandstone of medium to high and high strength, mainly fresh, slightly fractured to unbroken.

Note: Rock Class in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech Jrnl., Dec, 1998

No seepage was observed in the investigation bores. As outlined in Section 5.2, the use of water for rotary drilling and coring prevented observation of groundwater within the rock.

Groundwater level recorded at a nearby site to the southwest was measured between RL 37.8 m to RL 46.1 m. The groundwater level is expected to be slightly higher on site due to the elevated topography, relative to the nearby site.

8. Proposed Development

It is understood that the proposed development includes the demolition of the existing structure and the construction of a high-rise 53-level residential, build-to-rent tower with four basement levels (see Figure 4 below). It is understood that the existing basement will be deepened from the existing FFL at RL 46.3 m down to BEL at RL 38.95 m.

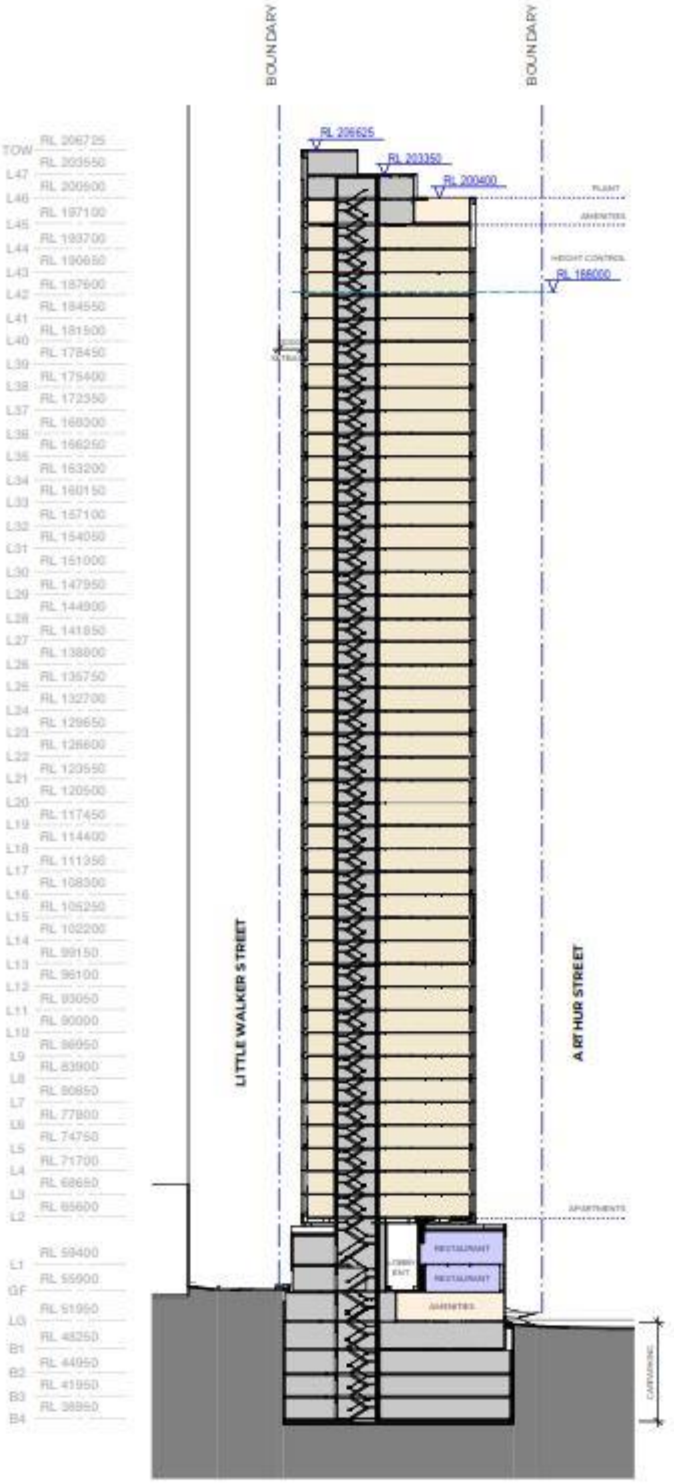

Figure 4: Woods Bagot Section East/West Drawing DA-1320 RevA (dated 05.03.2024).

9. Comments

9.1 General Considerations for the Proposed Excavation

9.1.1 Rock Defects

The two major joint sets striking NNE and ESE in Sydney are aligned sub-parallel to the east and west and the north and south excavation faces, respectively. The NNE striking joints are more prominent than the ESE striking joints and have been found to be persistent both vertically and horizontally, to the extent that they can affect the stability of an entire excavation face, depending on the joint orientation and dip angle. Although the NNE striking joints are generally subvertical, they have been found to dip up to 75° to the east and to the west.

ESE striking joints are generally strata bound, widely spaced and not persistent. They rarely affect overall stability but can act as release planes to form local wedges on the north and south excavation faces. The northern and southern faces are therefore less likely to be affected by these joints. The southern face along the common boundary with 140 Arthur Street, however, will require careful consideration as the neighbouring footings are likely to be founded above the proposed BEL.

Where these joints are nearly parallel to the orientation of the proposed excavation faces, it can be difficult to see the joint daylight as the excavation is systematically deepened. In such instances core holes can be drilled into the rock face as the excavation is systematically deepened, to investigate for joints and ensure that support, if required, is installed in a timely manner.

9.1.2 Existing Retention Structures and Adjacent Building(s)

Prior to below ground demolition and excavation it will be necessary to determine the type of existing retaining wall, the height of the wall, lateral earth pressure on the wall and founding conditions. It will also be necessary to determine the footing locations, type of footings, founding depths, sizes and applied loads for the neighbouring 140 Arthur Street building.

This will require investigation by careful and controlled exposure of the ground behind the existing basement walls, as required to assess the current lateral earth pressures on the walls and founding conditions of any affected high level neighbouring footings, while maintaining stability. Adjacent footings, depending on their founding level and foundation material, may require underpinning. If reliable and accurate records of the existing adjacent structure, footing types and foundation conditions are available, these records would assist in the preliminary assessment. From the information provided it is understood that the FFL at 140 Arthur Street (neighbours to the south) is at RL 46.5 m. The future excavation on site, down to RL 38.95 m, may extend below the base of these footings and would therefore require careful consideration.

9.2 Excavation Conditions

Excavation is currently planned to approximately RL 38.95 m AHD down to the proposed Basement 4 car park level (lowest basement level - refer Appendix D). The excavation is shown to be within the existing basement footprint and is expected to encounter sandstone of medium and high strength.

9.2.1 Excavatability

Excavation of medium and high strength sandstone will require medium to heavy rock breaking and ripping equipment (such as D10/D11 Dozers and large rock hammers). Medium strength rock is defined as having an unconfined compressive strength (UCS) of 6 to 20 MPa. High strength rock has a UCS of > 20 MPa.

The use of rock breaking equipment will generally cause dust, noise and vibration that has the potential to affect adjacent sensitive infrastructure such as heritage buildings as well as occupants of nearby buildings.

9.2.2 Excavation Induced Ground Movement (Stress Relief)

Locked-in stresses are present within the rock. During excavation, these stresses are to be partly released which generally results in lateral movement of the rock face towards the excavation, dragging the overburden (and any structure) with it as movement occurs. Generally, units of stiffer rock (medium strength or stronger rock) will have higher horizontal locked-in stresses. The amount of displacement that may occur depends on the rock excavation depth, locations of bedding planes and joints in the rock mass, excavation face length and face orientation. As the maximum principal stress in Sydney is in the north-south direction, the north and south faces can be expected to experience more stress relief deformation. Due to the limited depth of the proposed excavation, however, stress relief displacement is expected to be relatively small.

The excavation is understood to extend to the property boundaries, set-back along a portion of the northern boundary. Consideration should therefore be given to any future neighbouring excavations which may result in additional rock mass displacement. Any rock pillars that are formed between the proposed excavation and the neighbouring excavation will require careful consideration. The effect on any adjacent high-level footings will also require careful consideration (i.e., 140 Arthur Street foundations).

9.2.3 Vibration

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibration at adjacent buildings and structures within acceptable limits. The level of acceptable vibration is dependent on various factors including the type of building structure (e.g., reinforced concrete, brick, etc.), its structural condition, founding conditions, the frequency range of vibration produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

Ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s peak particle velocity (PPV). This is generally much lower than the vibration levels required to cause structural damage to most buildings. The Standard AS/ISO 2631.2 – 2014 "Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Vibration in buildings (1 Hz to 80 Hz)" suggests an acceptable daytime limit of 8 mm/s PPVi for human comfort.

Based on DP's experience and with reference to AS/ISO 2631.2, it is suggested that a maximum PPVi of 8 mm/s (measured at the first occupied level of neighbouring buildings) be adopted at this site for both architectural and human comfort considerations for modern buildings.

DP maintains an extensive construction vibration database. As a preliminary estimate, Table 5 provides approximate minimum buffer distances for selected equipment, based on a set vibration limit of 8 mm/s (assuming that plant is appropriately sized for the ground conditions).

Table 5: Approximate buffer distances for selected Plant (PPVi 8 mm/s)

Excavation Plant		Distance from plant at which vibration attenuates to 8 mm/s[3]	
Type	**Operating Weight**	**From DP Trial Maxima[1]**	**From DP Trial Average**
Rock saw on excavator[2]	-	1 m	0.5 m
Ripper on 20 t excavator	-	3 m	0.7 m
Rock Hammer	<500 kg	7 m	3 m
	501 – 1000 kg	8 m	3 m
	1001 – 2000 kg	13 m	5 m

Notes:

1. *Smaller distances can generally be determined from individual trials, as indicated by those from trial averages.*
2. *Buffer distances for rock hammers may be slightly reduced by prior saw cutting along, or parallel to, excavation boundaries.*
3. *Loading effects from adjacent buildings may reduce vibration levels, to enable boundary saw cuts with few exceedances.*

As the magnitude of vibration transmission is site specific, it is recommended that a vibration trial be carried out at the commencement of rock excavation. These trials may indicate that smaller or different types of excavation equipment or a different approach are required to reduce vibration to acceptable levels.

9.2.4 Dilapidation Surveys and Monitoring

Dilapidation surveys should be carried out on adjacent buildings, pavements and sensitive structures that may be affected by the excavation. A baseline (reference) survey should be carried out before the commencement of any demolition or excavation work in order to document existing defects so that any claims for damage due to construction related activities can be accurately assessed.

Survey points and inclinometers may also be used to monitor the side wall movement of the excavation.

9.2.5 Disposal of Excavated Material

All surplus excavated materials will need to be disposed of in accordance with the Protection of the Environment Operations Act 1997 (POEO Act). All materials removed from the site are defined as waste under the POEO Act and must be disposed of in accordance with one of the following:

- Virgin excavated natural materials (VENM) as defined under the POEO Act, permitting beneficial reuse; or
- A waste category meeting the criteria set out in the NSW EPA Waste Classification Guidelines 2014, with the materials disposed to a landfill licenced to receive the waste under the assigned classification or taken to a recycling facility licenced to receive the waste; or

- Material complying with a Resource Recovery Order (RRO) as defined under the Protection of the Environment Operations (Waste) Regulation 2014, with complying materials able to be reused under certain conditions.

Accordingly, environmental testing will need to be carried out to determine the most appropriate off-site destination(s) for the surplus excavated material.

9.3 **Excavation Support**

As the proposed basement excavation will extend or be very close to the site boundaries, battering will not be feasible (refer drawings provided in the Appendix D). It may, however, be possible to use the existing basement walls to temporarily shore the existing excavation, depending on the founding depth and position of these walls. Careful consideration should nevertheless be given to the design of the excavation sidewall retention systems. The additional excavation is expected to be in medium strength or stronger material which should be self-supporting if not adversely affected by defects.

Whether existing or new, all retaining walls are to be temporarily supported with anchors. New shoring will be required where the excavation faces do not align with the existing walls or where existing walls are in the way. Particular care should be taken where installation of the new wall is obstructed by the existing wall. A special approach will be required in such a case, where the old wall is systematically removed as the new wall is installed. This will require a design and construct approach and is generally carried out under close supervision of the geotechnical and structural engineers. Horizontal drilling and slot investigation will be required where existing basement walls are used.

The shoring should be designed to support the soil, weak rock and any surcharge loads, taking into account the allowable deformation limits of any affected services and structures.

The medium strength or stronger sandstone is considered to be free-standing unless adversely affected by weathering, joints or faults. Steeply dipping joints can form unstable wedges that will require systematic support on exposure.

Excavation should be carried out in a controlled manner, with inspection by a suitably experienced engineering geologist / geotechnical professional every 1.5 m drop to identify and support any potentially any unstable wedges in a timely manner. A site-specific excavation methodology should be prepared, particularly for the works along the southern boundary. This may include limiting excavation to 1.0 m drops and leaving a 2.0 m wide bench prior to excavating the face back to its final cut line, with both the excavated bench and final cut-line inspected by an experienced engineering geologist/geotechnical engineer. The requirement for regular geotechnical inspections every 1.5 m drop and an excavation methodology for the southern boundary should be explicitly stated on the issued for construction drawings and the earthworks contractor should be made aware of these requirements.

Allowance should be made for ground anchors, rockbolt and shotcrete support. All clay seams and shale layers (>50 mm thick) will require shotcrete protection to prevent future weathering and regression. All thick shale / laminite seams will also require, in addition to the shotcrete face protection, rockbolt or anchors support.

It is recommended that a geotechnical engineer inspect any existing exposed sandstone walls prior to demolition to determine if any weathering protection is required and to identify any adversely oriented discontinuities in the rock mass.

9.3.1 Earth Pressures for Shoring Design

Design pressures for retaining walls should take into account the requirement to limit movement of the surrounding ground and adjacent structures and to ensure an adequate factor of safety is maintained against failure (for temporary and permanent retaining walls).

It is suggested that the design of cantilevered shoring systems (or shoring systems with one row of anchors) be based on a triangular earth pressure distribution using the earth pressure coefficients provided in Table 6. 'Active' earth pressure coefficient (K_a) values may be used where some wall movement is acceptable. 'At Rest' earth pressure coefficient (K_o) values should be used where the wall movement needs to be limited, taking into account the passive nature of cantilevered walls.

Table 6: Recommended Design Parameters for Shoring Systems

Material	Unit Weight (kN/m3)	Earth Pressure Coefficient	
		Active (Ka)	At Rest (Ko)
Filling, Sand, Clay and Sandy Clay	20	0.35	0.5
Extremely Low to Low Strength Sandstone	22	0.2	0.3
Medium Strength or better Sandstone	24	0	0

Notes: The values above assume a level surface behind the wall.
It is assumed that the rock mass is free of adverse dipping joints and seams.
It should also be noted that the K_a and the K_o designs will not prevent stress relief movement.

For braced walls or where two or more rows of anchors are used, the shoring can be designed using a rectangular or trapezoidal earth pressure distribution. The support pressure in this case can be related to the height of soil / weathered rock retained. Where there are no movement-sensitive structures within the influence zone behind retaining walls, an earth pressure distribution equal to 4H kPa (where H, in metres, equals the depth to the top of self-supporting medium strength or stronger rock) can be used. Where the wall movement is to be minimised (i.e., close to adjacent buildings or services) the lateral earth pressure can be calculated using 6H kPa. For movement-sensitive structures, where it is critical that deformation is controlled, it may be necessary to calculate the pressure using 8H kPa. These pressures can be applied as either rectangular or trapezoidal earth pressure distributions. Note these earth pressure distributions are "pressure envelopes", selected to ensure that no row of anchors is overloaded during the temporary support phase.

In all cases, additional surcharge loads such as new and existing footings, construction loads, hoardings, façade retention systems, pavements, etc., must be allowed for in the design, applied as a rectangular earth pressure distribution over the depth of influence, or as specified by the designers.

The earth pressure loading described above does not include either earthquake loads or hydrostatic pressures. Unless positive drainage measures are incorporated to prevent water pressure build-up behind the walls, full hydrostatic head should be allowed for in design, while at the same time reducing the unit weight of the retained material to account for the buoyant condition.

9.3.2 Ground Anchors and Rockbolts

Post-stressed ground anchors, rockbolts and dowels (support elements) can be used to laterally support existing walls, new shoring, underpinning works or unstable rock blocks and wedges. Anchors could also be used vertically as hold down anchors (hold-down anchors should be designed in accordance with AS4678). Support elements used for lateral support should be bonded in the stronger rock, inclined as required, but preferably not steeper than 30° below the horizontal. Table 7 provides ultimate and allowable bond stresses for concept design and estimating purposes.

Table 7: Anchor Bond Stresses

Material	Allowable Bond Stress (kPa)	Ultimate Bond Stress (kPa)
Low Strength Sandstone	100	250
Medium Strength Sandstone	350	800
Medium to High Strength Sandstone	600	1500
High Strength Sandstone	1200	3000

These values should be confirmed by pull-out tests prior to installation of support elements. Ultimately, it is the contractor's responsibility to ensure that the correct design values (specific to the support system and method of installation) are used and that the support element holes are carefully cleaned prior to grouting.

After temporary support elements have been installed, it is recommended that they are tested to at least 125% of their nominal working load (but no more than 150% and in accordance with AS4678). Where stress relief or further unavoidable movement of the shoring is expected, it is recommended that the support elements are locked-off between 60% and 100% of their working loads, as required to accommodate additional movement and subsequent increase in stress in the support elements. Consideration should, however, be given to the immediate design requirements. The capacity of the anchor may have to be increased if a lower initial lock-off is not feasible. Checks should be carried out to confirm that the load in the support elements has been maintained and that losses due to creep effects or other causes have not occurred.

Shorter support elements (i.e., rockbolts, dowels and pins) may be required to support any unstable rock wedges, slivers or blocks. Short dowels and pins may be required to support feather edges where sub-parallel joints acutely intersect the face. Shotcrete with mesh (or fibrecrete) may be required where beds / seams of extremely low or very low strength rock are encountered within higher strength sandstone, secured with anchors, rockbolts, dowels or pins, designed to secure the shotcrete.

Care should be exercised to ensure that anchors are installed progressively during excavation and stressed prior to excavation of the next drop to ensure that stability is maintained at all times.

It is anticipated that the new structure will support the shoring walls over the long term and therefore support elements are expected to be temporary only. The use of permanent rockbolts and ground anchors, if required, will need careful attention to corrosion protection.

It should be noted that permission will be required from authorities and adjacent property owners prior to installing rockbolts / ground anchors below their land. Due consideration should also be given to the location and type of below-ground excavations, services, etc.

9.3.3 Excavation and Loading Adjacent to TfNSW Assets

Reference should be made to TfNSW Technical Direction GTD 2020/001, Version No. 01, dated 2 July 2020 for the requirements of TfNSW concurrence for developments where there is a risk that it may affect the road reserves. An assessment of ground movement and monitoring requirements as well as instrumentation may be required by TfNSW prior to commencing construction.

It is recommended that the design team familiarise themselves with the relevant documents for future consultation with TfNSW.

9.4 Foundations

Based on available information it is likely that medium strength or stronger sandstone will be exposed at the base of the excavation, which should be suitable for shallow foundations. Typical parameters for the design of pad foundations on sandstone, based on the classification methods of Pells et al. (1998) are shown in Table 8, subject to spoon testing / proof coring, where required.

