
Report on Geotechnical Investigation

Proposed Residential Development

**24, 26 and 28 Middle Harbour Road,
Lindfield NSW**

**Prepared for The Trustee for MHR
LINDFIELD TRUST**

Project 234319.00

6 May 2025

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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

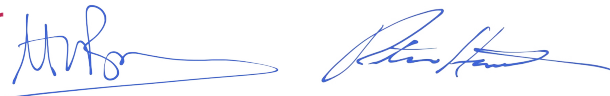
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Report on Geotechnical Investigation Proposed Residential Development 24, 26 and 28 Middle Harbour Road, Lindfield NSW

1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a geotechnical investigation undertaken for a proposed residential development at 24, 26, and 24, 26 and 28 Middle Harbour Road, Lindfield NSW (the Site). The investigation was commissioned by email from Gabrielle Chidiac on behalf of The Trustee for MHR LINDFIELD TRUST dated 11 March 2025 and was undertaken in accordance with Douglas' proposal 234319.00.P.001.Rev1 dated 14 February 2025.

It is understood that the proposed development of the Site includes a two to three-level basement (up to 11 m below ground), and a 9-level building with 157 apartments.

The scope of the investigation was to assess the subsurface soil and groundwater conditions across the Site and provide the following:

- Review of available subsurface information including geological maps and Douglas reports nearby;
- Reporting on the details and results of the field work carried out;
- Description and sequence of the subsurface geotechnical profile encountered as well as preparation of geological sections through the Site;
- Assessment and monitoring of groundwater levels; and
- Geotechnical commentary on Site preparation, excavation, excavation support and anchoring, foundations, groundwater, earthquake hazard factor and aggressivity.

The investigation included the drilling of 6 boreholes, the installation and subsequent monitoring of 3 temporary observation wells (hereafter called wells) 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.

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

2. Background

Willowtree Planning has provided the following for inclusion in the report.

The proposed redevelopment of the Site will deliver essential housing supply, choice, and affordability to meet the needs of Ku-ring-gai's growing population. Strategically positioned near key transport links and services, the Proposal will provide convenient access to jobs while aligning with the locality's strategic goals. By redeveloping and renewing the existing land, the Proposal

aims to revitalise the area, enhancing its contribution to the community's long-term growth and sustainability.

3. Site Description

The Site is subject to the applicable provisions outlined within the State Environmental Planning Policy (Housing) 2021 (Housing SEPP) and Ku-ring-gai Local Environmental Plan 2015 (KLEP2015).

The Site comprises a total area of approximately 4,757m². The Site is roughly square in shape and is approximately 65 m wide, with a depth ranging between 70-78 m. The frontage along Middle Harbour Road to the southeast is approximately 65 m. The Site is zoned as R2 Low Density Residential under the KLEP2015.

The Site comprises three (3) existing detached residential properties that have a mixture of one (1) and two (2) storeys with separate vehicular access points from Middle harbour Road. Middle Harbour Road is a two-way local road (a single lane in each direction) under the control of the Council with parallel car parking and verges incorporating street trees and footpaths on both sides of the road.

To the south, east, north and west are residential properties similar in scale and design to the residential properties located within the Site, with the immediate surrounding area also being zoned as R2 Low Density Residential. Further north and west is Lindfield Town Centre, which includes a variety of uses and a higher density of development, including further height, comprising R3 Medium Density Residential, R4 High Density Residential and E1 Local Centre zones. Lindfield railway station is approximately 500 m to the north west of the Site, which offers regular services to the Sydney Central Business District (CBD).

The Site is located approximately 330 m east of the Pacific Highway, which is a major arterial route, providing regular buses servicing the Lindfield Learning Village, Killara, Gordon and Chatswood. The Site is approximately 15km from the Sydney CBD.