Table 8: Recommended Parameters for Foundation Design

Foundation Stratum	Allowable Bearing Pressure (Serviceability)	Ultimate Bearing Pressure
	End Bearing (kPa)	End Bearing (kPa)
Class III - Medium strength sandstone	3,500	20,000
Class II - Medium to high strength sandstone	6,000	60,000
Class I - High strength sandstone	12,000	120,000

Foundations proportioned on the basis of the allowable bearing pressures in Table 8 would be expected to experience total settlements of less than 1% of the footing width under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

The proposed excavation is shown to be taken well below the founding levels of the neighbouring (140 Arthur Street) footings. Some of these footings are therefore likely to be founded within the zone of influence of the proposed excavation. The zone of influence may be taken as a 45° line drawn up from the base of the proposed bulk excavation level. The allowable bearing pressure beneath neighbouring footings located within this zone of influence is generally downgraded. An assessment of the bearing capacity beneath these neighbouring footings should be undertaken to ensure that foundations remain within their serviceability design limits. Progressive inspections of the excavated face below the neighbouring footings may have to be carried out in panels or restricted drops with benching, as required to check for defects or adversely dipping joints that may affect the neighbouring foundations.

All foundations should be inspected by a geotechnical engineer to confirm that founding conditions are consistent with the design parameters used, with proof drilled or spoon tested as appropriate.

To use a bearing pressure value for design of greater than 3,500 kPa, a minimum of four cored bores are required with spoon testing or cores carried out in a third of footings across the site during construction. If bearing pressures greater than 6 MPa are used in design, then cored bores are required at a maximum 10 m grid spacing or cored bores for 50% of footings and spoon testing carried out on the remaining footings. For spoon testing, a 50 mm diameter hole is drilled below the base of the footing to a depth of 1.5 times the footing width, followed by testing to check for the presence of weak layers or clay bands.

If weak seams or defects are encountered, footings may need to be deepened until suitable founding material is reached. Alternatively, the footing can be enlarged, or redesigned for a lower bearing pressure, keeping in mind the increase in potential settlement with width increase. Ideally all footings should be founded on similar rock. Occasionally weaker shale / laminite lenses within the sandstone can be encountered which may require further assessment.

9.5 Groundwater

Given the relatively shallow depth of the basement it is expected that the regional groundwater table will be below the proposed bulk excavation level. Transitory seepage, however, should be expected along the top of the rock (particularly after periods of wet weather) and through open joints and bedding planes.

Based on the footprint and depth of the basement, seepage is unlikely to exceed 3 megalitres per year. During construction and in the long term, it is anticipated that seepage into the excavation could be controlled by perimeter drains connected to a "sump-and-pump" system. Approval from Water NSW, however, will be required prior to designing and constructing a drained basement. A drained basement, if approved by Water NSW, will require permanent subfloor drainage to direct seepage to the stormwater drainage system. A dewatering management plan is likely to be required to meet requirements of local council.

It is not possible to provide a reliable estimate of the seepage quantity that may be expected within the basement based on the available data. Rock mass permeability testing will therefore be required during the detailed geotechnical investigation to provide the necessary parameters for seepage analysis (if required). In addition, inflow into the current basement can be measured from the existing sump by the data-loggers.

Previous experience in Sydney is that seepage will likely contain relatively high levels of soluble iron that will form a precipitate in the form of a gelatinous ‘sludge’ when exposed to oxygen. This ‘sludge’ has the potential to block-up subsoil (gravel) drains and ‘seize-up’ pumps. Therefore, detailing of subfloor drains, sumps and pumps should incorporate provision for regular maintenance such as flushing and ‘rodding’ of drains.

9.6 Earthquake Design

A Hazard Factor (*Z*) of 0.08 would be appropriate for preliminary design in accordance with Australian Standard AS 1170.4 – 2007 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class is considered to be Class B_e.

10. Proposed Future Geotechnical Work

The following additional work is recommended:

1) Geotechnical investigation of the site comprising diamond core drilling to at least 4 m below the future bulk excavation level at three (3) additional locations across the proposed basement footprint.
2) Installation and monitoring of water levels across the basement footprint.
3) Inflow analysis will likely be required if the basement is not tanked.
4) Horizontal coreholes and slot inspections in the existing basement walls (above the exposed sandstone) to determine shoring requirements.
5) Footing investigation of any adjacent buildings to determine footing type(s), founding depths and conditions.
6) Waste Classification Assessment of material proposed to be transported off site, in accordance with the appropriate guidelines.
7) Assessments required by TfNSW, which may include numerical analysis to assess the impact on the road infrastructure. The TfNSW Technical Direction Geotechnology GTD 2020/001 Version No. 01 – 2 July 2020 Excavation adjacent to TfNSW Infrastructure provides a technical direction for all proposed excavations and or any temporary structures by private and commercial developments which have a zone of influence that extends into the road reserve and RMS easements.

11. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at 146 Arthur Street, North Sydney NSW in accordance with DP's proposal dated 24 October 2023 and acceptance received from Nina Parsons dated 26 October 2023. The work was carried out under Aqualand Agreement. This report is provided for the exclusive use of The Trustee for JW Argyle Trust 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 DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP 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 DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP 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 advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical / environmental / 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. DP 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 DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Appendix A

About this Report

About this Report

Introduction

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

DP's 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.

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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 Conditions of Engagement 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, DP 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, DP 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, DP will be pleased to assist with investigations or advice to resolve the matter.

continued next page

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, DP 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. DP 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.

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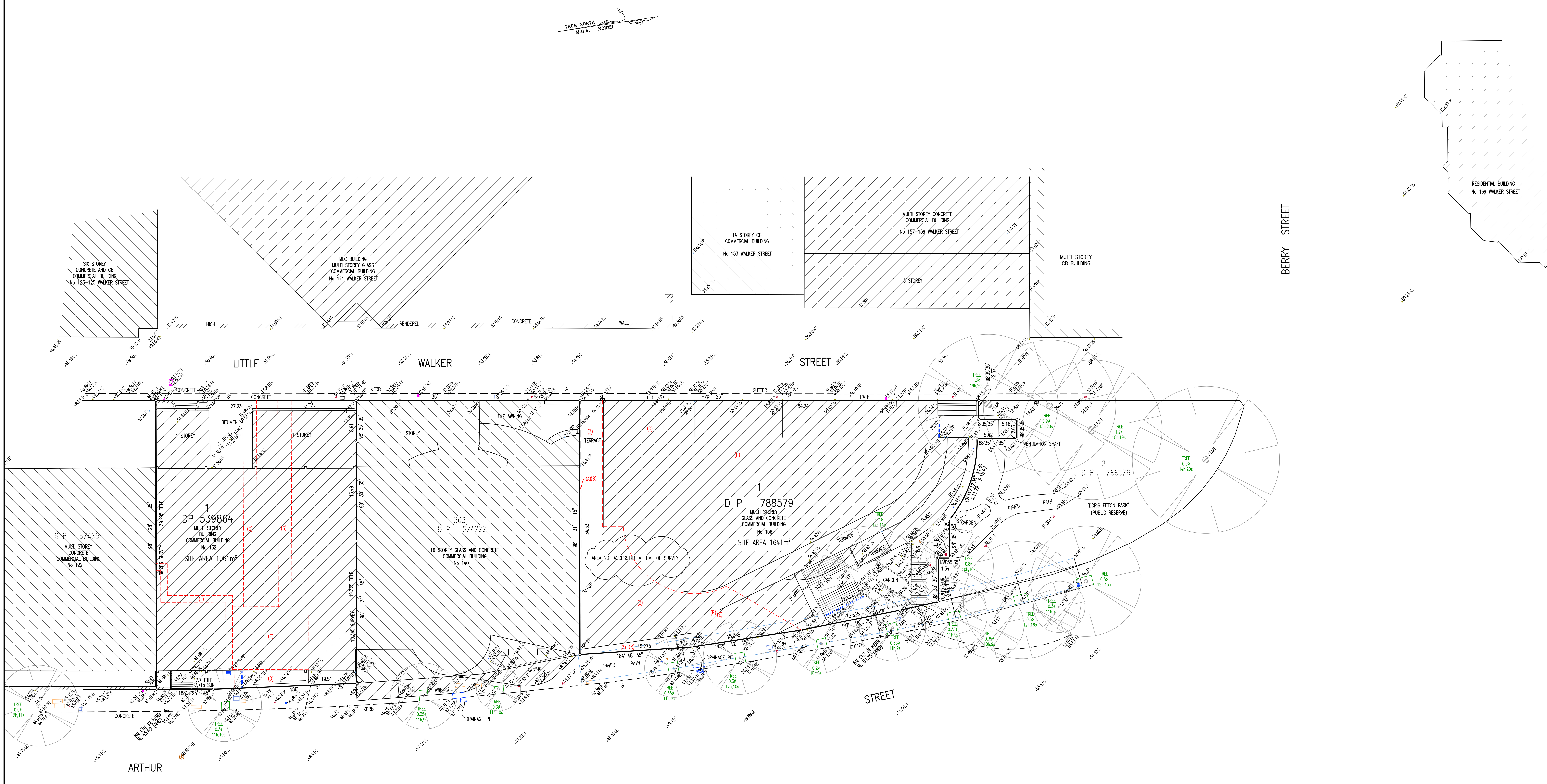
Appendix B

Survey Drawings

ISSUE	DATE	AMENDMENT	BY



(A) AH457072 EASEMENT FOR OVERHANG 0.15 WIDE (DP 1188014)
(B) AH457072 EASEMENT TO PERMIT ENCROACHING STRUCTURE TO REMAIN 0.15 WIDE (DP 1188014)
(C) SUBSTATION PREMISES No 6640 (LEVEL 1) VIDE Y402333
(D) E177513 RIGHT OF WAY VARIABLE WIDTH VIDE M240954
(E) E177513 SUBSTATION PREMISES No 3002 (GROUND FLOOR) VIDE M240954
(F) E177513 EASEMENT FOR ELECTRICITY PURPOSES 0.915 WIDE VIDE M240954
(G) E177513 EASEMENT FOR ELECTRICITY PURPOSES 1.83 WIDE VIDE M240954
(P) LAND EXCLUDES MINERALS (S141 PUBLIC WORKS ACT 1912)
(R) LAND EXCLUDES MINERALS. LAND SUBJECT TO RESERVATIONS AND CONDITIONS
– SEE S700000A
(Z) DP 788579 RESTRICTION ON THE USE OF LAND

TYPICAL NOTES:

1. ORIGIN OF LEVELS **SSM 25302, R.L.55.657 (A.H.D.)**
2. BEARINGS ARE ON **MGA** NORTH
3. NO BOUNDARY SURVEY HAS BEEN UNDERTAKEN.
4. BEARINGS & DISTANCES HAVE BEEN COMPILED FROM TITLE AND/OR DEED INFORMATION SUPPLIED BY DEPARTMENT OF LANDS NSW.
5. RELATIONSHIP OF IMPROVEMENTS AND DETAIL TO BOUNDARIES IS DIAGRAMMATIC ONLY AND SPECIFIC DETAILS, IF CRITICAL, WILL REQUIRE FURTHER SURVEY.
6. SERVICES SHOWN ARE BASED ON VISIBLE SURFACE INDICATORS EVIDENT AT THE DATE OF SURVEY AND THE RELEVANT SERVICE DIAGRAMS OF THE VARIOUS AUTHORITIES. ALL SERVICE MUST BE VERIFIED ON SITE PRIOR TO ANY WORK BEING UNDERTAKEN. VERIS AUSTRALIA PTY LTD BEAR NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE SERVICES SHOWN HEREON.
7. RIDGE, EAVE & GUTTER HEIGHTS HAVE BEEN OBTAINED BY AN INDIRECT METHOD AND ARE ACCURATE FOR PLANNING PURPOSES ONLY.
8. ADJOINING BUILDINGS AND DWELLINGS HAVE BEEN PLOTTED FOR DIAGRAMMATIC PURPOSES ONLY AND SPECIFIC DETAILS, IF CRITICAL, WILL REQUIRE FURTHER SURVEY.
9. THE DIAMETER (ø), SPREAD (S) & HEIGHT (H) OF EACH TREE IS INDICATIVE ONLY AND SPECIFIC DETAILS, IF CRITICAL, WILL REQUIRE FURTHER SURVEY.
10. CONTOURS ARE AN INDICATION OF THE TOPOGRAPHY ONLY. SPOT LEVELS SHOULD BE USED IF DETAILED DESIGN IS TO BE UNDERTAKEN.
11. CONTOUR INTERVAL XXX METRE.

LEGEND OF TYPICAL CODES

AE	ARCHITECTURAL EMBELLISHMENT	MLID	METAL LID
AP	ALIGNMENT PIN	NS	NATURAL SURFACE
AWN	AWNING	OCC	STRUCTURE
BALC	BALCONY	OPT	OPTUS PIT
BAWN	BOTTOM OF AWNING	PC	PRAM CROSSING
BB	BOTTOM OF BANK	PED	PEDESTRIAN CROSSING
BCH	BOTTOM OF CHIMNEY	PERG	PERGOLA
BD	BOTTOM OF DOOR	PM	PERMANENT MARK
BDY	BOUNDARY	PP	POWER POLE
BF	BOTTOM OF FENCE	RCK	ROCK
BHR	BOTTOM OF HANDRAIL	RLWY	RAILWAY
BIT	BITUMEN	RM	REFERENCE MARK
BK	BOTTOM OF KERB	RR	ROOF RIDGE
BLD	BUILDING	RSN	CONCRETE NAIL
BM	BENCH MARK	SEW	SEWER
BOL	BOLLARD	SHR	SHRUB
BR	BOTTOM OF ROCK	SIP	SEWER INSPECTION PIT
BRK	BRICK	SLH	SEWER LAMP HOLE
BRW	BOTTOM OF RETAINING WALL	SMH	SEWER MANHOLE
BS	BOTTOM OF STEPS	SP	SIGN POST
BW	BOTTOM OF WALL	SSM	STATE SURVEY MARK
BWIN	BOTTOM OF WINDOW	SV	STOP VALVE
CHIM	CHIMNEY	SW	STORM WATER
CL	CENTRELINE	TARCH	TOP OF ARCH
CLID	CONCRETE LID	TAWN	TOP OF AWNING
COL	COLUMN	TB	TOP OF BANK
COM	COMMUNICATIONS PIT	TBX	TELSTRA BOX
CONC	CONCRETE	TCH	TOP OF CHIMNEY
CPT	CARPORT	TD	TOP OF DOOR
D	DOOR	TEL	TELSTRA PIT
DD	DISH DRAIN	TELP	TELSTRA PILLAR
DH	DRILL HOLE	TF	TOP OF FENCE
DHW	DRILL HOLE & WINGS	TG	TOP OF GUTTER
DWY	DRIVEWAY	THR	TOP OF HANDRAIL
EB	EDGE OF BITUMEN	TI	TRAFFIC ISLAND
EBOX	ELECTRICITY BOX	TK	TOP OF KERB
EC	EDGE OF CONCRETE	TL	TRAFFIC LIGHT
ED	EDGE OF DOOR	TP	TOP OF PARAPET
EG	EDGE OF GARDEN	TR	TREE
ELEC	ELECTRICITY PIT	TRF	TOP OF ROOF
EP	EDGE OF PATH	TRK	TOP OF ROCK
ER	EDGE OF ROAD	TRW	TOP OF RETAINING WALL
FCE	FENCE	TS	TOP OF STEPS
FL	FLOOR LEVEL	TW	TOP OF WALL
FFL	FINISHED FLOOR LEVEL	TWIN	TOP OF WINDOW
FP	FENCE POST	US	UNDERSIDE
GD	GLASS DOOR	UAWN	UNDERSIDE OF AWNING
GL	GROUND LEVEL	UKS	UNKNOWN SERVICE
GM	GAS METER	USB	UNDERSIDE OF BEAM
HPG	HIGH POWERED GAS	USC	UNDERSIDE OF CEILING
HR	HANDRAIL	USE	UNDERSIDE OF EAVE
HYD	HYDRANT	USG	UNDERSIDE OF GUTTER
IL	INVERT LEVEL	V	VENT
K	KERB	VER	VERANDAH
LIN	LINTEL	VC	VEHICLE CROSSING
LP	LAMP POST	W	WINDOW
MH	MANHOLE	WM	WATER METER

LEGEND OF TYPICAL SERVICES

C	COMMUNICATIONS CABLE	RW	RECYCLED WATER
CSWP	CERAMIC STORMWATER PIPE	RM	RISING MAIN
E	UNDERGROUND ELECTRICITY CABLES	RMS	ROADS & MARITIME SERVICES
AE AO	UNDERGROUND ELECTRICITY & OPTUS CABLES	S	SEWER
FS	FIRE SERVICE	SO	SEWER OUTFALL
G	GAS LINE	ST	SHARED TRENCH
GE	GAS LINE & ELECTRICITY CABLES	SW	STORM WATER
NBN	NATIONAL BROAD BAND CABLES	SW CK	STORMWATER CREEK
NG	NATURAL GAS LINE	T	TELSTRA CABLES
OH	OVERHEAD CABLES	TG	TELSTRA & GAS CABLES
OPT	OPTUS CABLE	U	UNKNOWN SERVICE
PE	PRIVATE ELECTRICITY	VO	VOCUS CABLES
PS	PRIVATE SEWER	VR	VERIZON CABLES
PW	PRIVATE WATER	W	WATER SUPPLY
		WM	WATER MAIN

1. ALL UNDERGROUND SERVICE INFORMATION INCLUSIVE OF GENERAL POSITION AND SURFACE COVER DEPTHS NOTED ON THE PLAN ARE APPROXIMATELY ONLY.
2. ALL UNDERGROUND SERVICE INFORMATION HAS BEEN COMPILED FROM SERVICE AUTHORITY PLANS PROVIDED BY THE AUTHORITIES.
3. THE LOCATION OF SERVICES BETWEEN SURVEYED POINTS (AS INDICATED) HAVE BEEN SHOWN DIAGRAMMATICALLY ONLY USING THE SERVICE DIAGRAMS AS PROVIDED. THE EXACT LOCATION OF THESE SERVICES BETWEEN THE SURVEYED POINTS MUST BE VERIFIED PRIOR TO ANY EXCAVATION OR PILING. NO WARRANTY IS GIVEN AGAINST THE POSSIBILITY OF THE EXISTENCE OF FURTHER UNCHARTED SERVICES.
4. ALL CONTRACTORS, TRADESMEN, BUILDING & PROJECT CONSULTANTS MUST CONTACT THE VARIOUS AUTHORITIES, IN ACCORDANCE WITH STANDARD "DIAL BEFORE YOU DIG" PROCEDURES PRIOR TO UNDERTAKING ANY WORKS WITHIN THE VICINITY OF THE SERVICE LINES TO VERIFY THE POSITION OF THE SERVICE LINES.

REDUCTION RATIO 1 : 200

0 2 4 6 8 10 12 14 16 18 20

LENGTHS ARE IN METRES

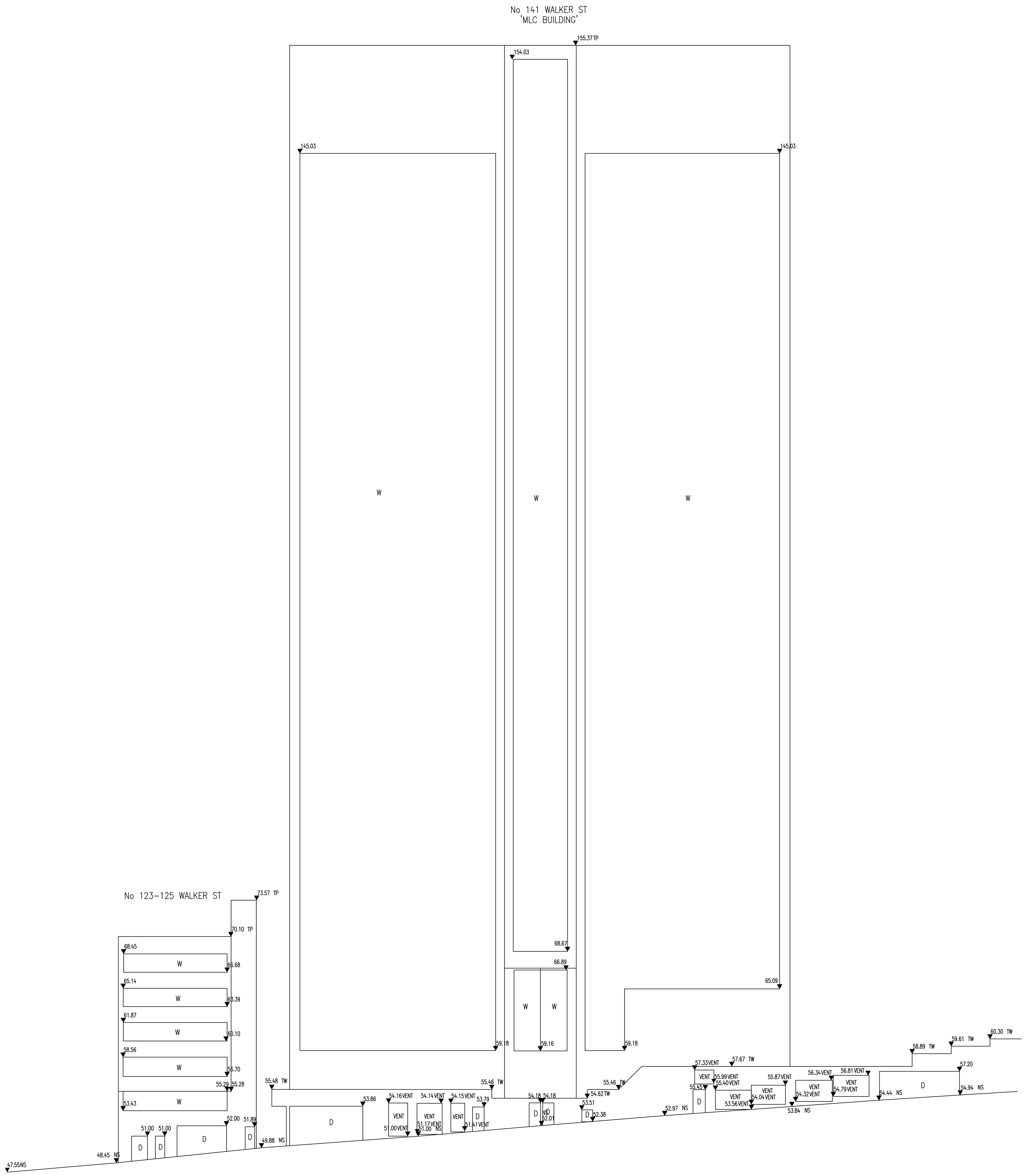
CLIENT: JW ARGYLE NOMINEE

TITLE No: 1/788579 & 1/539864	REF: 201304
DATUM: A.H.D.	ISSUE: 1
DATE OF SURVEY: 18.03.19	ISSUE DATE: 01.04.19
SURVEYOR: SC	SHEET SIZE: A0
DRAFTER: PH	SHEET 1 OF 2 SHEETS

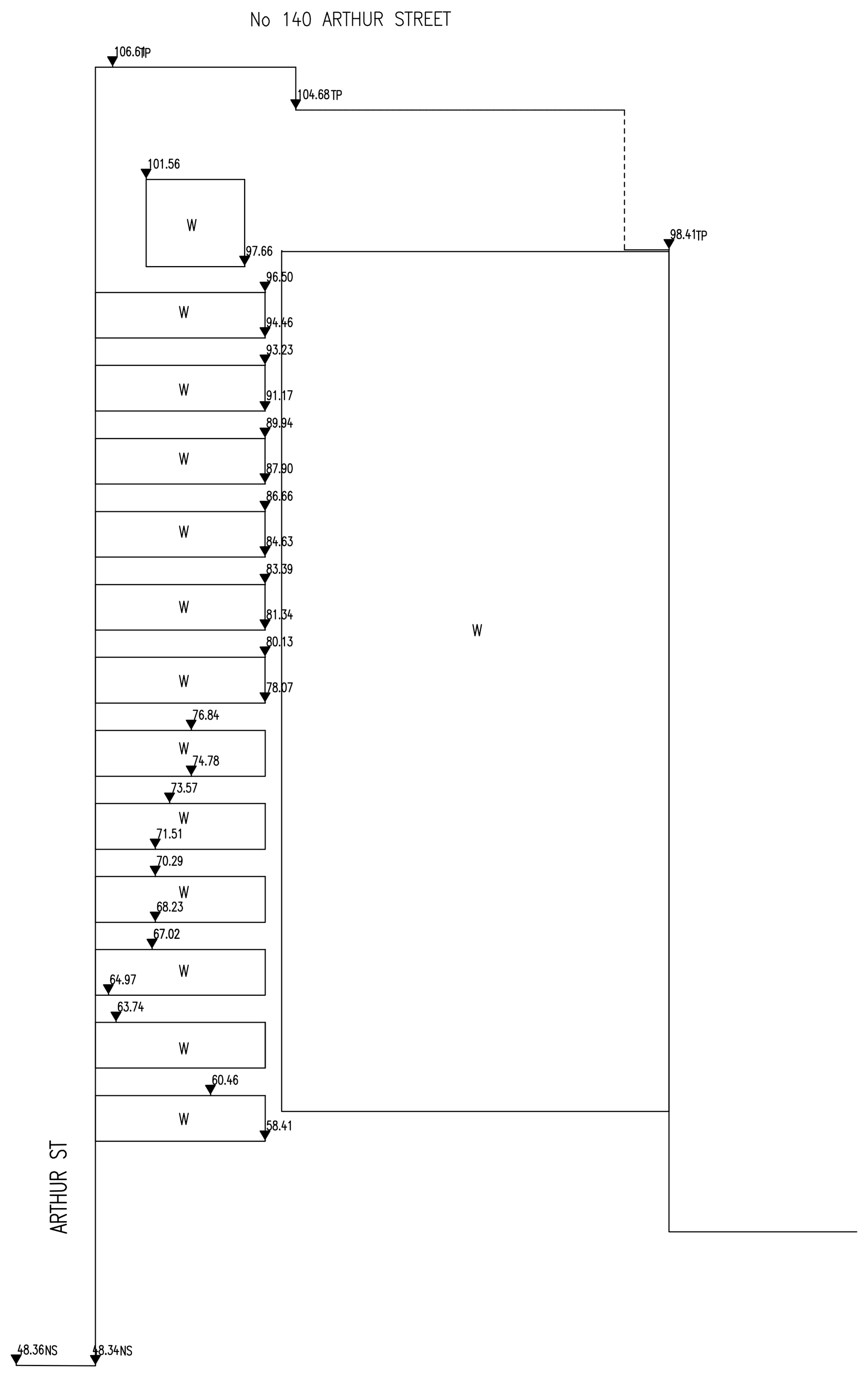
PLAN OF DETAIL & LEVELS AT No 146 & 132 ARTHUR STREET NORTH SYDNEY

veris

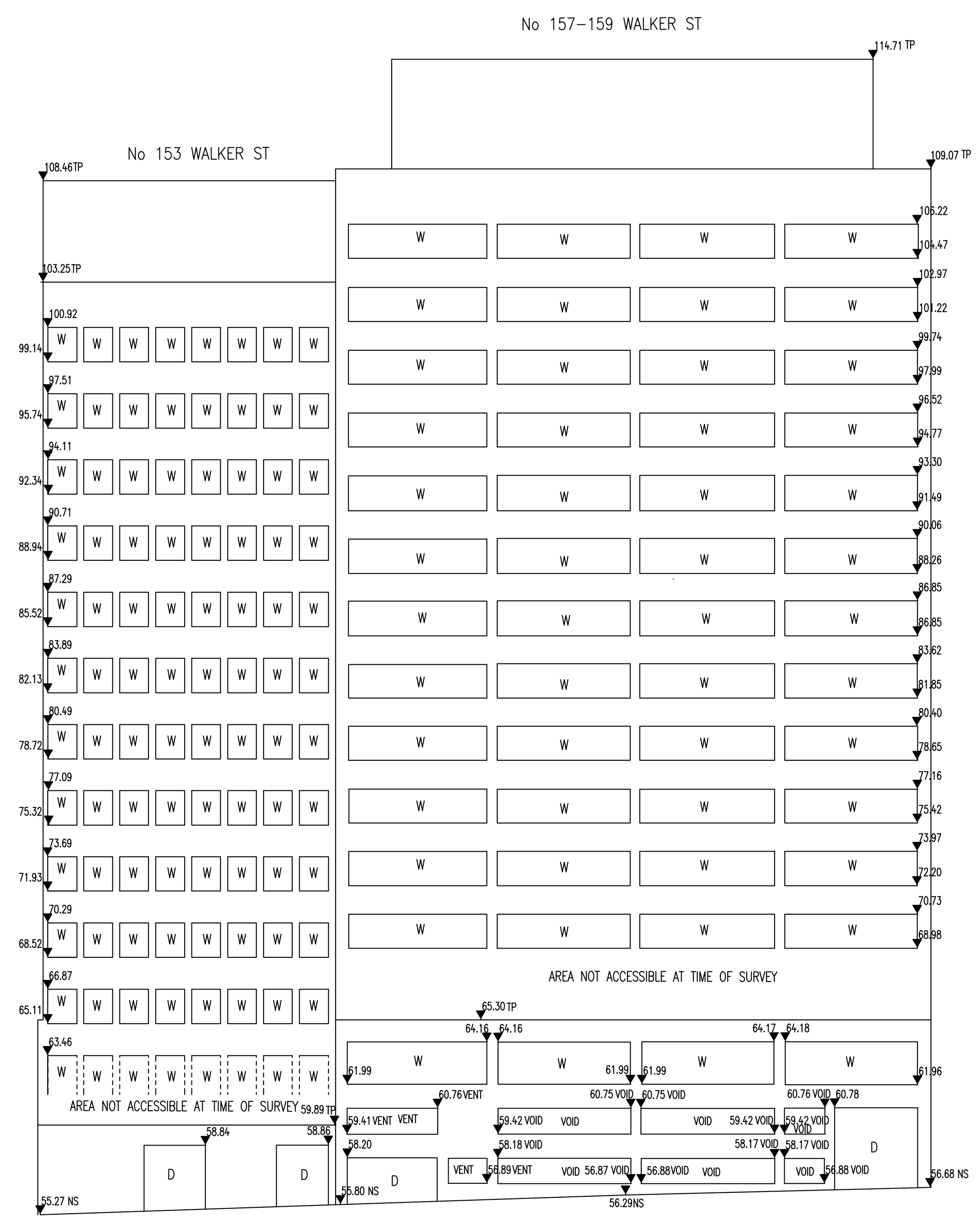
Veris Australia Pty Ltd
Suite 301, Level 3, 55 Holt Street
Surry Hills NSW 2012
PO Box 1807
Strawberry Hills NSW 2012
t: (02) 92124655
email: surryhills@veris.com.au
web site: www.veris.com.au



EASTERN ELEVATION No 123-125 & 141 LITTLE WALKER STREET



NORTHERN ELEVATION No 140 ARTHUR STREET



EASTERN ELEVATION No 153-159 LITTLE WALKER STREET

ISSUE	DATE	AMENDMENT	BY

TYPICAL NOTES:

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11. CONTOUR INTERVAL XXX METRE.

LEGEND OF TYPICAL CODES

AE – ARCHITECTURAL EMBELLISHMENT
AP – ALIGNMENT PIN
AWN – AWNING
BALC – BALCONY
BAWN – BOTTOM OF AWNING
BB – BOTTOM OF BANK
BCH – BOTTOM OF CHIMNEY
BD – BOTTOM OF DOOR
BDY – BOUNDARY
BF – BOTTOM OF FENCE
BHR – BOTTOM OF HANDRAIL
BIT – BITUMEN
BK – BOTTOM OF KERB
BLD – BUILDING
BM – BENCH MARK
BOL – BOLLARD
BR – BOTTOM OF ROCK
BRK – BRICK
BRW – BOTTOM OF RETAINING WALL
BS – BOTTOM OF STEPS
BW – BOTTOM OF WALL
BWIN – BOTTOM OF WINDOW
CHIM – CHIMNEY
CL – CENTRELINE
CLID – CONCRETE LID
COL – COLUMN
COM – COMMUNICATIONS PIT
CONC – CONCRETE
CPT – CARPORT
D – DOOR
DD – DISH DRAIN
DH – DRILL HOLE
DHW – DRILL HOLE & WINGS
DWY – DRIVEWAY
EB – EDGE OF BITUMEN
EBOX – ELECTRICITY BOX
EC – EDGE OF CONCRETE
ED – EDGE OF DOOR
EG – EDGE OF GARDEN
ELEC – ELECTRICITY PIT
EP – EDGE OF PATH
ER – EDGE OF ROAD
FCE – FENCE
FL – FLOOR LEVEL
FFL – FINISHED FLOOR LEVEL
FP – FENCE POST
GD – GLASS DOOR
GL – GROUND LEVEL
GM – GAS METER
HPG – HIGH POWERED GAS
HR – HANDRAIL
HYD – HYDRANT
IL – INVERT LEVEL
K – KERB
LIN – LINTEL
LP – LAMP POST
MH – MANHOLE
MLID – METAL LID
NS – NATURAL SURFACE
OCC – STRUCTURE
OPT – OPTUS PIT
PC – PRAM CROSSING
PED – PEDESTRIAN CROSSING
PERG – PERGOLA
PM – PERMANENT MARK
PP – POWER POLE
RCK – ROCK
RLWY – RAILWAY
RM – REFERENCE MARK
RR – ROOF RIDGE
RSN – CONCRETE NAIL
SEW – SEWER
SHR – SHRUB
SIP – SEWER INSPECTION PIT
SLH – SEWER LAMP HOLE
SMH – SEWER MANHOLE
SP – SIGN POST
SSM – STATE SURVEY MARK
SV – STOP VALVE
SW – STORM WATER
TARCH – TOP OF ARCH
TAWN – TOP OF AWNING
TB – TOP OF BANK
TBX – TELSTRA BOX
TCH – TOP OF CHIMNEY
TD – TOP OF DOOR
TEL – TELSTRA PIT
TELP – TELSTRA PILLAR
TF – TOP OF FENCE
TG – TOP OF GUTTER
THR – TOP OF HANDRAIL
TI – TRAFFIC ISLAND
TK – TOP OF KERB
TL – TRAFFIC LIGHT
TP – TOP OF PARAPET
TR – TREE
TRF – TOP OF ROOF
TRK – TOP OF ROCK
TRW – TOP OF RETAINING WALL
TS – TOP OF STEPS
TW – TOP OF WALL
TWIN – TOP OF WINDOW
US – UNDERSIDE
UAWN – UNDERSIDE OF AWNING
UKS – UNKNOWN SERVICE
USB – UNDERSIDE OF BEAM
USC – UNDERSIDE OF CEILING
USE – UNDERSIDE OF EAVE
USG – UNDERSIDE OF GUTTER
V – VENT
VER – VERANDAH
VC – VEHICLE CROSSING
W – WINDOW
WM – WATER METER

LEGEND OF TYPICAL SERVICES

—— C —— COMMUNICATIONS CABLE
——CSWP—— CERAMIC STORMWATER PIPE
—— E —— UNDERGROUND ELECTRICITY CABLES
—AE——AO— UNDERGROUND ELECTRICITY & OPTUS CABLES
—— FS —— FIRE SERVICE
—— G —— GAS LINE
—— GE —— GAS LINE & ELECTRICITY CABLES
—— NBN —— NATIONAL BROAD BAND CABLES
—— NG —— NATURAL GAS LINE
—— OH —— OVERHEAD CABLES
—— OPT —— OPTUS CABLE
—— PE —— PRIVATE ELECTRICITY
—— PS —— PRIVATE SEWER
—— PW —— PRIVATE WATER
—— RW —— RECYCLED WATER
—— RM —— RISING MAIN
—— RMS —— ROADS & MARITIME SERVICES
—— S —— SEWER
—— SO —— SEWER OUTFALL
—— ST —— SHARED TRENCH
—— SW —— STORM WATER
—SW——CK— STORMWATER CREEK
—— T —— TELSTRA CABLES
—— TG —— TELSTRA & GAS CABLES
—— U —— UNKNOWN SERVICE
—— VO —— VOCUS CABLES
—— VR —— VERIZON CABLES
—— W —— WATER SUPPLY
—— WM —— WATER MAIN

1. ALL UNDERGROUND SERVICE INFORMATION INCLUSIVE OF GENERAL POSITION AND SURFACE COVER DEPTHS NOTED ON THE PLAN ARE APPROXIMATELY ONLY.
2. ALL UNDERGROUND SERVICE INFORMATION HAS BEEN COMPILED FROM SERVICE AUTHORITY PLANS PROVIDED BY THE AUTHORITIES.
3. THE LOCATION OF SERVICES BETWEEN SURVEYED POINTS (AS INDICATED) HAVE BEEN SHOWN DIAGRAMMATICALLY ONLY USING THE SERVICE DIAGRAMS AS PROVIDED. THE EXACT LOCATION OF THESE SERVICES BETWEEN THE SURVEYED POINTS MUST BE VERIFIED PRIOR TO ANY EXCAVATION OR PILING. NO WARRANTY IS GIVEN AGAINST THE POSSIBILITY OF THE EXISTENCE OF FURTHER UNCHARTED SERVICES.
4. ALL CONTRACTORS, TRADESMEN, BUILDING & PROJECT CONSULTANTS MUST CONTACT THE VARIOUS AUTHORITIES, IN ACCORDANCE WITH STANDARD "DIAL BEFORE YOU DIG" PROCEDURES PRIOR TO UNDERTAKING ANY WORKS WITHIN THE VICINITY OF THE SERVICE LINES TO VERIFY THE POSITION OF THE SERVICE LINES.

REDUCTION RATIO 1 : 200
0 2 4 6 8 10 12 14 16 18 20
LENGTHS ARE IN METRES

CLIENT: JW ARGYLE NOMINEE

TITLE No: 1/788579 & 1/539864	REF: 201304
DATUM: A.H.D.	ISSUE: 1
DATE OF SURVEY: 18.03.19	ISSUE DATE: 01.04.19
SURVEYOR: SC	SHEET SIZE: A0
DRAFTER: PH	SHEET 2 OF 2 SHEETS

PLAN OF DETAIL & LEVELS AT No 146 & 132 ARTHUR STREET NORTH SYDNEY

veris
Veris Australia Pty Ltd
Suite 301, Level 3, 55 Holt Street
Surry Hills NSW 2012
PO Box 1807
Strawberry Hills NSW 2012
t: (02) 92124655
email: surryhills@veris.com.au
web site: www.veris.com.au

Appendix C

Existing Development Drawings

2. General Description of Property

Front Corner Elevation

The property is a purpose-built commercial office building constructed in the late1980s from modern materials at the time.

The property is located within North Sydney which is a suburb to the north of Sydney CBD and has a street address of 146 Arthur Street, North Sydney, NSW 2060. It is bounded by Arthur Street to the east and Little Walker Street to the west. The building abuts an adjacent building to the south.

The property is readily accessible by public transport comprising taxi, train, ferry and buses.

According to the information provided to us, the property provides approximately 8,171m^2 of net lettable space (NLA) and a site area of circa 1,641m^2. The accommodation is provided over a total of 12 floors with basement parking.