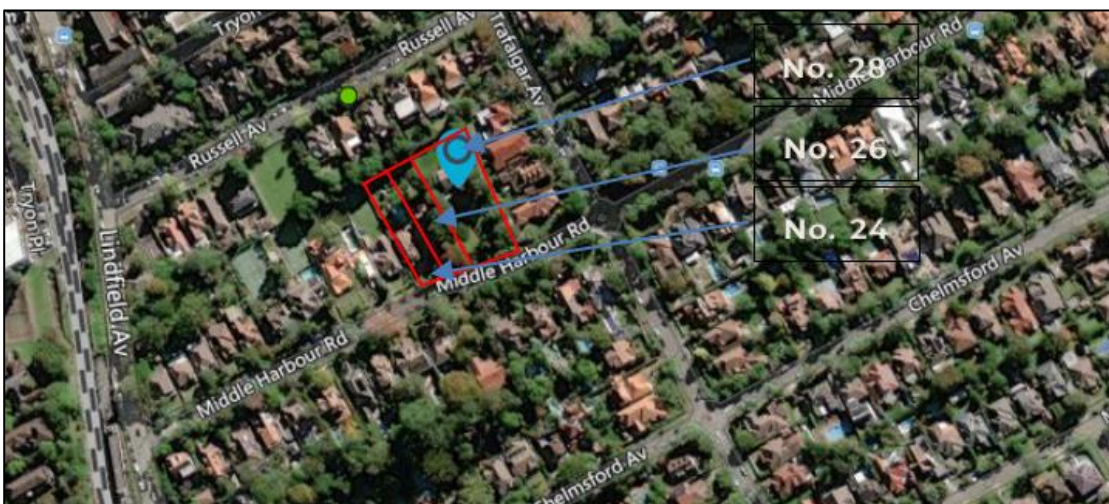


Figure 1: Location of Site (Red Polygons)

CMS Survey Drawing 23693 (attached in Appendix B) indicate that the Site slopes to the south-east with surface levels ranging from RL 87 m to 80 m.

4. Published Data

4.1 Geology

Reference to the *Sydney 1:100 000 Geological Series Sheet* indicates that the Site is underlain by Triassic aged Ashfield Shale (black to dark grey shale and laminite) of the Wianamatta Group (refer Figure 2). The Ashfield Shale is underlain by Hawkesbury Sandstone (medium to coarse grained quartz sandstone with minor shale and laminite lenses) at depth, often with the intermediate Mittagong Formation (interbedded shale, laminite and fine-grained quartz sandstone) between the two units. Note, the investigation only encountered Mittagong Formation and Hawkesbury Sandstone rock.

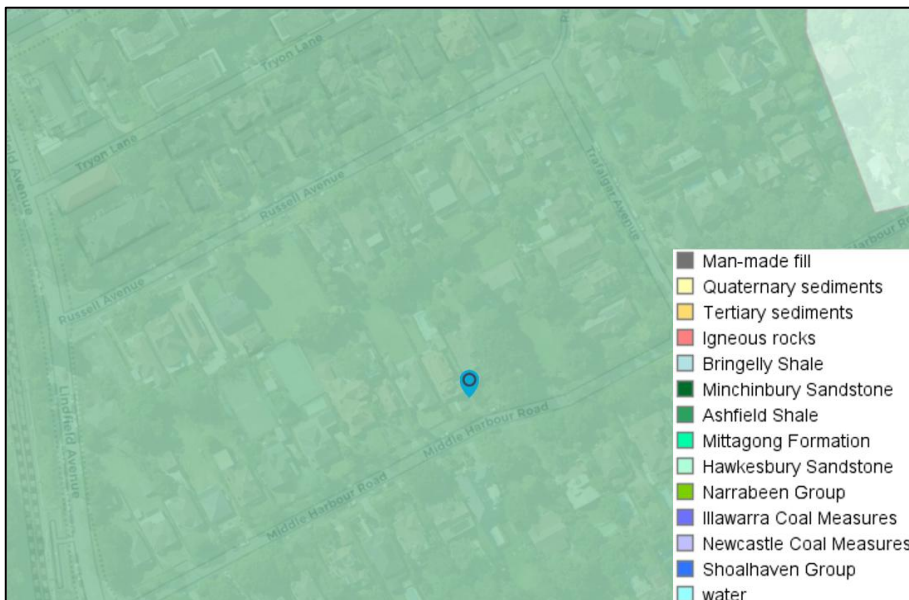


Figure 2: NSW Geology Map with Approximate Site Location (blue marker)

The Mittagong Formation is a transitional formation between the overlying Ashfield Shale and the underlying Hawkesbury Sandstone. The rock typically comprises fine-grained quartzose sandstone with interbeds of siltstone and laminite. The rock contains two orthogonal, steeply dipping (75° to 90°) joint sets striking NNE and ESE and spaced between 1 m and 10 m.