Asset Overview

Street Address:	Pepper House, 146 Arthur Street, North Sydney
Description:	Pepper House, a 12-storey commercial office tower comprising 10 levels of office space with each floor area approximately 750 sqm, a lower ground floor showroom of 195 sqm and security parking for 133 cars in three basement levels, completed in 1989. Formerly CPF House. Net lettable area 8,171 sqm. Architect, Devine Erby Mazlin.
NABERS:	Energy 3.0 stars, Energy without Green Power 3.0 stars, Water 4.0 stars (rating expiry - 29/06/2016, scope - base building, rating area 7,685 sqm).

Leasing:	Office space on level 1 of 259 sqm and office space on ground floor of 298 sqm for lease in July 2016; agent Colliers International North Sydney. Office space ranging from 258 to 1,500 sqm for lease in July 2016; agent Colliers International North Sydney.
Building Services:	Lifts - ThyssenKrupp Elevator Australia Pty Ltd (3 lifts).
Zoning:	3(a) Commercial.
Site Area:	1,641 sqm
Title Details:	1/788579.

The external envelope of the property comprises of a combination of single glazed aluminium curtain walling to the front elevation with a reinforced concrete structure with pre-cast concrete cladding panels and single glazed fixed windows forming the elevations.

External areas include stepped access to the front entrance and level access to the rear entrance. There is a terrace on level 1 with balconies on levels 7 to 10.

The boundaries of the property are denoted by council footpaths, roads, landscaped areas and adjacent developments.

The property benefits from mains supplies of gas, water, electricity and soil and waste. Water drains into the local sewer/drains via the internal soil and waste pipes.

Internally the property includes the following floor split as below and includes 2 emergency stair wells to either side of the core area and 3 no. lifts:

Level	Use
Level B1	Carpark & Plant rooms
Level B2	Carpark & Plant rooms, showers
Level B3	Carpark & Plant rooms
Ground floor	Main entrance foyer, retail/commercial tenancies, Substation & fire escape, toilets and plant rooms
Level 1 - 10	Commercial Offices
Level 11	Plant and Roof

Toilet accommodation comprises male and female toilets with finishes varied subject to refurbishment. There is a male, female and tea point located to each of the office floors with a plant room off the tea point per floor level. The toilets include for WC's, cubicles, wash basins and urinals. There is also showers on level B2 and an accessible WC off the main lobby on ground floor level.

The tenancy areas are fitted out with bespoke tenant fitout including floor coverings, partitions, ceilings and recessed lighting.

The building benefits from the following services:

Mechanical

The mechanical services in the building include the following:

- The air conditioning system comprises floor by floor water cooled packaged equipment connecting to a variable volume distribution system.
- Two cooling towers and associated pumps serve the condenser water system.
- A single axial fan serves toilets on each floor.
- Fire stairs have pressurisation systems.
- The car park has ducted supply and exhaust systems installed
- Kitchen exhaust facilities are installed but not in use.

Electrical

The electrical services in the building consist of the following:

- Electrical services power supply infrastructure comprises supply from the building chamber substation in Little Walker Street to the adjacent Main switchboard and provide metered power supplies to plant & equipment and the building general power & lighting requirements.
- Distribution boards are located in dedicated cupboards on each floor.
- Lighting is a mix of older and new fittings.
- The building security system is recent CCTV is installed

Fire Services

The fire services in the building consist of the following:

- Lower Levels of the building up to the Ground Floor are protected by automatic sprinklers.
- A fire detection system serves the upper floors.
- An EWIS is linked through the main fire indicator panel at the Fire Control Room at the Ground Floor.
- A combined Hydrant and Hose Reel systems is installed, with diesel and electric booster pumps fed from a roof tank system.

Hydraulic Services

The hydraulic services in the building consist of the following:

- Domestic hot & cold water systems, sewer reticulation, storm water collection trade waste and sanitary fixtures & fittings.
- The cold water supply is from the Arthur Street main.
- Domestic hot water is generated by central electric storage heaters.
- Trade waste provisions are in place for the building but not used at present.

Vertical Transportation

The inspected building has 3 (Three) Passenger Elevators as listed in the table below. All Lifts are currently under comprehensive maintenance agreement with ThyssenKrupp Australia Pty Ltd.

3. Description and Condition

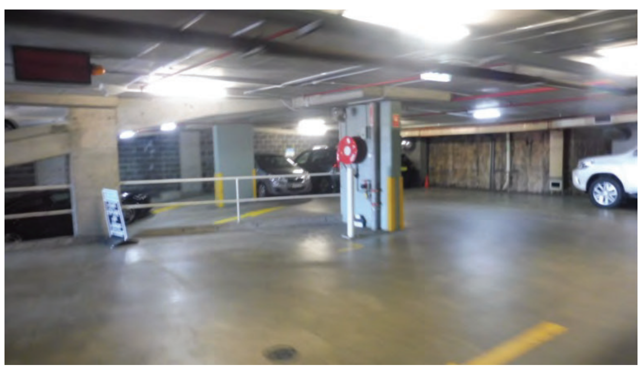
3.1. Foundations and Sub-Structure

The foundations and sub-structure of the subject property comprise the following:

- The foundations of the property were concealed and no construction drawings were provided.
- It is likely the foundations are a series of reinforced concrete pad foundations varying in size and depth dependent on location housed on rock with the reinforced basement floor slab constructed above to the building with reinforced columns.
- Exposed rock forms part of the basement structure.

We didn't note any major issues with the foundations of sub-structure from our visual inspection and there was no evidence of any major structural issues with the foundations.

3.2. Super Structure



Typical Structure

The super structure of the subject property comprises the following:

- Combination of reinforced concrete columns and brick columns supporting reinforced concrete slabs and floors. No floor thickness was reviewed but from site measures on stairs the floor thickness is circa 190mm thick.

3.2.1. Design Loads

No design loads were clearly identified on the as built drawings but anticipate they were designed to the commercial loads required at the time of construction.

From our visual inspection the super structure was in good condition commensurate with its age with no major defects noted.

The floor to soffit heights within the building are detailed below:

Location	Floor to soffit	Floor to ceiling
Basement 1	3,300mm	
Basement 2	2,550mm & 6,100mm	
Basement 3	2,500mm	
Lobby Ground floor		2,800mm
Switch room ground floor	3,600mm	
Level 1		2,250mm & 2,600mm
Level 3		2,600mm
Level 11 Plant	5,900mm	

Key items of note during our inspection are as follows:

- Local carbonation of concrete and corrosion to reinforcements within the Level B3 carpark soffit evident by the cracked concrete and corroded reinforcements. These have been partially repaired and treated but the concrete still requires making good. Allow for local repairs in the short term;

Spalling concrete to soffit B3

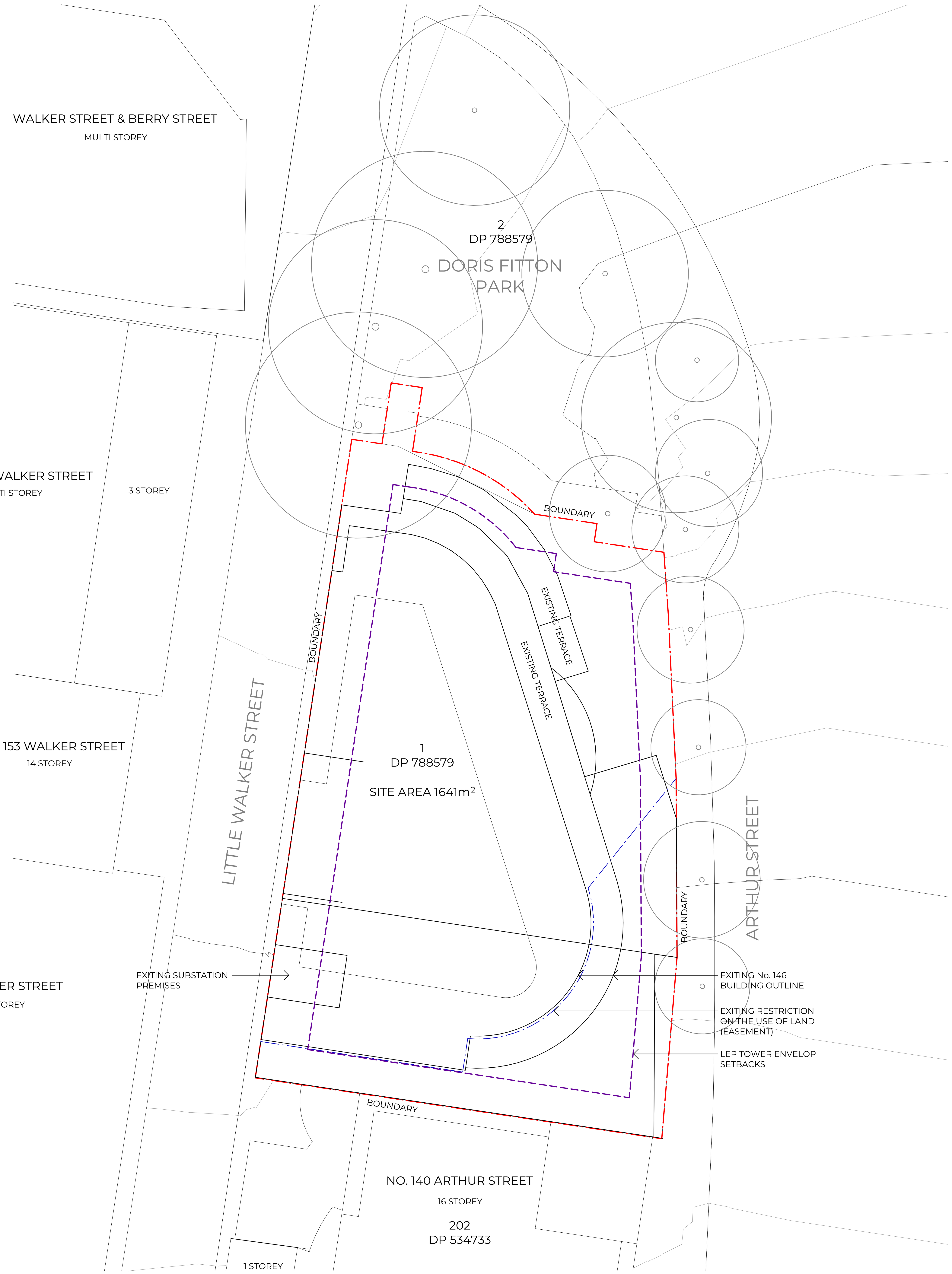
- Cracking circa 2-3mm was noted in one location to B2 floor slab. Although not a major structural concern we would recommend these be locally treated and repaired as required;

Local cracking to B2 floor

The above items have been included within the capex report within Appendix I.

Appendix D

Proposed Development Drawings



W—B
WOODS BAGOT

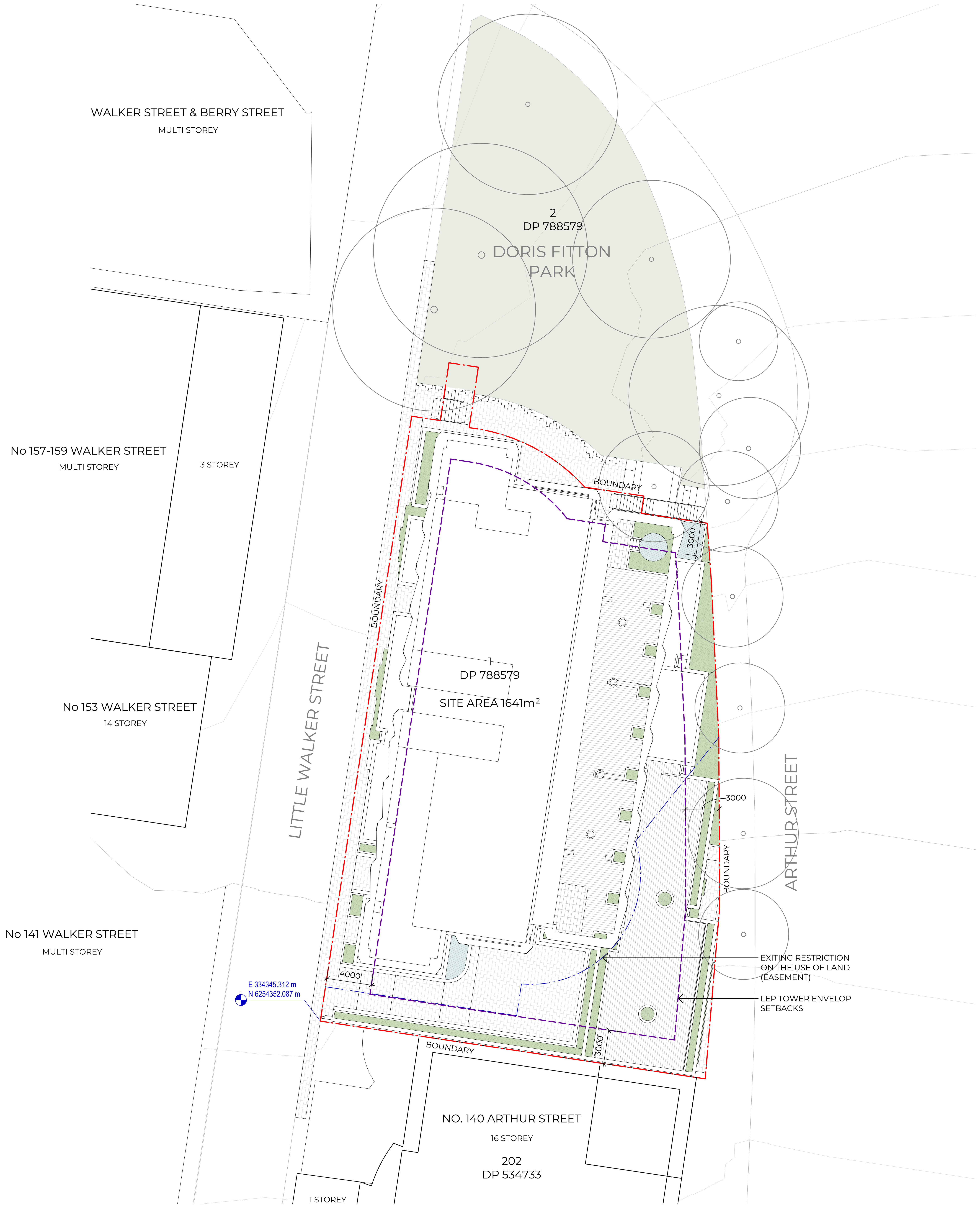
Client
Aqualand

Project
146 Arthur Street

Sheet title
Existing Site Plan

Project no.	Scale	Sheet size
121888	1 : 200	A1
Sheet no.	**Revision**	**Date**
DA - 1110	A	05/03/24

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent

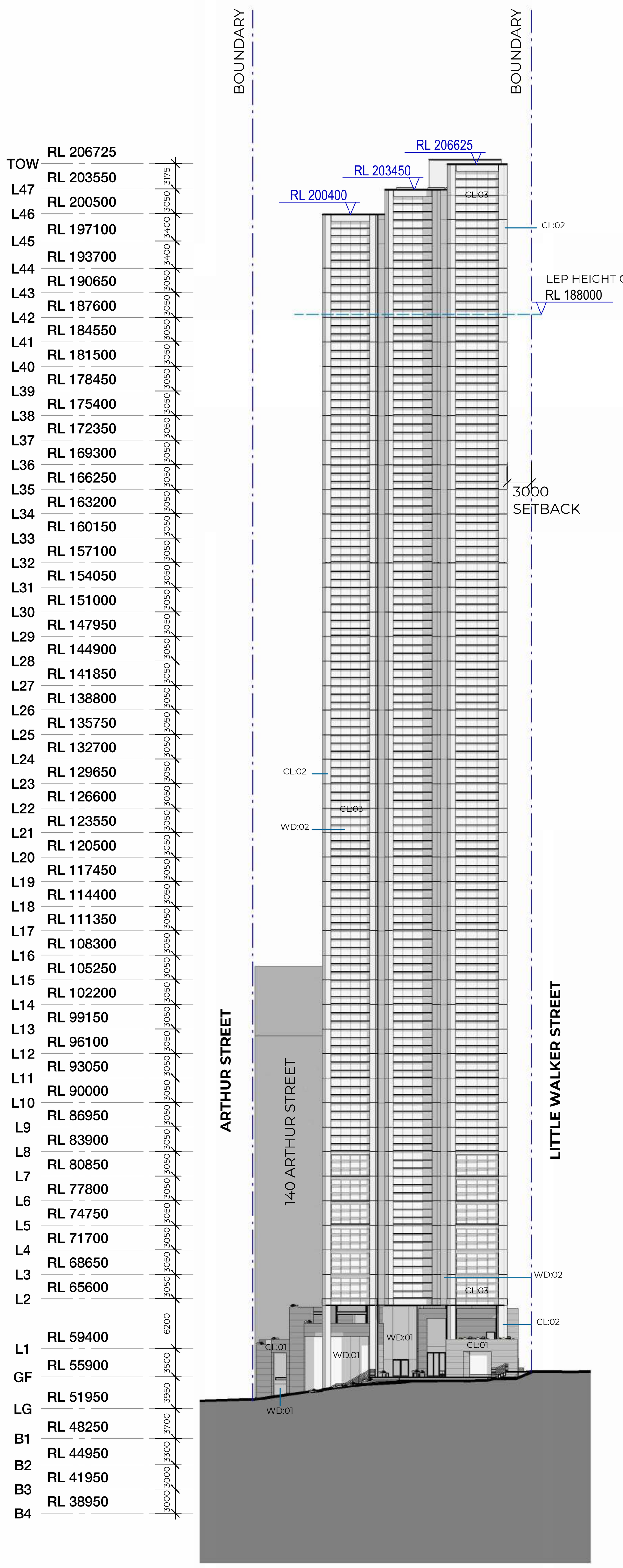


W—B WOODS BAGOT

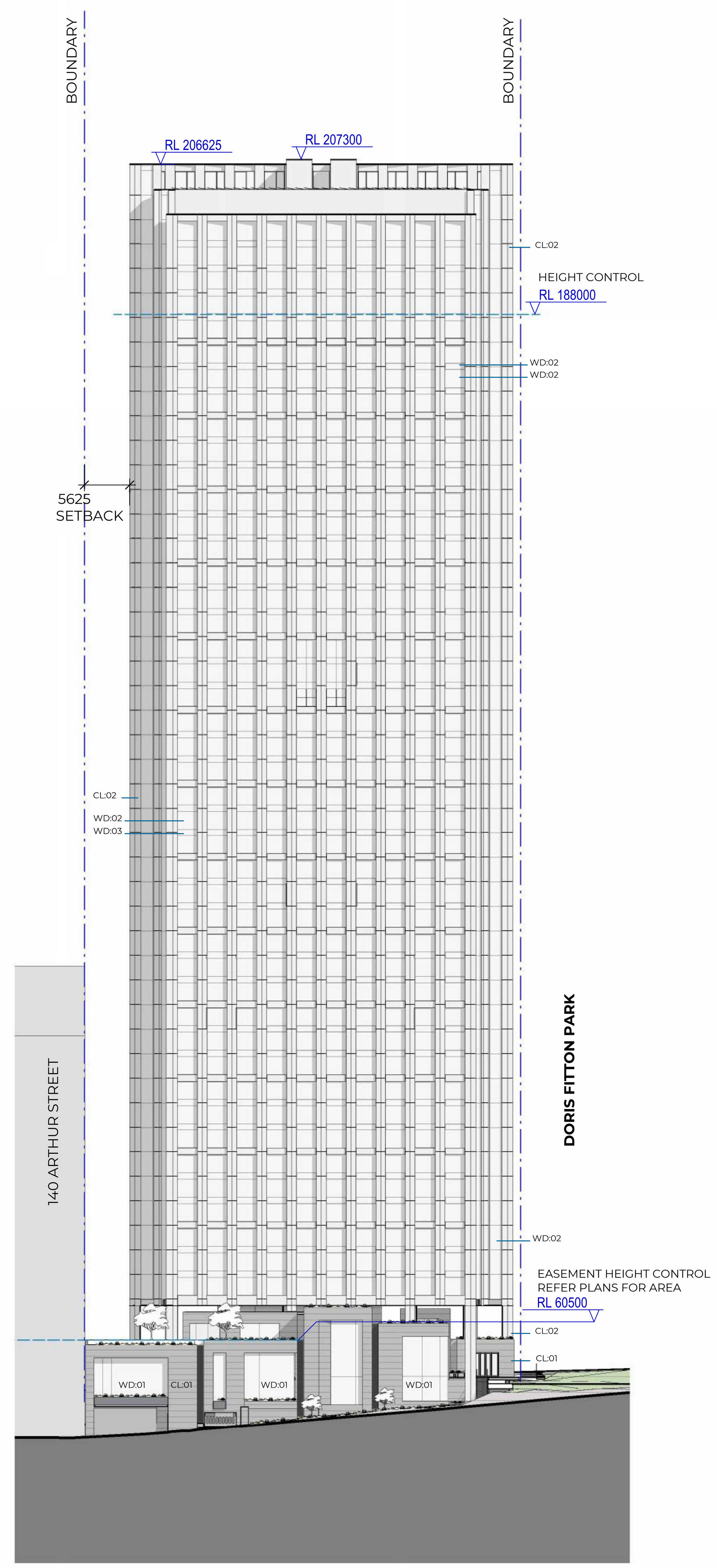
Client	Project	Sheet title
Aqualand	**146 Arthur Street**	**Proposed Site plan**