Hawkesbury Sandstone generally comprises medium to coarse grained quartz sandstone with minor shale seams and laminite lenses. Sandstone beds range in thickness from 0.1 m to 5 m, averaging 2 m to 3 m and are separated by bedding planes. The rock is prone to weathering with red brown or brown iron staining common in the upper beds. Hawkesbury Sandstone is also generally cut by two orthogonal near-vertical joint sets, one striking 020° (NNE), the other 110° (ESE).

A possible dyke was encountered on Site during the geotechnical investigation. Dykes within the Sydney region generally trend in an east-west direction¹. Intrusive igneous dykes within the Hawkesbury Sandstone are typically less than 1 m to 3 m in width and usually comprise extensively and deeply weathered basalt rock, weathered to a 'heavy', high plasticity clay.

¹ The Geology and Engineering Geology of the "Great Sydney Dyke", Sydney NSW (Dale, Rickwood & Won)

Associated with the dyke, the immediately adjacent sandstone is often 'cooked' and commonly closely jointed with the sandstone weathered to a significantly greater depth than the unaffected sandstone.

4.2 Soil Landscape

Reference to the Sydney 1:100,000 Soils Landscape Sheet shows the Site is underlain by Glenorie soil, created by erosional processes (refer Figure 3). The landscape consists of undulating to rolling hills over Wianamatta group.

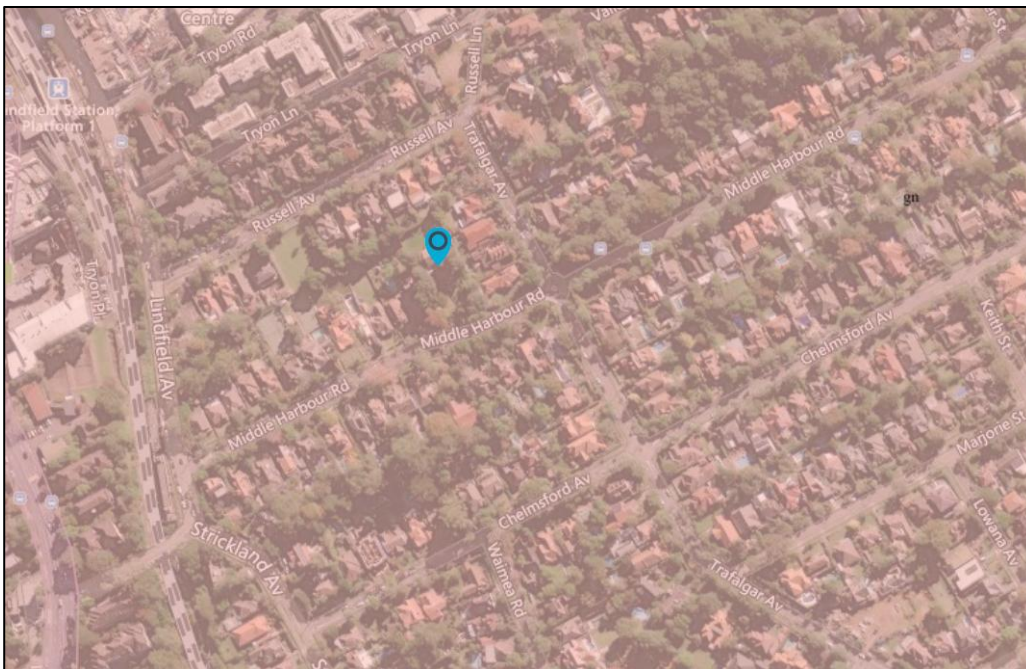


Figure 3: NSW Soil Map with Approximate Site Location (blue marker)

4.3 Acid Sulphate Soils

The 1:25 000 Acid Sulphate Soil Risk map for Lindfield indicates the Site does not lie within an area known for acid sulphate soils.

Douglas has also reviewed the Site location in relation The National Map, which is a webSite for map-based access to spatial data from Australian government agencies. The map indicates that the Site is mapped as low probability of ASS occurrence.

4.4 Salinity

With reference to the Map of Salinity Potential in Western Sydney, the Site is not situated within the map boundaries and is therefore not in an area with potential for dryland salinity.

5. Field Work

5.1 Field work methods

5.1.1 Boreholes

Six boreholes (BH01 to BH06) were drilled to depths between 15.9 m and 20.4 m. Drilling took place between the 18 March 2025 to the 25 March 2025.

Prior to drilling, the proposed test locations were checked for underground services by reviewing the available Dial Before You Dig (DBYD) drawings and scanning the test locations with an electromagnetic scanner and ground penetrating radar.

Drilling was commenced using solid-flight auger and wash-bore techniques through soil layers to the top of bedrock. On reaching the top of rock, boreholes were cased before continuing into the bedrock using NMLC sized diamond core drilling equipment to obtain core samples of the rock for identification and testing purposes. Three boreholes (BH01, BH04, and BH05) were reamed to 96 mm diameter and temporary observation wells installed after completion of drilling. Permeability testing was carried out in each standpipe post purging.

Soil and rock samples recovered from boreholes were photographed and logged on Site, and samples for laboratory testing selected by a geotechnical engineer. Point load testing for Strength Index ($I_{s(50)}$) values were carried out on selected samples of the rock core at approximately 1 m intervals whilst on Site. The core was returned to Douglas's workshop for review, and other samples were sent to laboratories for testing.

Borehole locations are shown on Drawing 1 in Appendix C. Coordinates of borehole locations were determined using a digital GPS.

5.1.2 Temporary Groundwater Observation Wells

Three temporary observation wells were installed to allow measurements of groundwater levels (refer Appendix C for well locations and well construction logs). BH01, BH04, and BH05 were reamed to 96 mm external diameter with a PCD bit. The wells were constructed using 60 mm external diameter Class 18 unplasticised Polyvinyl Chloride (uPVC) casing. Machine-slotted screen sections comprised 0.4 mm apertures. The base of the wells was finished with an end cap. A durable single sized (poorly graded) quartzose sand filter was placed around the screened section and sealed-off from above with bentonite to prevent any surface water entering the filter zone. Well heads were finished with a gatic cover installed flush with the existing surface level.

The temporary observation wells were developed (purged of drilling contaminated water) and subsequent groundwater levels taken using an electronic dipmeter. Later, a downhole data-logger was installed in each well after the initial reading to allow long-term monitoring (approximately 3 months). This report will subsequently be updated at the end of the monitoring period.

5.2 Field work results

5.2.1 Boreholes

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

The general sequence of materials encountered in the boreholes is summarised below:

Fill: Sandy silt or sandy clay	Typically, sandy silt or sandy clay, poorly to moderately compacted, with trace ironstone gravel to depths of generally around 1.0 m, with BH4 having the deepest fill at 3.0 m below the existing surface.
Residual soil	Typically, stiff residual silty or sandy clays occurring to a maximum depth of 3.5 m below existing surface level, but generally between 1.5 m and 2.0 m depth. Residual Clay and Silty Clays have a medium to high plasticity. Sandy clays have fine to medium sand. Some areas of unknown strength were encountered.
Fine grained sandstone with siltstone bands and laminite (Mittagong Formation)	Mostly low to medium strength, highly weathered and fractured, fine grained sandstone with siltstone bands/laminite (BH05 & BH06 only)
Medium and coarse grained sandstone (Hawkesbury Sandstone)	Mostly medium to high strength, fresh, unbroken to highly fractured medium and coarse grained sandstone.
Possible dyke	Extremely weathered dyke (possibly dolerite) in BH01 only, recovered as pale grey clay.