Project no.	Scale	Sheet size
121888	**1 : 200**	**A1**
Sheet no.	**Revision**	**Date**
DA - 1220	**A**	**05/03/24**

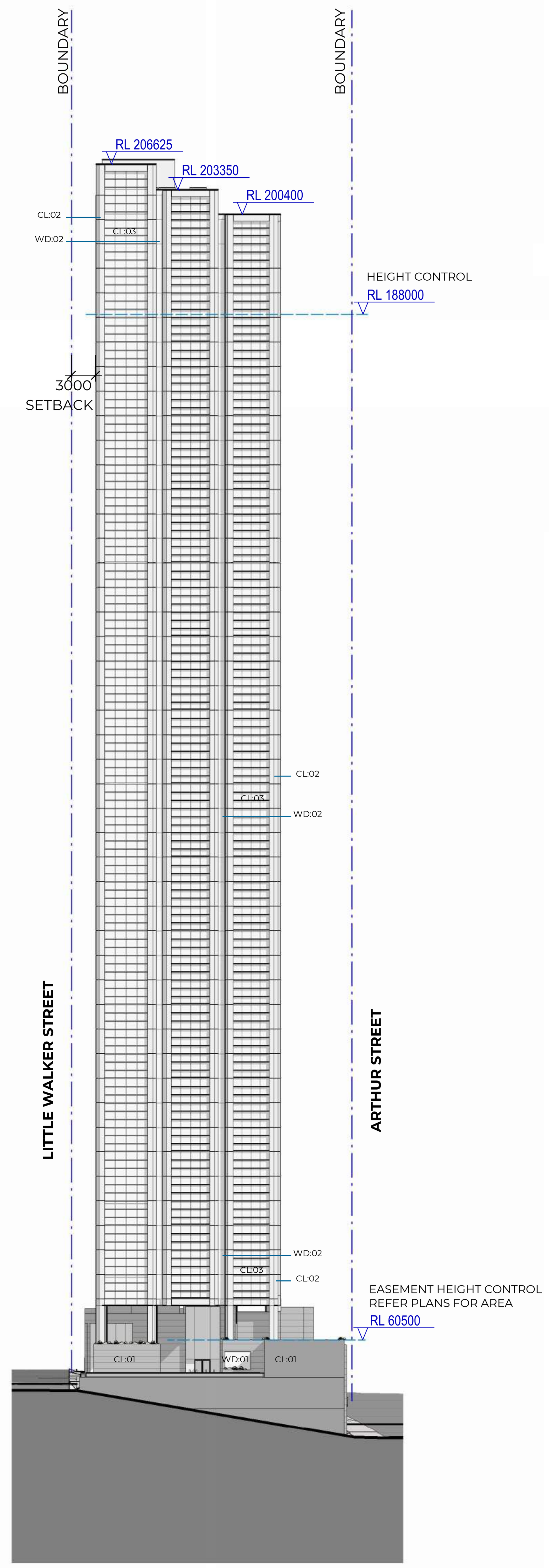
Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent



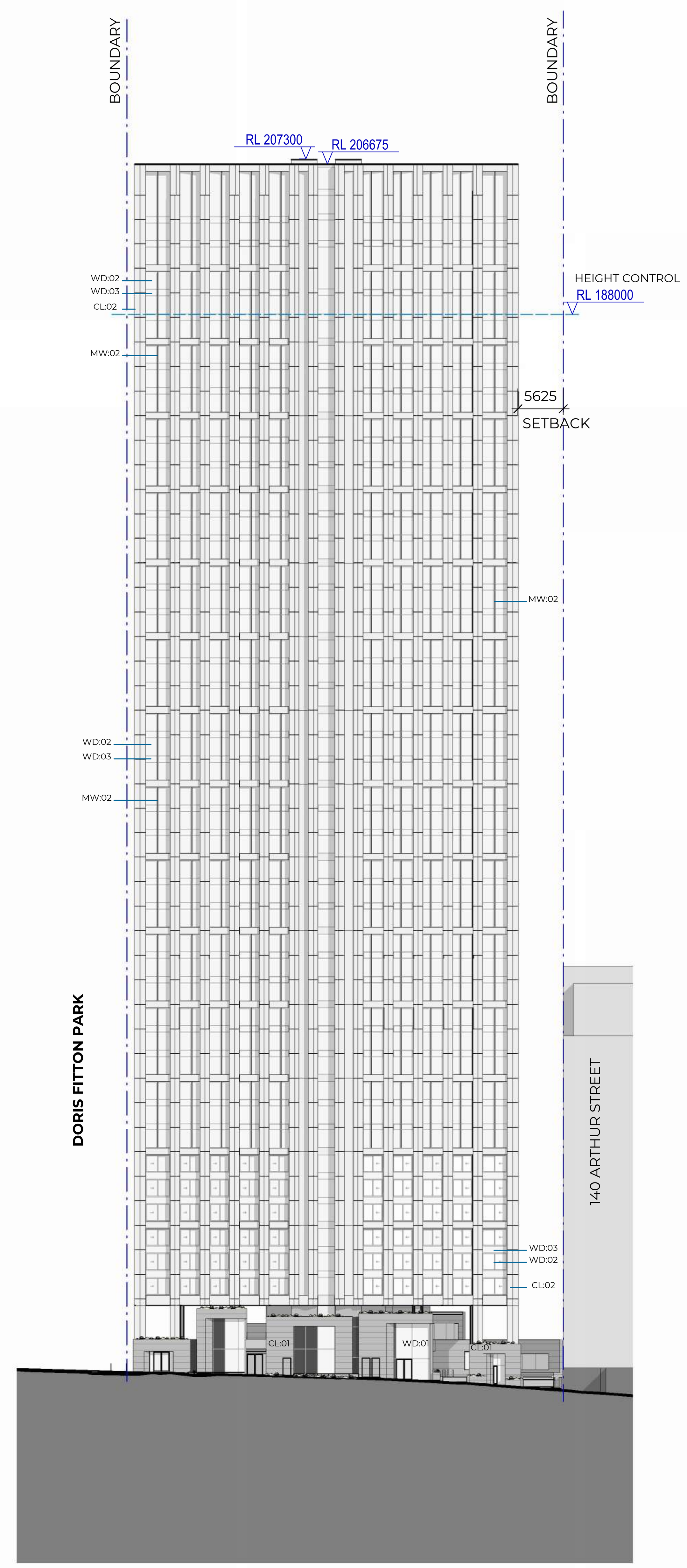
1 Overall Elevation - North
SCALE 1 : 500



2 Overall Elevation - East
SCALE 1 : 500



4 Overall Elevation - South
SCALE 1 : 500



3 Overall Elevation - West
SCALE 1 : 500

MATERIAL FINISHES LEGEND

CL:01 - BRICK CLADDING

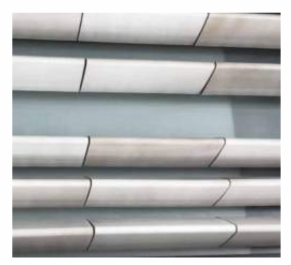
MW:01 - STEEL FRAMES

WD:01 - CHARCOAL WINDOW JOINERY

MW:02 - ALUMINIUM FINS

MW:03 - WOOD FINISH ALUMINIUM BATTENS

CL:02 - TERRACOTTA CLADDING



CL:03 - ALUMINIUM BAGUETTES

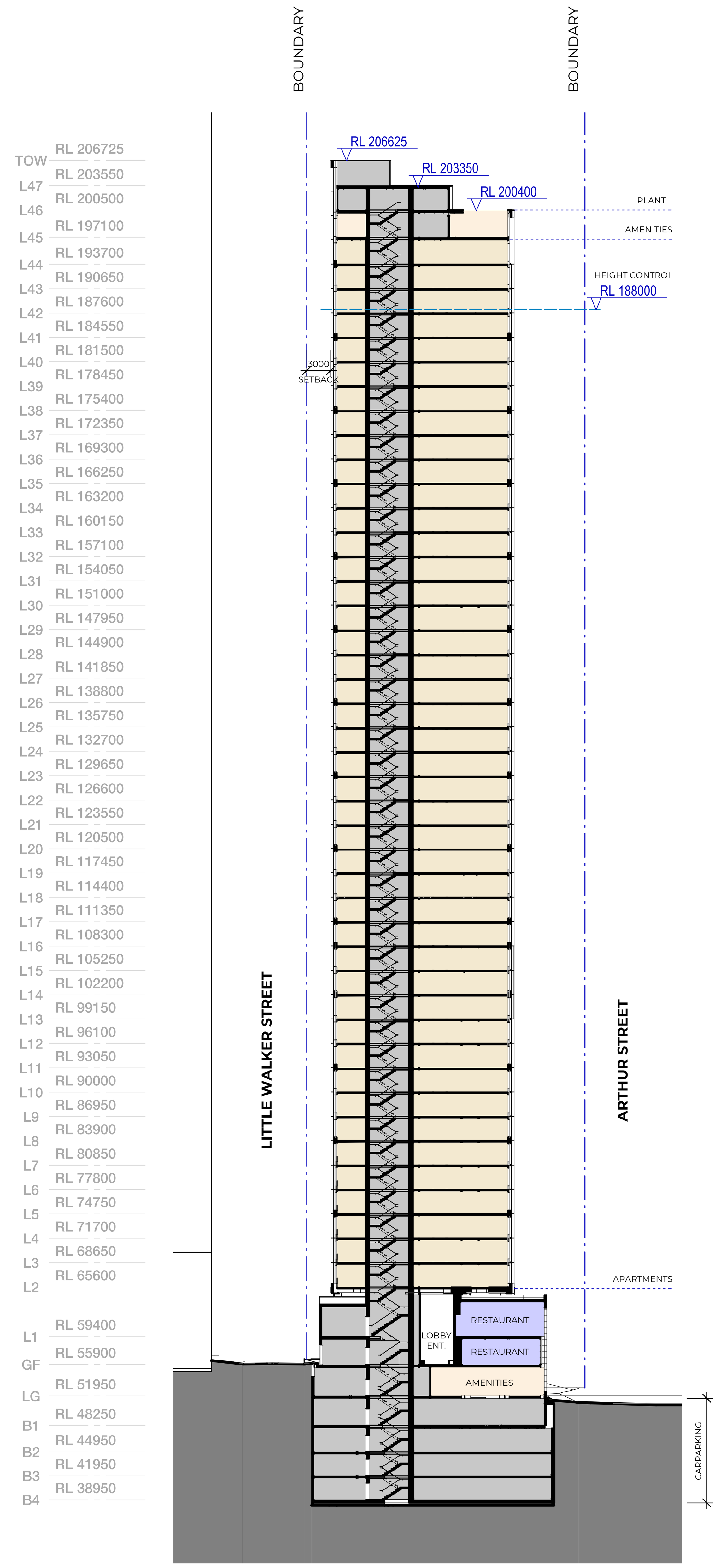
WD:02 - TRANSPARENT CURTAIN WALL

WD:03 - OPAQUE CURTAIN WALL

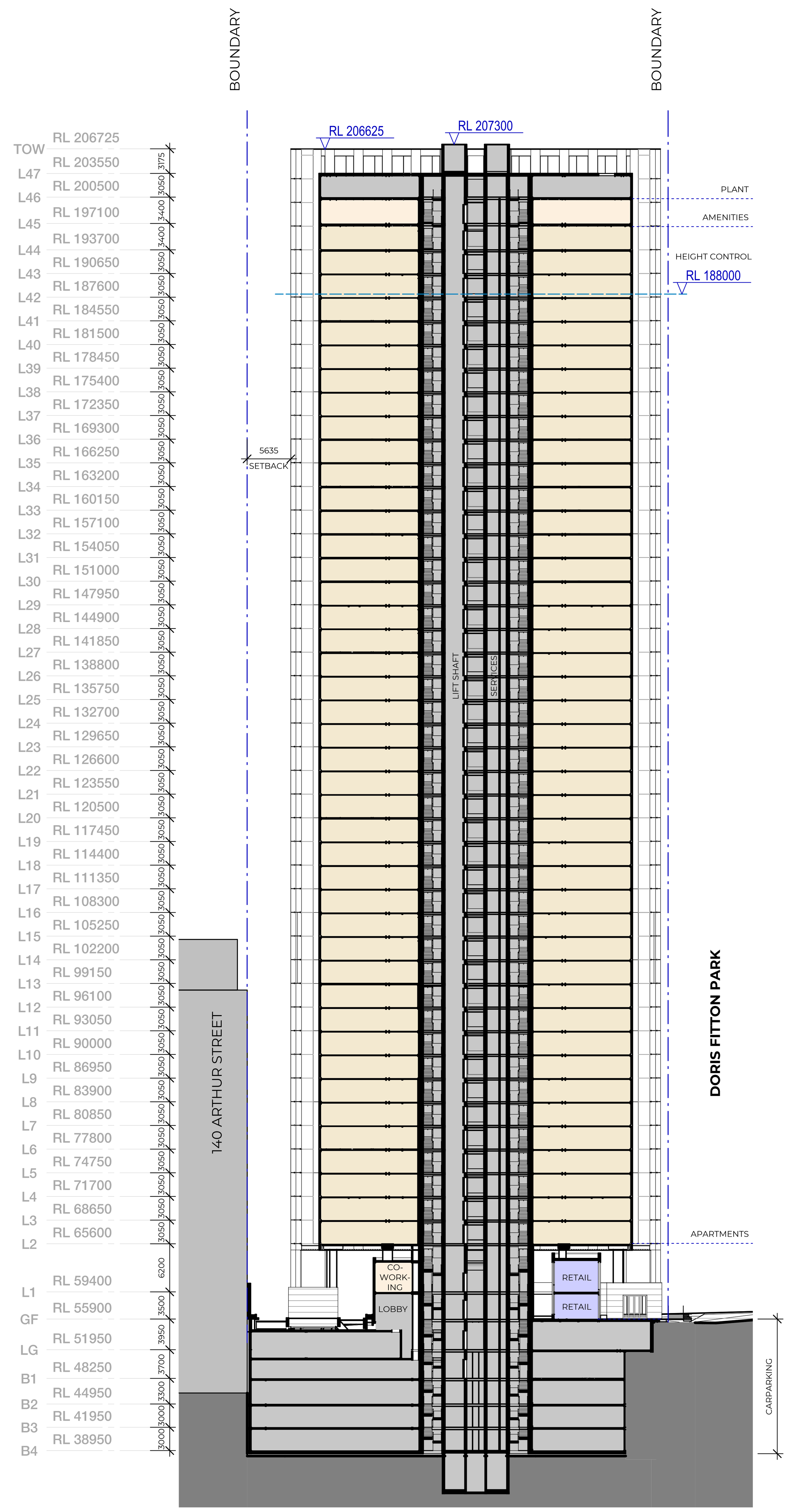
W–B WOODS BAGOT

Client	Project	Sheet title	Project no.	Scale	Sheet size
Aqualand	**146 Arthur Street**	**Overall Elevations**	121888	As indicated	A1
			Sheet no. DA - 1300	**Revision** A	**Date** 05/03/24

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent



1 Section East/West
SCALE 1 : 500



2 Section North/South
SCALE 1 : 500

WOODS BAGOT

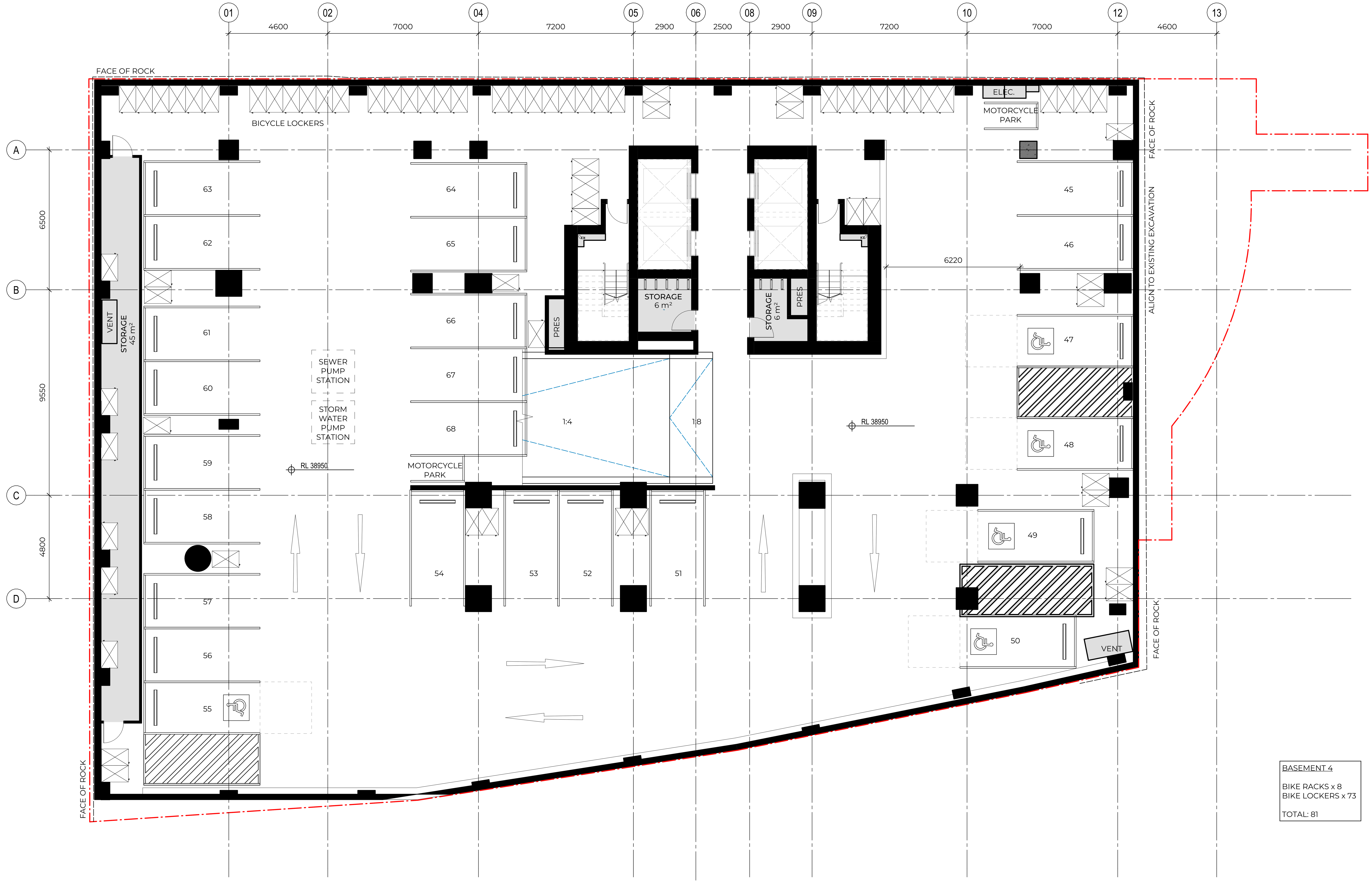
Client
Aqualand

Project
146 Arthur Street

Sheet title
Overall Sections

Project no. 121888	Scale 1 : 500	Sheet size A1	© Woods Bagot
Sheet no. DA - 1320	Revision A	Date 05/03/24	