The boreholes drilled in 24 and 26 Middle Harbour Road (BH01 and BH02 respectively) encountered fill and residual soil to depths of between about 1.5 m – 2.0 m, overlying Hawkesbury Sandstone of medium to high strength. The sandstone in BH01 was highly fractured and jointed from 9.5 m – 17.5 m depth, with a clay layer between 14.35 m (RL 69.09) and 14.70 m (RL68.74) is possibly an extremely weathered dyke.

The boreholes drilled at 28 Middle Harbour Road (BH03 to BH06) encountered fill and residual soils to depths of between 2.0 m - 3.8 m overlying Hawkesbury Sandstone of medium to high and high strength at BH03 and BH04 and Mittagong Formation and Hawkesbury Sandstone at BH05 and BH06. The Mittagong Formation varied from low to medium strength and the Hawkesbury Sandstone encountered was medium to high strength.

Table 1 summarises the strata levels encountered.

Table 1: Summary of Strata Levels at Each Borehole

Stratum	Depth to Top of Stratum m (RL)					
	BH01	BH02	BH03	BH04	BH05	BH06
Fill	0.0 (83.44)	0.0 (81.53)	0.0 (82.72)	0.0 (80.42)	0.0 (86.65)	0.0 (84.33)
Residual Soil	0.65 (82.79)	0.9 (80.63)	1.0 (81.72)	3.0 (77.42)	0.4 (86.25)	0.9 (83.43)
Mittagong Formation	NE	NE	NE	NE	2.0 (84.65)	2.0 (82.33)
Hawkesbury Sandstone	1.79 (81.65)	1.55 (79.98)	2.2 (80.52)	3.91 (76.51)	5.88 (80.77)	4.8 (79.53)
Possible dyke	14.35-14.70 (69.09- 68.74)	NE	NE	NE	NE	NE
End of Borehole	20.44 (63.00)	15.92 (65.61)	16.82 (65.90)	15.78 (64.64)	15.95 (70.70)	16.75 (67.58)

Notes: RLs based on approximate levels taken from dGPS measurements on Site
NE = Not Encountered

Bedding planes recorded in the rock cores dip 0-30° from horizontal, which is typical for Mittagong Formation/Hawkesbury Sandstone. Defect spacing (which includes bedding planes and joints) in the Mittagong Formation (BH05 and BH06) indicates the rock has fragmented bands and clay seams/decomposed beds with relatively low (very poor to poor rock mass quality) Rock Quality Designation (RQD) values. RQD in the Hawkesbury Sandstone is higher, generally 80 to 100% (good to excellent rock mass quality), barring BH01, which was highly jointed from 9.5 to 17.5 m, possibly with an extremely weathered dyke encountered from 14.35 m to 14.70 m, and had a relatively low RQD value. Defect dip angles recorded in the core generally range from 20° to 90°, with numerous joints in the 70° to 90° ranges. Fragmented bands and clay seams/decomposed beds, some up to 100 mm thick, were also encountered.

5.2.1 Groundwater Wells and Readings

No free groundwater was observed during augering (to depths of up to 3.81 m). The use of water prevented observation of any water entry into the bore during rotary drilling and coring .

Groundwater observation well installation details are outlined in Table 2. All wells were installed by 25th March 2025, with purging (removal of water from the well) taking place on 26th March 2025.

Table 2: Summary of Well Installation Details

Borehole No.	Depth of Filter Zone	Rock Strata at Filter Zone	Data Logger Level
	Depth, m [Reduced Level, m]		
BH01	6.4 - 15.3 [77 - 68.1]	Highly fractured medium to high strength sandstone, EW dyke	<i>To be updated</i>
BH04	5.5 - 12.3 [74.9 - 68.1]	High strength sandstone	<i>To be updated</i>
BH05	5.5 - 12.3 [81.2 - 74.4]	Medium to high strength sandstone	<i>To be updated</i>

Manual water level readings taken in the wells are outlined in Table 3.