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent



W—B WOODS BAGOT

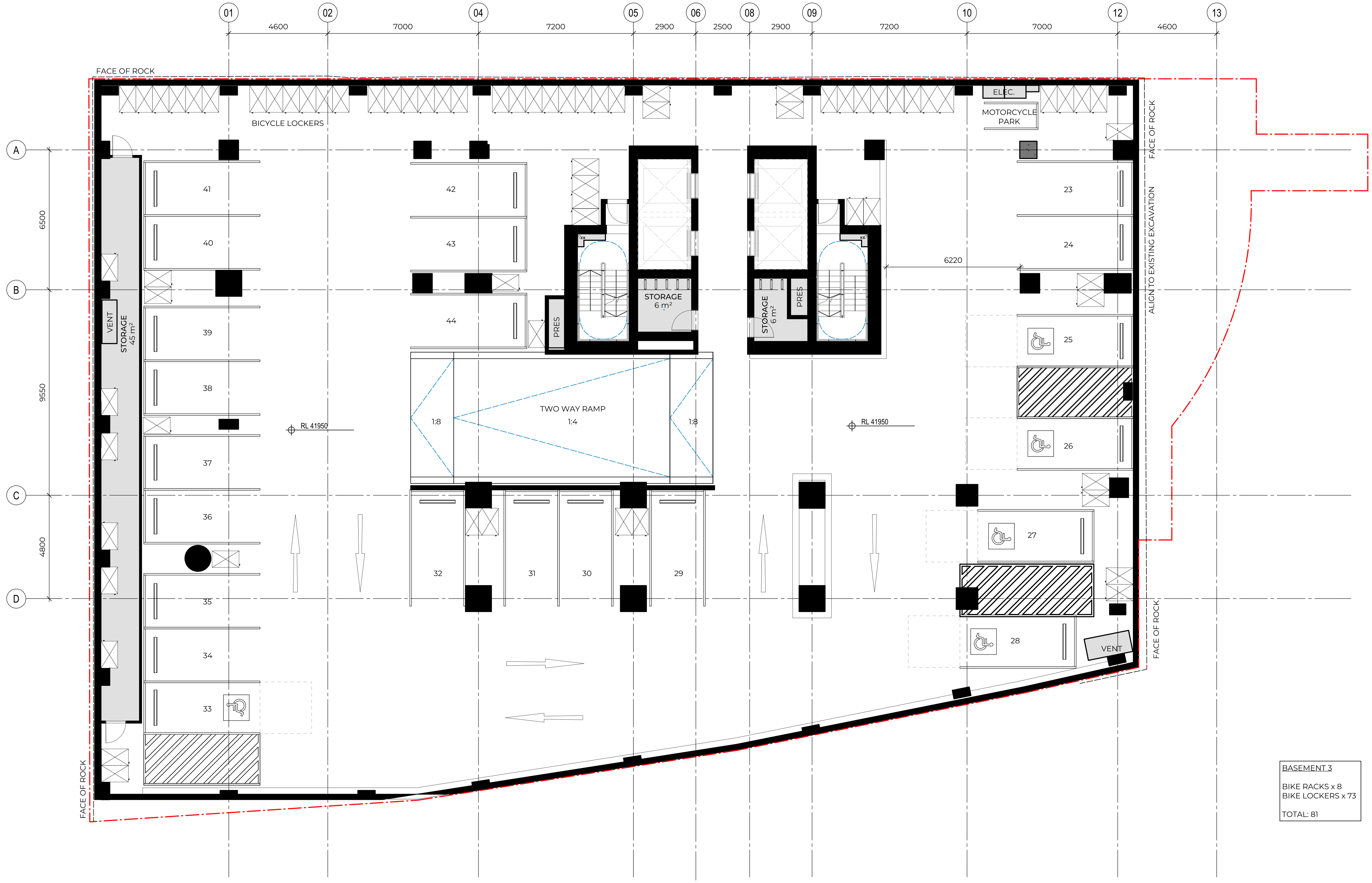
Client
Aqualand

Project
146 Arthur Street

Sheet title
Basement 04 - Car Park

Project no.	Scale	Sheet size
121888	1 : 100	A1
Sheet no.	**Revision**	**Date**
DA - 2204	A	05/03/24

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent



BASEMENT 3
BIKE RACKS x 8
BIKE LOCKERS x 73
TOTAL: 81

W—B WOODS BAGOT

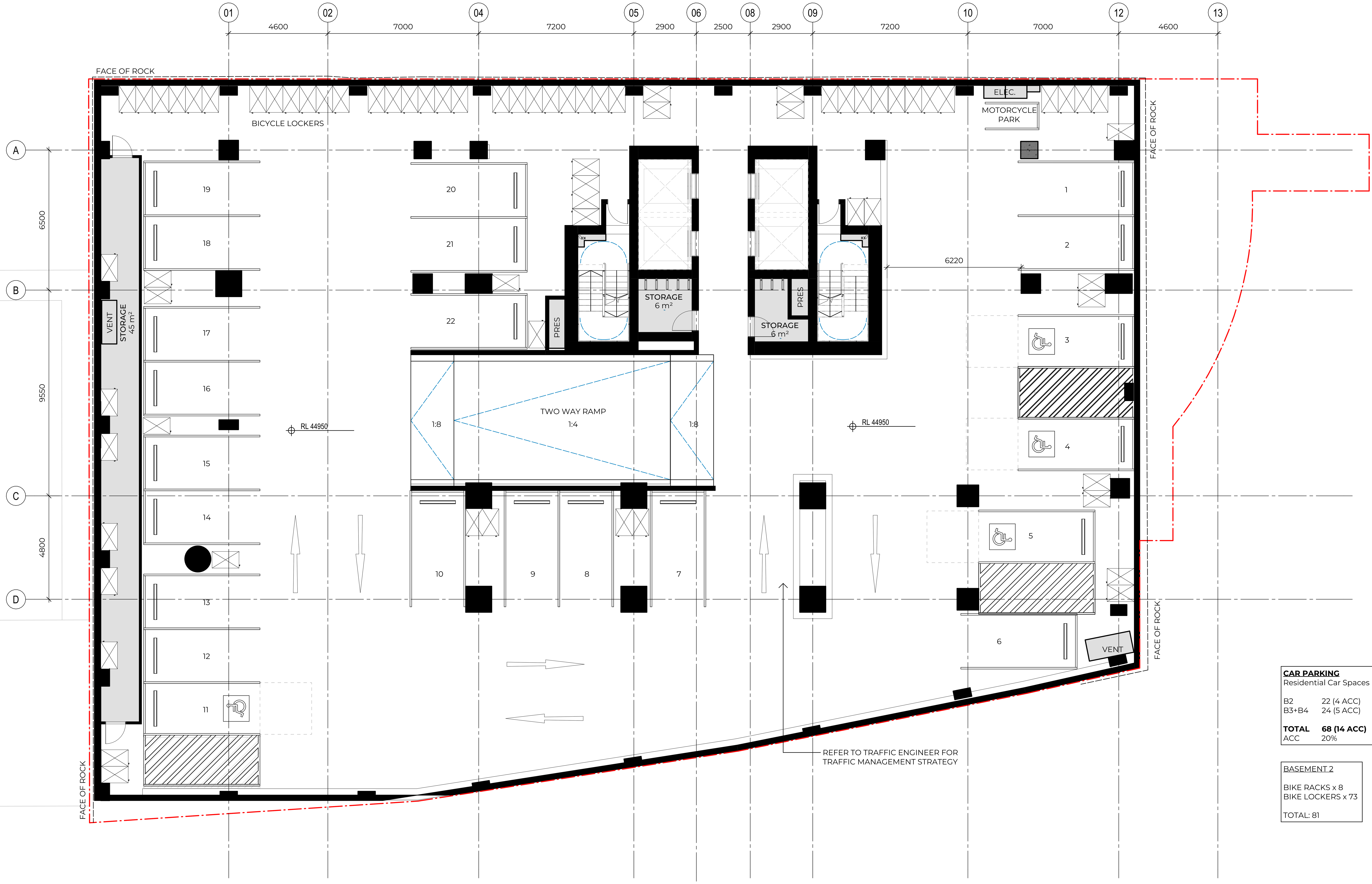
Client: Aqualand

Project: 146 Arthur Street

Sheet title: Basement 03 - Car Park

Project no.: 121888
Scale: 1 : 100
Sheet size: A1
Sheet no.: DA - 2205
Revision: A
Date: 05/03/24

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent



CAR PARKING

Residential Car Spaces Max = 78 (20% of Units)

B2	22 (4 ACC)
B3+B4	24 (5 ACC)
TOTAL	**68 (14 ACC)**
ACC	20%

BASEMENT 2

BIKE RACKS x 8
BIKE LOCKERS x 73

TOTAL: 81

W—B WOODS BAGOT

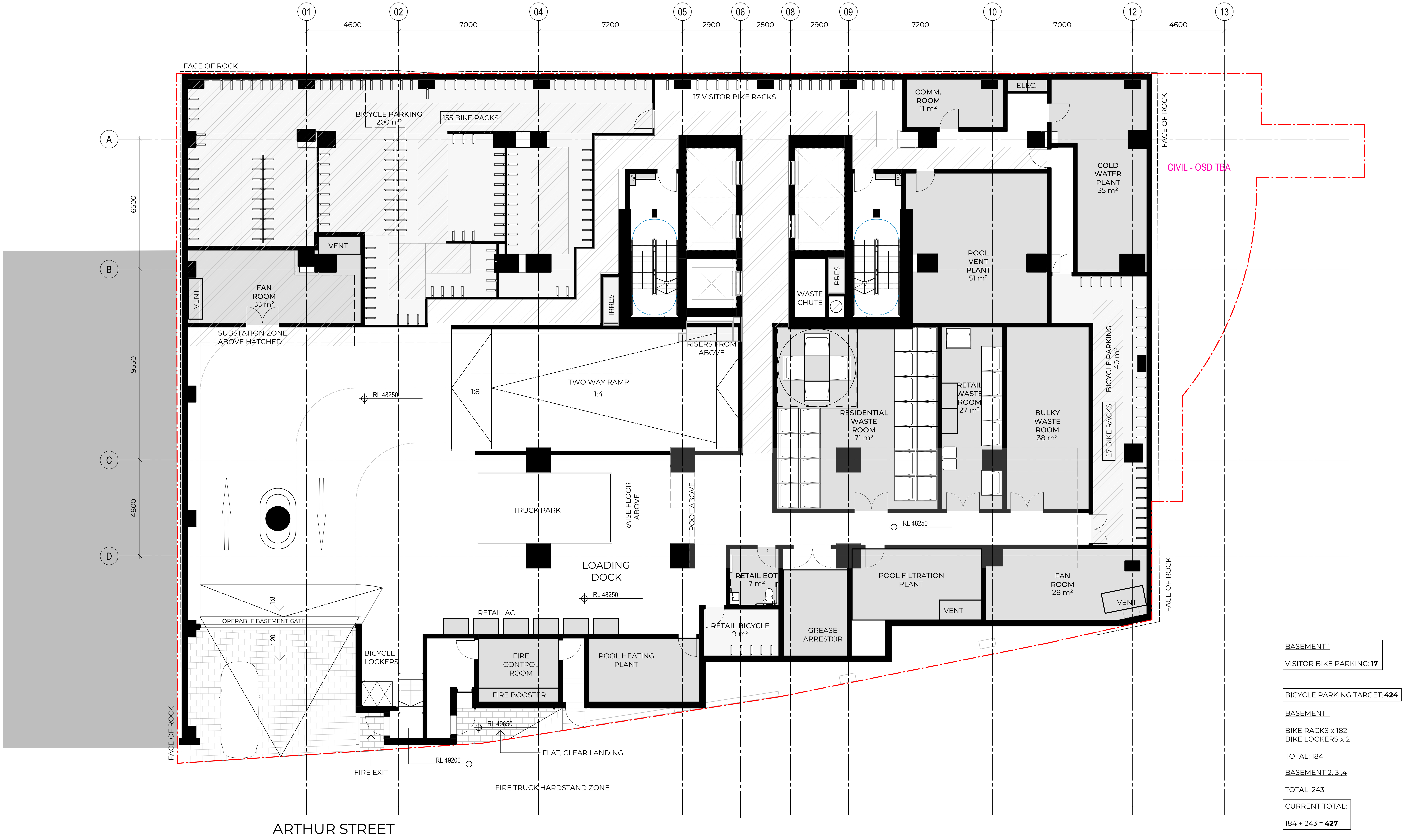
Client
Aqualand

Project
146 Arthur Street

Sheet title
Basement 02 - Car Park

Project no.	Scale	Sheet size
121888	1 : 100	A1
Sheet no.	**Revision**	**Date**
DA - 2206	A	05/03/24

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent



WOODS BAGOT

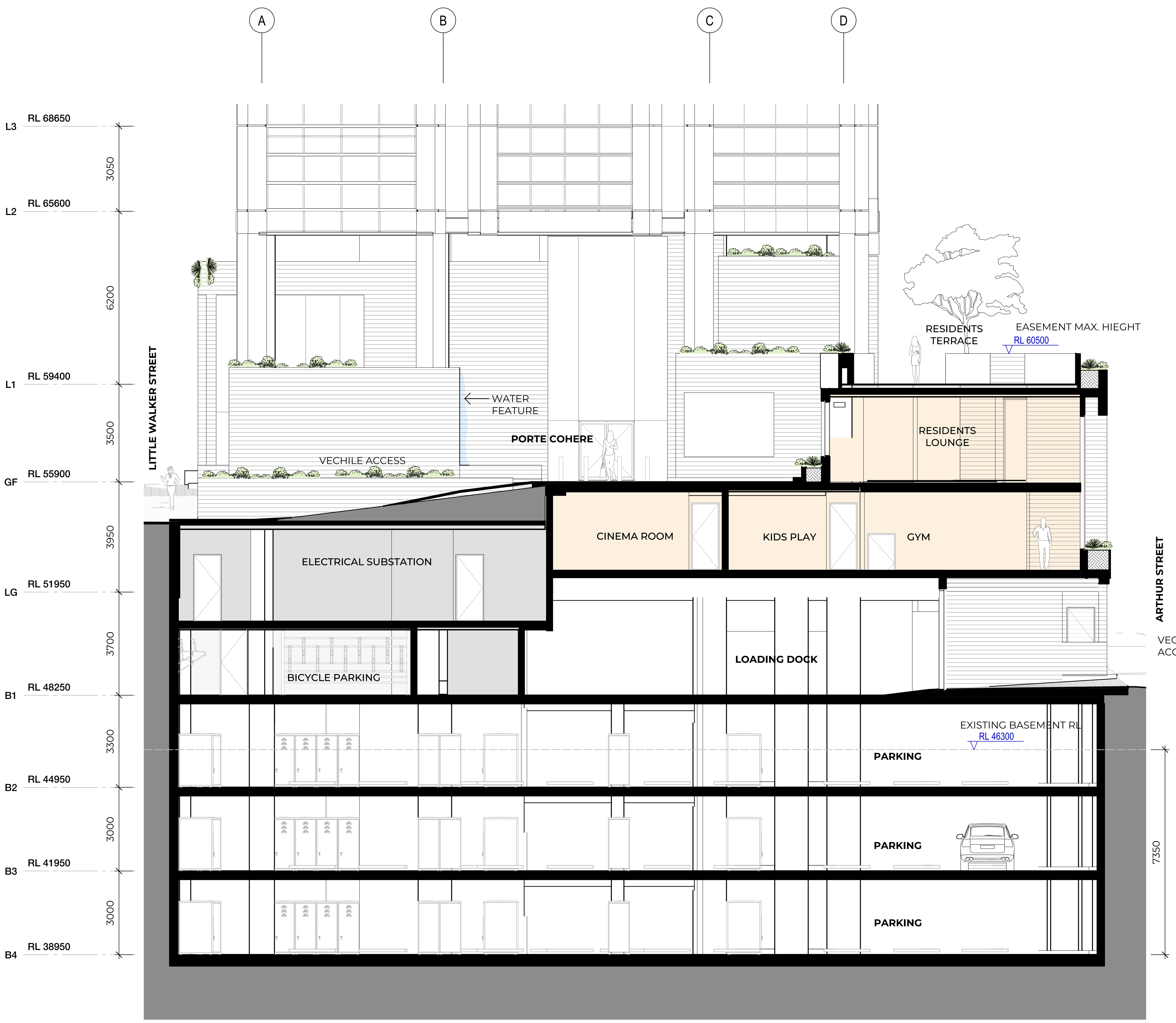
Client
Aqualand

Project
146 Arthur Street

Sheet title
Basement 01 - Car Park / Loading Dock

Project no.	Scale	Sheet size
121888	1 : 100	A1
Sheet no.	**Revision**	**Date**
DA - 2207	A	05/03/24

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent



1 PODIUM EAST WEST 01
SCALE 1 : 100

2 PODIUM EAST WEST 02
SCALE 1 : 100

W—B WOODS BAGOT

Client
Aqualand

Project
146 Arthur Street

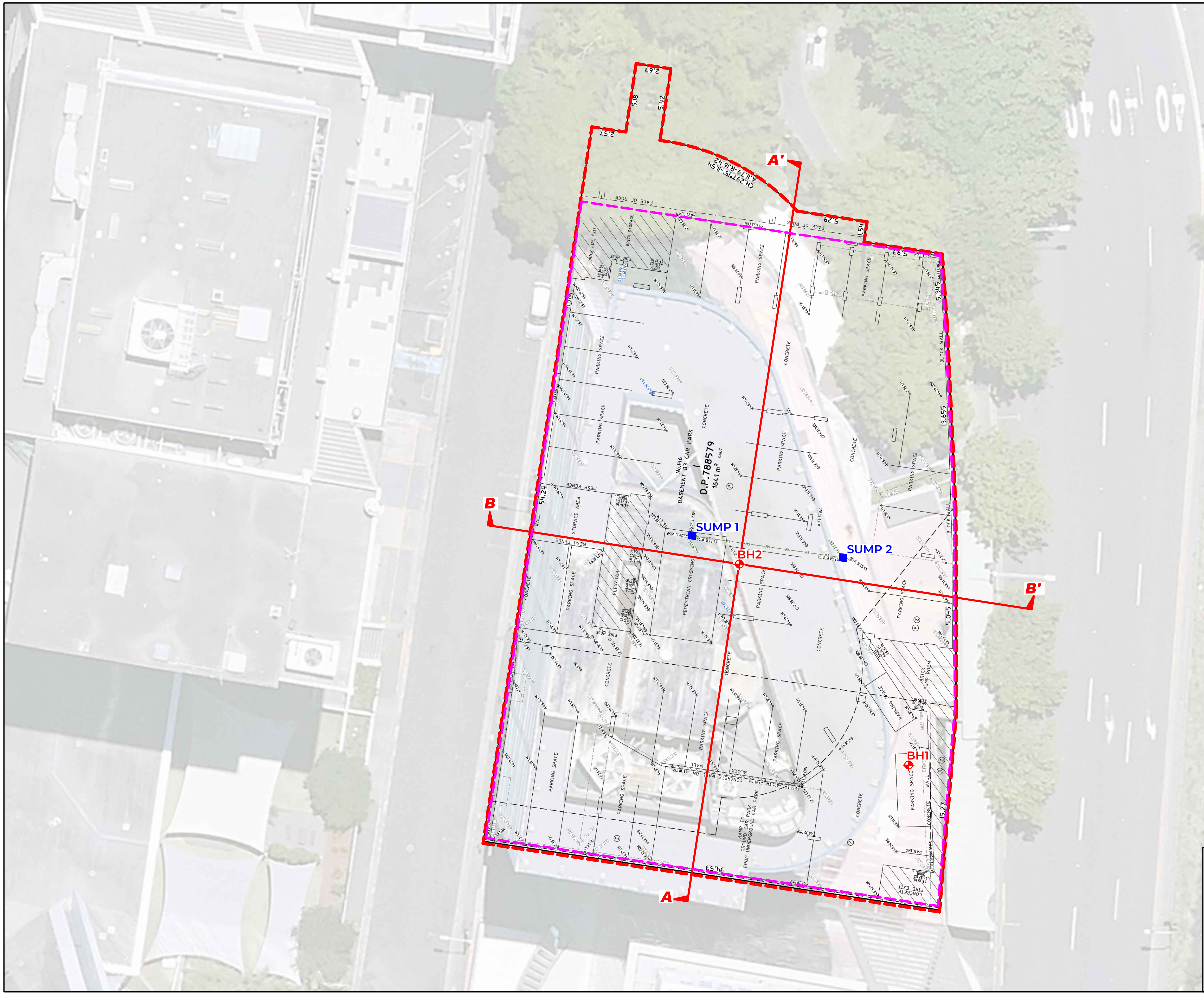
Sheet title
Sections - Podium East West

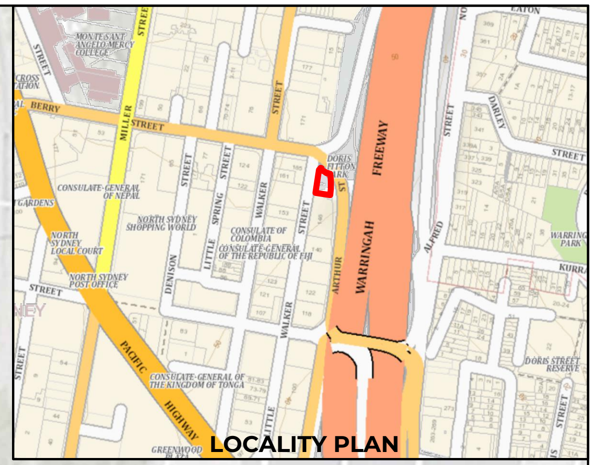
Project no. 121888	Scale 1 : 100	Sheet size A1	© Woods Bagot
Sheet no. DA - 3240	Revision A	Date 05/03/24	

Note:
Minor changes to form and configuration may be required when drawings are subsequently prepared for construction purposes after the grant of development consent

Appendix E

Geotechnical Plan and Cross-Sections





LEGEND

- Approximate Site Boundary
- Existing B3 Basement Outline - FFL 46.3 m
- Geological Cross Section A-A'
- Borehole Location
- Sump Location

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	11.01.2024	EC/MN

COORDINATE REFERENCE SYSTEM: GDA2020 MGA56

Douglas PARTNERS

OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02) 9809 0666

CLIENT: **The Trustee for JW Argyle Trust**

NOTE:
1: Base image from MetroMap (Dated 19.11.2023)
2: Base Survey Plan from CMS Surveyors, Reference 23009detail, Revision 1 (Dated 23.11.2023)

SCALE: 0 1 2 4 6 8 10 15 — 1:300 @ A3

PROJECT NAME: **Proposed Residential Tower**

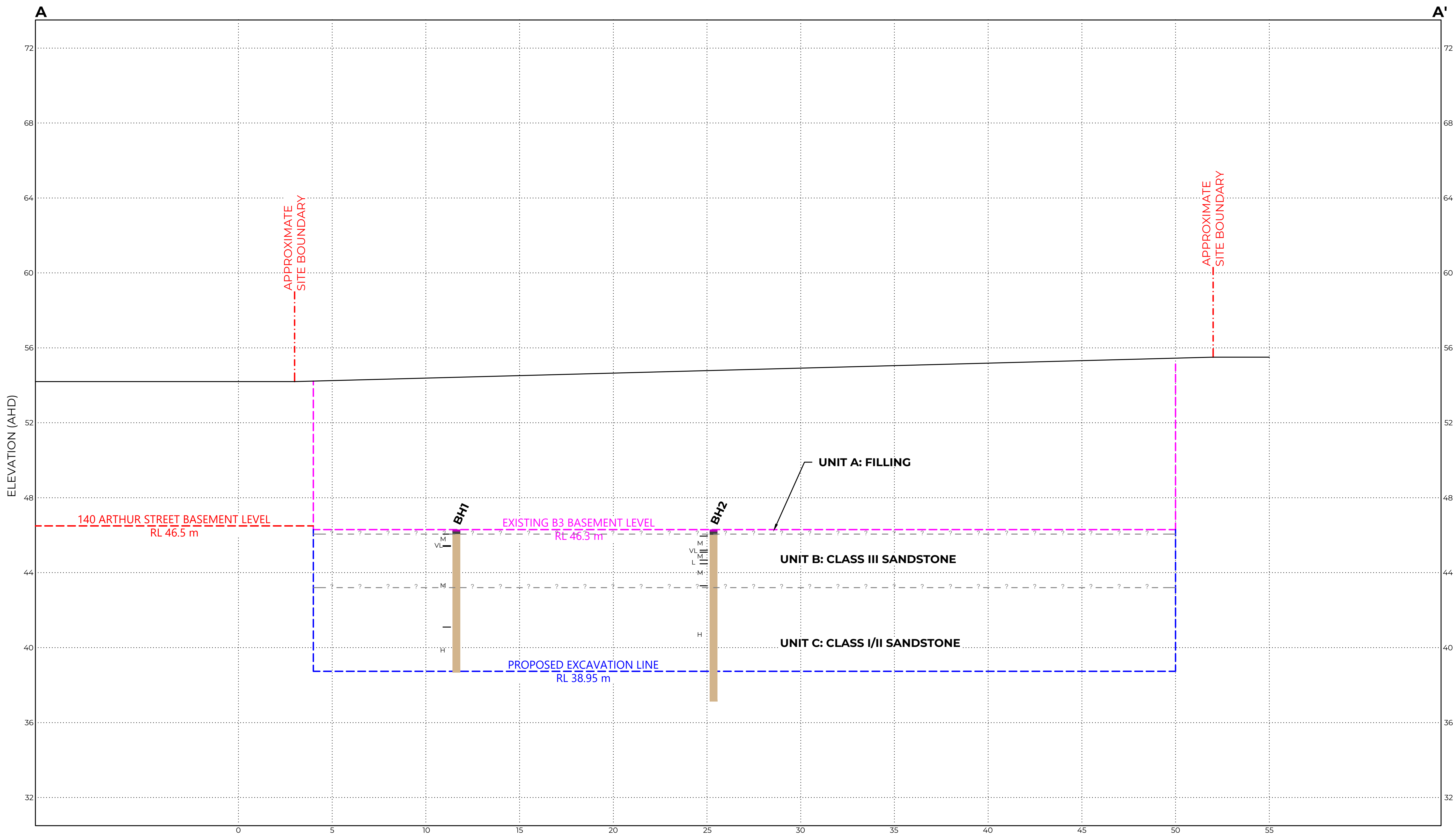
PROJECT ADDRESS: **146 Arthur Street, North Sydney**

DRAWING TITLE: **TEST LOCATION PLAN**

PROJECT No: **225758.00**

DRAWING No: **1**

REVISION: **0**



LEGEND
- CONCRETE
- FILL
- SANDSTONE

TESTS / OTHER
- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary

ROCK STRENGTH
- EL - Extremely Low
- VL - Very Low
- L - Low
- M - Medium
- H - High

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	11.01.2024	EC/MN
1	REVISED PROPOSED DEVELOPMENT	19.04.2024	CJ

SCALE: 0 4 Horizontal Scale (metres) 1:200 (H) 1:200 (V) @ A3

Douglas PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02) 9809 0666

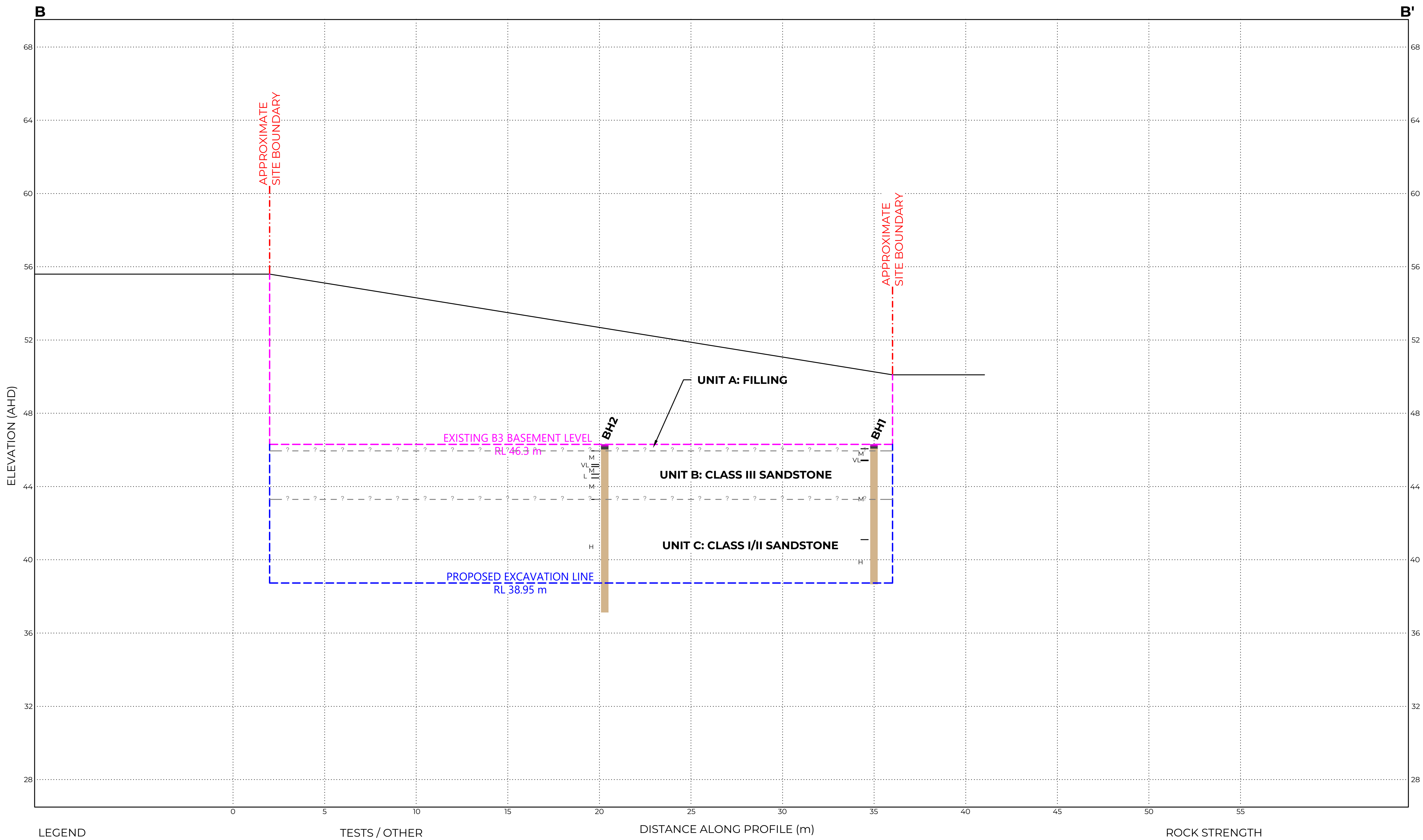
CLIENT: The Trustee for JW Argyle Trust

NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.

PROJECT NAME: Proposed Residential Tower
PROJECT ADDRESS: 146 Arthur Street, North Sydney

DRAWING TITLE: INTERPRETED GEOTECHNICAL CROSS-SECTION A-A'

PROJECT No: 225758.00
DRAWING No: 2
REVISION: 1



LEGEND
- CONCRETE
- FILL
- SANDSTONE

TESTS / OTHER
- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary

ROCK STRENGTH
- EL - Extremely Low
- VL - Very Low
- L - Low
- M - Medium
- H - High

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	11.01.2024	EC/MN
1	REVISED PROPOSED DEVELOPMENT	19.04.2024	CJ

SCALE: 0 – 4 Horizontal Scale (metres) 1:200 (H) 1:200 (V) @ A3

Douglas PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02) 9809 0666

CLIENT: **The Trustee for JW Argyle Trust**

NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.

PROJECT NAME: **Proposed Residential Tower**

PROJECT ADDRESS: **146 Arthur Street, North Sydney**

DRAWING TITLE: **INTERPRETED GEOTECHNICAL CROSS-SECTION B-B'**

PROJECT No: **225758.00**

DRAWING No: **3**

REVISION: **1**

Appendix F

Borehole Logs, Photographs and Explanatory Notes

BOREHOLE LOG

CLIENT: The Trustee for JW Argyle Trust
PROJECT: Proposed Residential Tower
LOCATION: Pepper House, 146 Arthur Street, North Sydney, NSW
SURFACE LEVEL: 46.3 AHD
COORDINATE: E:334381.0, N:6254358.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°
LOCATION ID: BH1
PROJECT No: 225758.00
DATE: 08/12/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED

Groundwater: 08/12/23 Groundwater observation obscured due to drilling water

Depth (m)	Description of Strata	Origin	Moisture
0.11	CONCRETE: 2 x rebar at 40mm		
0.24	FILL / SAND, trace gravel: grey; medium to coarse; sandstone gravel; (drainage material).	FILL	M
	SANDSTONE: grey, fine to medium grained. Hawkesbury Sandstone From 2.28m: grey and orange-brown From 4.11m: grey and crossbedded at 10-15°		
7.63	Borehole discontinued at 7.63m depth. .		

Rock

Depth (m)	Weath.
0.24–0.86	SW
0.89–4.11	SW
4.11–7.63	FR

Strength depth boundaries: 0.24, 5.20 m. Letters on the strength plot: M (at about 0.5 m), M (at about 3.05 m), H (at about 6.5 m).

Recovery (%)	RQD
100	92
100	100
100	95
100	100
100	100

Defects & Remarks

Defect
0.49m: B/5°, PR, CN, RF
0.85m: B/0°, PR, CT Clay, RF, and CBS SN
0.86m: EW, Clay 30mm
1.87m: B/5°, PR, SN Fe, RF, and Clay INF
1.98m: B/5°, PR, CT Clay, RF
2.08m: B/0°, PR, CN, PO
2.64m: B/5°, PR, CN, RF
3.04m: B/5°, PR, SN Fe, RF
3.11m: B/5°, PR, SN Fe, RF
3.22m: B/5°, PR, CN, RF
3.67m: B/10°, PR, CN, RF
4.20m: B/10°, PR, CN, RF
4.38m: B/10°, PR, CN, RF
4.90m: B/5°, PR, SN M, RF
5.03m: B/0°, PR, SN M, RF
5.20m: B/5°, PR, CN, RF
5.36m: B/5°, PR, CN, RF
5.47m: B/5°, PR, CN, RF
5.64m: B/5°, PR, CN, RF
6.20m: B/5°, PR, CT Clay, RF
6.71m: B/5°, PR, INF Clay, RF

SAMPLE

Type	Depth (m)
C	0.90
UCS	6.53

TESTING

Test Type	Results and Remarks
PLT	PL(A)=0.8MPa
PLT	PL(A)=0.8MPa
PLT	PL(A)=1.3MPa
PLT	PL(A)=0.9MPa
PLT	PL(A)=0.5MPa
PLT	PL(A)=1.3MPa
PLT	PL(A)=1.5MPa
PLT	PL(A)=1.2MPa

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand-portable drilling rig
OPERATOR: TightSite (BB)
LOGGED: LDS
METHOD: DT to 0.11m, HA to 0.24m, NMLC to 7.63m
CASING: HW to 0.4m
REMARKS: Borehole location measured from site features and determined based on the survey drawing (Dwg No: 23009detail) prepared by CSM Surveyors Pty Ltd

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

CORE PHOTO LOG

CLIENT:	The Trustee for JW Argyle Trust	**SURFACE LEVEL:**	46.3 AHD	**LOCATION ID:**	BH1
PROJECT:	Proposed Residential Tower	**COORDINATE:**	E:334381.0, N:6254358.0	**PROJECT No:**	225758.00
LOCATION:	Pepper House, 146 Arthur Street, North Sydney, NSW	**DATUM/GRID:**	MGA2020 Zone 56	**DATE:**	08/12/23
		DIP/AZIMUTH:	90°/---°	**SHEET:**	1 of 1

0.43-5.00 m depth

5.00-7.63 m depth

BOREHOLE LOG

CLIENT: The Trustee for JW Argyle Trust
PROJECT: Proposed Residential Tower
LOCATION: Pepper House, 146 Arthur Street, North Sydney, NSW
SURFACE LEVEL: 46.3 AHD
COORDINATE: E:334364.8, N:6254374.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°
LOCATION ID: BH2
PROJECT No: 225758.00
DATE: 15/12/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED

Groundwater: 15/12/23 Groundwater observation obscured due to drilling water

Depth (m)	Description of Strata	Origin	Moisture
0.12	CONCRETE SLAB: 2x rebar at 40mm		
0.28	FILL / SAND, trace gravel: grey and dark grey; medium to coarse; sandstone gravel.	FILL	M
	SANDSTONE: grey and orange-brown, medium to coarse grained. Hawkesbury Sandstone		
	From 5.82m: trace high strength ironstone bands		
9.17	Borehole discontinued at 9.17m depth.		