Table 3: Standing Water Levels in Wells

Borehole No.	Date	Surface RL (m, AHD)	Manual Water Level Measurements in Wells	
			Depth (m, bgl)	Reduced Level (m, AHD)
BH01	27/3/25	83.44	0.55	82.89
	28/3/25		2.6	80.84
	03/4/25		2.28	81.16
	29/4/25		2.37	81.07
BH04	27/3/25	80.42	0.25	80.17
	28/3/25		0.29	80.13
	03/4/25		0.2	80.22
	29/4/25		0.2	80.22
BH05	27/3/25	86.65	3.68	82.97
	28/3/25		3.26	83.39
	03/4/25		1.8	84.85
	29/4/25		3.30	83.35

On-going water level monitoring using data-loggers is currently being carried out with the first month's readings to be downloaded around end of April and then two further months thereafter.

5.2.1 Permeability Testing

Rising head permeability testing in BH01, BH04, and BH05 was carried out on the 25th and 26th March 2025 and again on 29 April 2025 to estimate the rock mass hydraulic conductivity (or "permeability").

The rising head permeability test involves removing water from the standpipe and measuring the change in water level with time. The results of the permeability tests using Hvorslev's (1951) method are summarised in Table 4 below with the calculations provided in Appendix D.

Table 4: Summary of Permeability Test in Wells

Borehole	Hydraulic Conductivity, k (m/s)		
	Test 1	Test 2	Test 3
BH01	1.2xE-06	1.2xE-06	1.4xE-06
BH04	7.0xE-07	6.5xE-07	7.1xE-07
BH05	2.3xE-06	7.6xE-06	7.2xE-06

6. Laboratory Testing

6.1 Soil and Groundwater Aggressivity Testing

Laboratory testing was carried out on a number of soil and groundwater samples to determine aggressiveness exposure classification for steel and concrete structures and piles, refer AS 3600 (Concrete Structures) and AS2159 (Piling).

The results of the laboratory testing are summarised in Table 5. The detailed laboratory test reports are provided in Appendix E.

Table 5: Summary of Aggressivity Testing Results

Borehole	Material	Depth (m)	Conductivity (µS/cm)	pH	Cl (mg/L or mg/kg)	SO ₄ (mg/L or mg/kg)
BH01	Clay, trace sand, trace gravel	1.0	15	5.6	<10	20
BH01	Groundwater	-	1,700	4.5	360	180
BH04	Groundwater	-	2,000	3.9	480	200
BH05	Sandy Clay	1.0	32	5.1	<10	39
BH05	Groundwater	-	350	4.8	54	58
BH06	Sandy Clay trace gravel	1.0	58	5.0	<10	99

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”. The results indicate that soil samples range from non-aggressive to mildly aggressive and groundwater samples range from mild to moderate and severe.

6.2 Atterberg Limit (1 point)

Atterberg limit testing was conducted on three soil samples with results shown in Table 6 and Appendix E.

Table 6: Summary of Atterberg Limit Results

Borehole	Material	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
BH01	Clay, trace sand, trace gravel	1.0-1.5	62	26	36
BH05	Sandy Clay	1.0-2.0	35	20	15
BH06	Sandy Clay trace gravel	0.9	43	21	22

Atterberg limit results indicate samples of medium to high plasticity, where there is potential for significant changes in volume due to variations in moisture content, leading to swelling when wet and shrinkage when dry.

6.3 Linear Shrinkage

Linear Shrinkage testing was conducted on three soil samples with results shown in Table 7 and Appendix E.

Table 7: Summary of Atterberg Limit Results

Borehole	Material	Depth (m)	Linear Shrinkage (%)
BH01	Clay, trace sand, trace gravel	1.0-1.5	16.0
BH05	Sandy Clay	1.0-2.0	8.5
BH06	Sandy Clay, trace gravels	0.9-1.0	12.0

Linear Shrinkage results determined by AS 1726:2017 also indicate samples of medium to high plasticity and further confirm the potential for shrink/swell behaviour, indicating that the soil may experience noticeable volume change with moisture.

6.4 Point Load Index ($I_{s(50)}$) Tests

Axial point load strength index testing ($I_{s(50)}$) was carried out on selected rock core samples. The results are shown on the respective borehole logs and summarised in Figure 4 below. The $I_{s(50)}$ values from axial tests were used to provide an estimate of the Uniaxial Compressive Strength (UCS) of the sandstone, based on a UCS: $I_{s(50)}$ ratio of 20:1 (as per AS1726). Results ranged from 0.14 MPa to 3.30 MPa which correspond to low strength and high strength rock, respectively. The $I_{s(50)}$ results suggest Uniaxial Compressive Strengths of between about 3 MPa and 66 MPa based on the conversion factor of 20. The $I_{s(50)}$ results are shown on the borehole logs as PL(A) at the respective depths.