Rock

Depth (m)	Weathering	Strength
0.35 – 1.19	SW	M
1.21 – 1.66	SW	M
1.66 – 1.83	MW	L
1.83 – 2.20	SW	M
2.20 – 3.00		M
3.00 – 9.17	SW to FR	H

Recovery (%)	RQD
100	93
100	91
100	94
100	100
100	100
100	100

Defects & Remarks

- 0.50m: B, 0°, PR, CN, RF
- 0.59m: B, 5°, PR, CN, RF
- 1.19m: CS, 20mm
- 1.51m: B, 10°, PR, SN Fe, RF
- 2.17m: B, 10°, PR, SN Fe, RF
- 2.23m: B, 5°, PR, CT Clay, RF
- 2.37m: B, 5°, PR, CT Clay, RF
- 2.70m: B, 10°, PR, SN Fe, RF, M SN
- 2.81m: B, 5°, PR, CT Clay, RF
- 2.85m: B, 0°, PR, CT Clay, RF
- 2.90m: B, 10°, PR, CN, RF
- 3.50m: CS, 10mm
- 3.65m: B, 20°, PR, CN, RF
- 3.68m: B, 20°, PR, CN, RF
- 3.84m: B, 20°, PR, CN, RF
- 4.03m: B, 20°, PR, CN, RF
- 4.37m: B, 5°, PR, SN Fe, RF
- 6.12m: B, 5°, PR, SN Fe, RF
- 7.16m: B, 0°, PR, CN, RF
- 8.47m: B, 0°, PR, CN, RF

SAMPLE

Type	Depth (m)
C	1.51
UCS	6.11

TESTING

Test Type	Results and Remarks
PLT	PL(A)=0.7MPa
PLT	PL(A)=0.2MPa
PLT	PL(A)=0.7MPa
PLT	PL(A)=1MPa
PLT	PL(A)=1.2MPa
PLT	PL(A)=1.5MPa
PLT	PL(A)=1.8MPa
PLT	PL(A)=1.5MPa
PLT	PL(A)=0.7MPa
PLT	PL(A)=1.2MPa

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand-portable drilling rig
OPERATOR: TightSite (BB)
LOGGED: LDS
METHOD: DT to 0.12m, HA to 0.28m, HMLC to 0.35m, NMLC to 9.17m
CASING: HW to 0.4m
REMARKS: Borehole location measured from site features and determined based on the survey drawing (Dwg No: 23009detail) prepared by CSM Surveyors Pty Ltd

Refer to explanatory notes for symbol and abbreviation definitions

CORE PHOTO LOG

CLIENT: The Trustee for JW Argyle Trust
PROJECT: Proposed Residential Tower
LOCATION: Pepper House, 146 Arthur Street, North Sydney, NSW
SURFACE LEVEL: 46.3 AHD
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DIP/AZIMUTH: 90°/---°
LOCATION ID: BH2
PROJECT No: 225758.00
DATE: 15/12/23
SHEET: 1 of 1

0.35-5.00 m depth

5.00-9.17 m depth

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style `XW`. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	`KL`
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	`UK`
No data	Information required to allow classification of the property was not available. For example, if drilling is commenced from the base of a hole predrilled by others	`ND`
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example, providing a description of the strength of a concrete pavement	`NA`

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:

The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

<u>Component proportions</u>

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to its engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub-categories. Refer "identification of minor components" below.

<u>Composite Materials</u>

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, "INTERBEDDED Silty CLAY AND SAND".

Soil Descriptions

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component [1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Descriptions

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example (VS).

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as "extremely weathered material" in reports and by the abbreviation code XWM on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be "oversize" may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with "MIXTURE OF".

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Rock Strength

Rock strength is defined by the unconfined compressive strength, and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $I_{s(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Unconfined Compressive Strength (MPa)	Point Load Index[1] $I_{s(50)}$ MPa	Abbreviation Code
Very low	0.6 - 2	0.03 - 0.1	VL
Low	2 - 6	0.1 - 0.3	L
Medium	6 - 20	0.3 - 1.0	M
High	20 - 60	1 - 3	H
Very high	60 - 200	3 - 10	VH
Extremely high	>200	>10	EH

[1] Rock strength classification is based on UCS. The UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site. The point load Index ranges shown above are as suggested in AS1726 and should not be relied upon without supporting evidence.

The following abbreviation codes are used for soil layers or seams of material “within rock” but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the “Description of Strata” and soil properties columns.	SOIL
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	SEAM

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil[1]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.	RS
Extremely weathered[1]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible	XW
Highly weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.	HW
Moderately weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

[1] The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

Rock Descriptions

Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	XA
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching or may be decreased due to precipitation of secondary materials in pores.	HA
Moderately altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MA
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	SA
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching or may be decreased due to precipitation of secondary minerals in pores.	DA

Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD } \% = \frac{\text{cumulative length of 'sound' core sections} > 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e., drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Rock Descriptions

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Infilled seam	IS
Cleavage	CV
Crushed zone	CZ
Decomposed seam	DS
Fault	F
Joint	JT
Lamination	LAM
Parting	P
Shear zone	SZ
Vein	VN
Drilling/handling break	DB , HB
Fracture	FC

Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

Rock Defect Coating

Term	Abbreviation Code
Clean	CN
Coating	CT
Healed	HE
Infilled	INF
Stained	SN
Tight	TI
Veneer	VNR

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLAY
Iron oxide	FE
Manganese	MN

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Rock Defect Shape/Planarity

Term	Abbreviation Code
Curved	CU
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RF
Slickensided	SL
Smooth	SM
Very rough	VR

Defect Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

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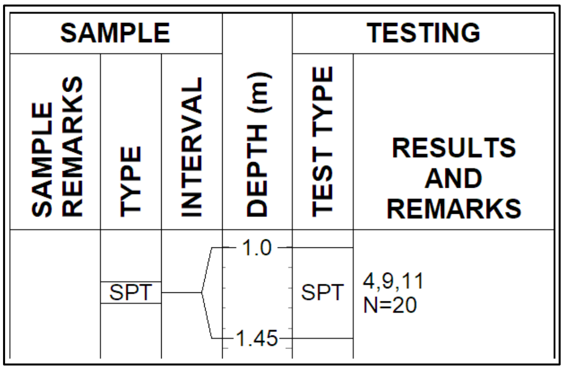
Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Bulk sample	B
Core sample	C
Disturbed sample	D
Sample from SPT test	SPT
Environmental sample	ES
Gas sample	G
Undisturbed tube sample	U[1]
Water sample	W
Piston sample	P
Core sample for unconfined compressive strength testing	UCS
Material Sample	MT

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y = *x* blows for *y* mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Toothed bucket	TB[1]
Mud/blade bucket	MB[1]
Ripping tyne/ripper	R
Rock breaker/hydraulic hammer	RB
Hand auger	HA[1]
NMLC series coring	NMLC
HMLC series coring	HMLC
NQ coring	NQ3
HQ coring	HQ3
PQ coring	PQ3
Push tube	PT[1]
Rock roller	RR[1]
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD[1]
Sonic drilling	SON[1]
Vibrocore	VC[1]
Wash bore (unspecified bit type)	WB[1]
Existing exposure	X
Hand tools (unspecified)	HAND
Predrilled	PD
Diatube	DT[1]
Hollow flight auger	HSA[1]
Vacuum excavation	VE

[1] – numeric suffixes indicate tool diameter/width in mm

Appendix G

Laboratory Test Results

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 340670

Client Details

Client	Douglas Partners Pty Ltd
Attention	Jean-Christo Pyper
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**225758.00, Arthur St, North Sydney**
Number of Samples	2 Soil
Date samples received	20/12/2023
Date completed instructions received	20/12/2023

Analysis Details

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

Samples were analysed as received from the client. Results relate specifically to the samples as received.

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

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

Report Details

Date results requested by	04/01/2024
Date of Issue	04/01/2024

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Results Approved By
Nick Sarlamis, Assistant Operation Manager

Authorised By
Nancy Zhang, Laboratory Manager

Misc Inorg - Soil			
Our Reference		340670-1	340670-2
Your Reference	UNITS	BH01	BH06
Depth		0.9	1.51
Date Sampled		08/12/2023	16/12/2023
Type of sample		Soil	Soil
Date prepared	-	28/12/2023	28/12/2023
Date analysed	-	28/12/2023	28/12/2023
pH 1:5 soil:water	pH Units	5.4	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	23	18
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	21	20

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			28/12/2023	[NT]	[NT]	[NT]	[NT]	28/12/2023	[NT]
Date analysed	-			28/12/2023	[NT]	[NT]	[NT]	[NT]	28/12/2023	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	111	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	116	[NT]

Result Definitions

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

Quality Control Definitions

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

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

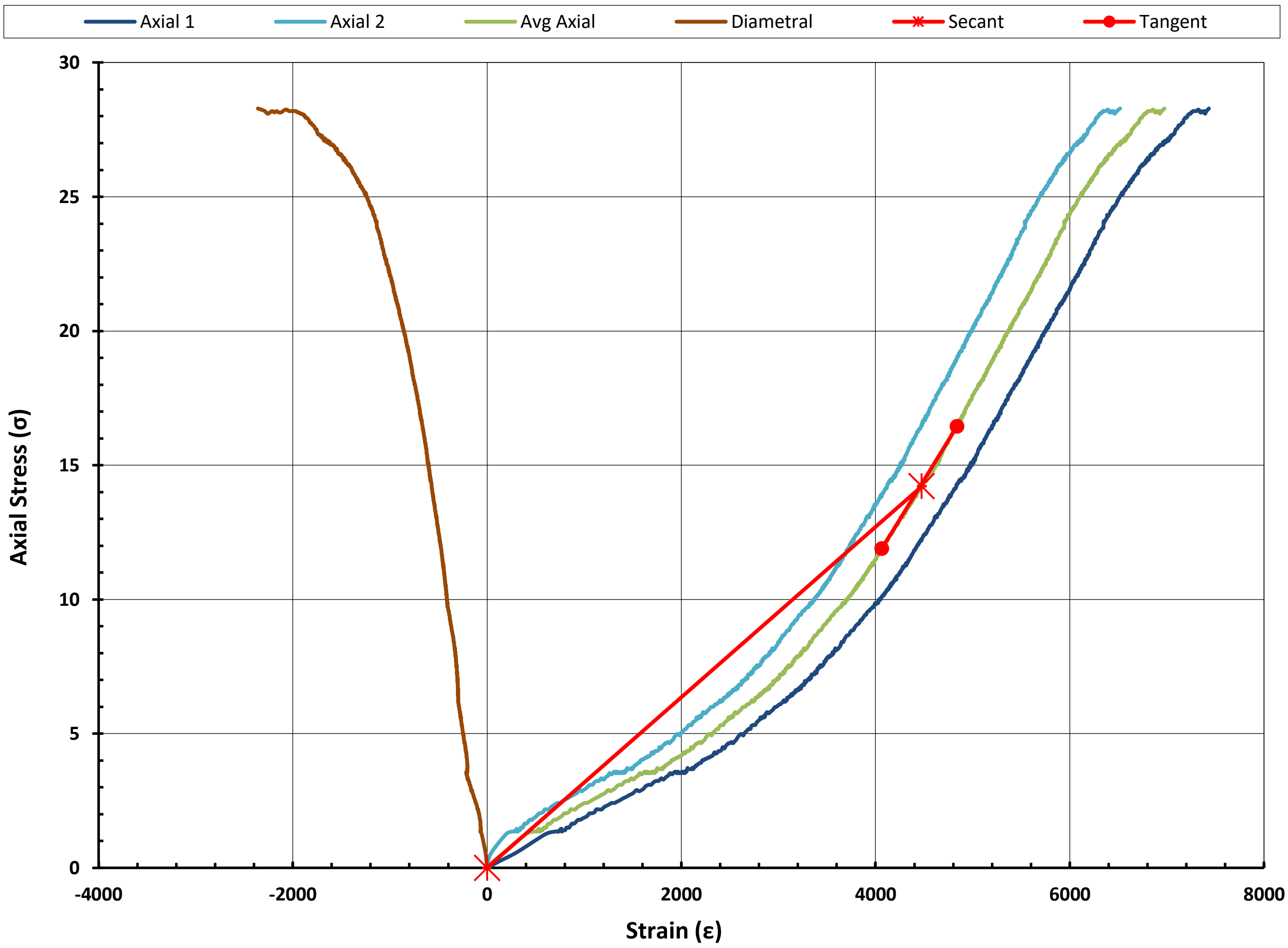
pH analysed outside holding time for #1.

Deformability of Rock Materials in Uniaxial Compression

Client	Douglas Partners	**Sample Source**	BH1 6.53m
Address	PO Box 472 West Ryde NSW 1685	**Sample Description**	Sandstone
Project	146 Arthur St North Sydney (225758)	**Report #**	S93185-MOD
Job #	S23573-1	**Sample #**	S93185

Test Procedure	AS 4133.4.3.2 Deformability of rock materials in uniaxial compression-Rock strength less than 50 MPa		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	8/12/2023
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Axial Stress vs Strain Plots



	Uniaxial Compressive Strength		28	MPa
	Young's Modulus	**Poisson's Ratio**		
Tangent	5.9 GPa	0.14	from 42 % to 58 % of Max UCS	
Secant	3.2 GPa	0.13	from 0 % to 50 % of Max UCS	

Notes

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Results relate only to the samples tested.
NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

Date: 9/01/2024

MACQUARIE GEOTECH

Macquarie Geotechnical
14 Carter Street
Lidcombe NSW 2141

Deformability of Rock Materials in Uniaxial Compression

Client	Douglas Partners	**Sample Source**	BH1 6.53m
Address	PO Box 472 West Ryde NSW 1685	**Sample Description**	Sandstone
Project	146 Arthur St North Sydney (225758)	**Report #**	S93185-MOD
Job #	S23573-1	**Sample #**	S93185

Test Procedure	AS 4133.4.3.2 Deformability of rock materials in uniaxial compression-Rock strength less than 50 MPa		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	8/12/2023
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Average Specimen Diameter (mm)	51.3	**Moisture Content (%)**	4.8
Average Specimen Height (mm)	137.0	**Wet Density (t/m^3)**	2.49
Length to Diameter Ratio	2.7	**Dry Density (t/m^3)**	2.38
Duration of Test (min)	9.40	**Rate of Displacement (mm/min):**	< 0.1
Date of Test:	8/1/24	**Specimen Curing**	-
Mode of Failure	Single shear plane	**Test Apparatus**	Matest Compression Machine with Axial and Circumferential Extensometers.

Before Test

After Test

	Uniaxial Compressive Strength	**28**	**MPa**

	Young's Modulus	**Poisson's Ratio**	
Tangent	5.9 GPa	0.14	from 42 % to 58 % of Max UCS
Secant	3.2 GPa	0.13	from 0 % to 50 % of Max UCS

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Chris Lloyd

Date: 9/01/2024

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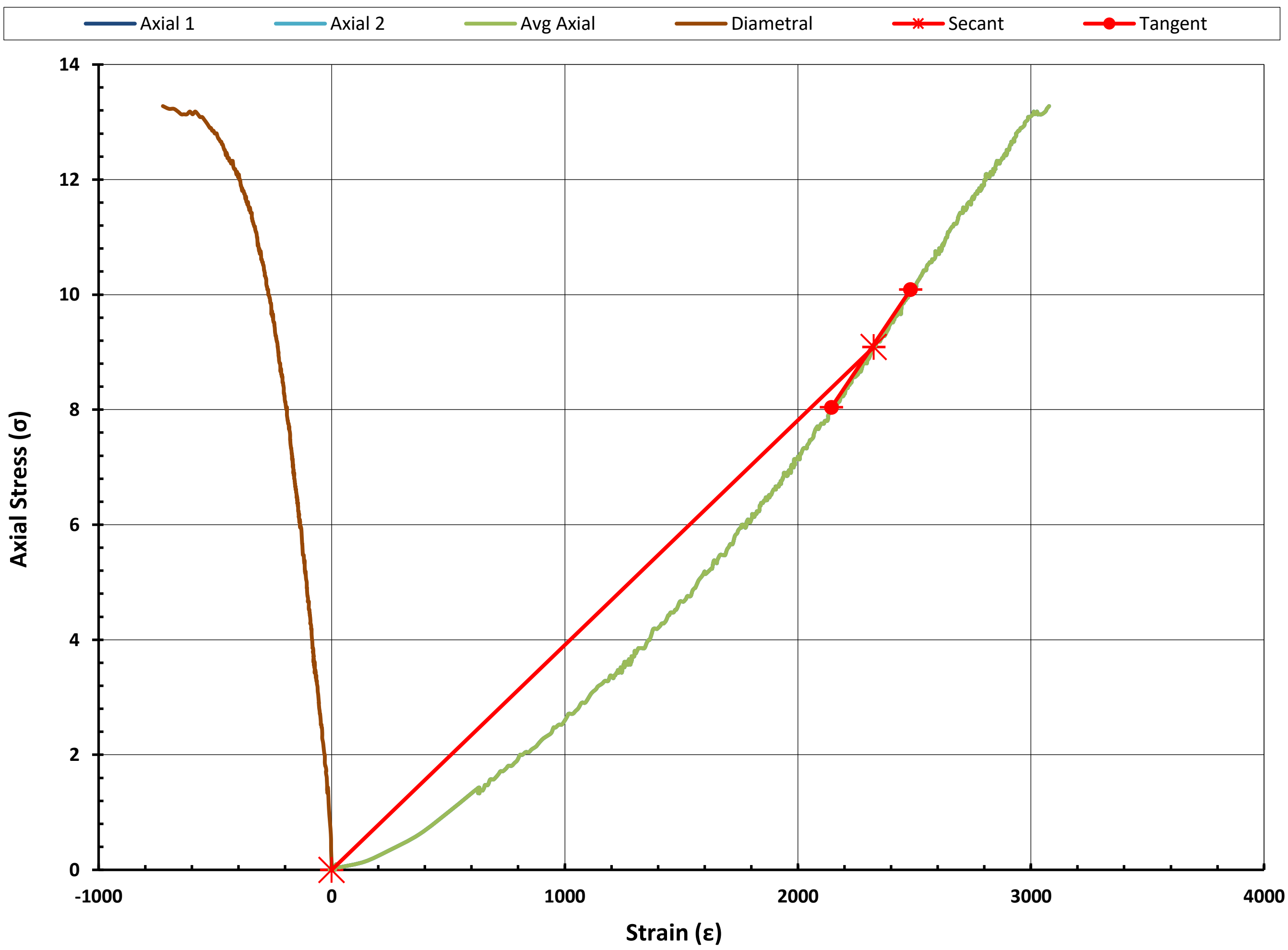
Lidcombe NSW 2141

Deformability of Rock Materials in Uniaxial Compression

Client	Douglas Partners	**Sample Source**	BH2 6.11-m
Address	PO Box 472 West Ryde NSW 1685	**Sample Description**	Sandstone
Project	146 Arthur St North Sydney (225758)	**Report #**	S93186-MOD
Job #	S23573-1	**Sample #**	S93186

Test Procedure	AS 4133.4.3.2 Deformability of rock materials in uniaxial compression-Rock strength less than 50 MPa		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	16/12/2023
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Axial Stress vs Strain Plots



Uniaxial Compressive Strength	13	MPa

	Young's Modulus	**Poisson's Ratio**	
Tangent	6.0 GPa	0.11	from 60 % to 75 % of Max UCS
Secant	3.9 GPa	0.10	from 0 % to 68 % of Max UCS

Notes

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Chris Lloyd
Date: 9/01/2024

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Deformability of Rock Materials in Uniaxial Compression

Client	Douglas Partners	**Sample Source**	BH2 6.11-m
Address	PO Box 472 West Ryde NSW 1685	**Sample Description**	Sandstone
Project	146 Arthur St North Sydney (225758)	**Report #**	S93186-MOD
Job #	S23573-1	**Sample #**	S93186

Test Procedure	AS 4133.4.3.2 Deformability of rock materials in uniaxial compression-Rock strength less than 50 MPa		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	16/12/2023
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition

Average Specimen Diameter (mm)	51.7	**Moisture Content (%)**	8.5
Average Specimen Height (mm)	139.5	**Wet Density (t/m^3)**	2.32
Length to Diameter Ratio	2.7	**Dry Density (t/m^3)**	2.13
Duration of Test (min)	4.53	**Rate of Displacement (mm/min):**	< 0.1
Date of Test:	8/1/24	**Specimen Curing**	-
Mode of Failure	Single shear plane	**Test Apparatus**	Matest Compression Machine with Axial and Circumferential Extensometers.

Before Test

After Test

Uniaxial Compressive Strength 13 MPa

	Young's Modulus	Poisson's Ratio	
Tangent	6.0 GPa	0.11	from 60 % to 75 % of Max UCS
Secant	3.9 GPa	0.10	from 0 % to 68 % of Max UCS

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Appendix H

Sump Pit Water Plot