Note that point load testing is not carried out in very low strength materials (i.e. below $I_{s(50)}$ values of 0.1 MPa) and that a Site-specific conversion factor would require further laboratory testing (if required).

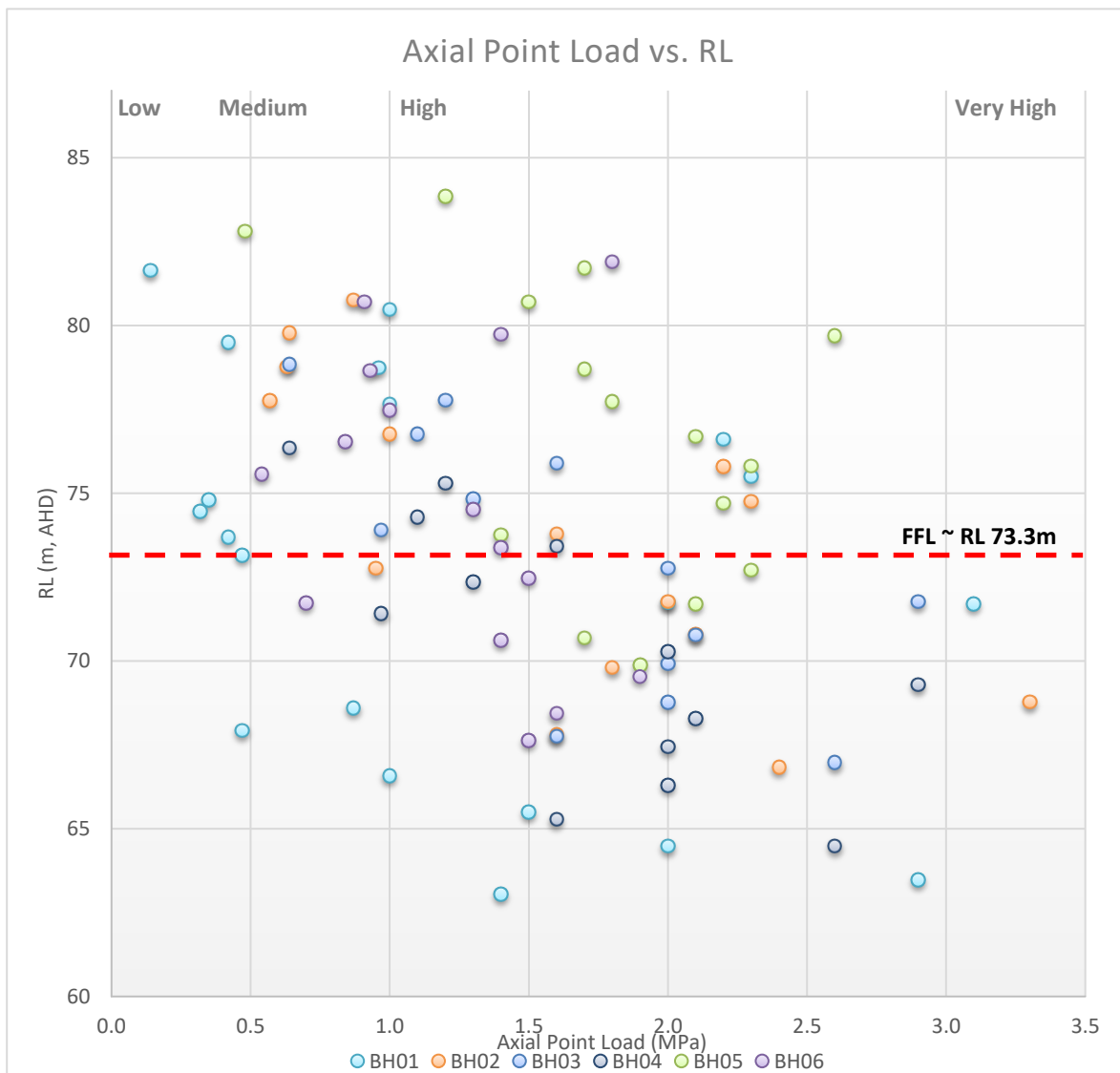


Figure 4: Point Load Results with RL

7. Geotechnical Model

The subsurface profile encountered in the boreholes has been summarised into three units as outlined in Table 8.

Table 8: Summary of Geotechnical Model

Unit	Material	Description	Depth Range at Top of Stratum (m, BGL)
1	Fill and residual soil	Generally poorly to moderately compacted fill, with trace ironstone gravel. And stiff, medium to high plasticity residual silty or sandy clay.	0.0
2	Very low to medium strength sandstone with siltstone bands/laminite (Mittagong Formation)	Generally low to medium strength, highly weathered and fractured laminite.	2.0 BH05 & BH06 only
3	Medium to high strength sandstone (Hawkesbury Sandstone)	Generally medium to high strength and high, fresh, unbroken to highly fractured sandstone.	1.55 – 5.88

Geotechnical cross-sections are presented in Sections A-A' to D-D' in Drawings 2 to 5 in Appendix B. Inferred geotechnical boundaries are shown between boreholes. It should be noted that the 'dashed' lines are for illustration purposes only and the subsurface conditions are only accurate at the borehole locations.

Groundwater levels were measured between RL 80.1 m and RL 84.9 m (depths between 0.2 m to 3.7 m below ground level).

8. Proposed development

Willowtree Planning has provided the following description of the development: *The Proposal comprises the construction and operational use of a nine (9) storey residential flat building (RFB) and ancillary land uses to support the functions intended for the Site. The Proposal will exemplify and showcase a State-of-the-Art and modernised residential development that complements the desired future streetscape character; and builds on the fundamental necessities required to achieve local, regional and state planning/strategic objectives with respect to the shortage of housing opportunities and housing affordability.*

It is understood from the DKO Architectural Drawings (attached in Appendix B) that the proposed development will comprise demolition of the existing buildings and the excavation of a 2 to 3

level basement. The finished Floor Level of the basement (FFL) is understood to be RL 73.3 m, approximately 10.7 m depth at the deepest point. The bulk excavation level is not expected to be much deeper than this. Localised detailed excavation required for foundations and lift pits is not currently known.

9. Comments

9.1 Site Preparation and Earthworks

Site preparation will be required for areas outside the basement excavation. SiteFill and residual soil materials on Site are expected to be predominantly cohesive. The following procedure is suggested for Site preparation and engineered filling for slabs-on-ground, lightly loaded footings and pavements:

- strip any organic topsoil, any deleterious, soft, wet or highly compressible material or material rich in organics or root matter and 'uncontrolled' Fill down to stable natural subgrade;
- tine the exposed subgrade and adjust the subgrade to optimum moisture content (OMC);
- compact the moisture conditioned subgrade with at least six passes of a minimum 12 tonne deadweight roller, with a final test roll pass accompanied by a visual inspection to ensure that any deleterious materials such as loose, wet or highly compressible soil and organic materials are identified for removal;
- excavate out the weak material identified and replace with select approved Fill suitably compacted;
- where required, place approved Fill (maximum particle size of 75 mm), free of organic or other deleterious material, in near horizontal layers of maximum 300 mm loose thickness;
- compact each layer to at least 98% Standard maximum dry density ratio, with horizontally placed layers in a cut and benched formation where ground slopes are greater than 8H:1V (in accordance with AS 3798 – 2007);
- maintain moisture contents for Fill exhibiting clay-like properties in the range 2% dry to 2% wet of optimum moisture content for Standard compaction; and,
- as soon as practicable, seal or cover any natural or compacted clayey soils once finished level has been reached, to prevent desiccation and cracking, or swelling and softening.

Level 1 inspection and testing, as defined in Section 8 of AS 3798 – 2007, is required where structural loads are to be supported by filling.

The above procedure should also be modified, depending on the design subgrade level, to take into account any contaminated material present at the Site and the design of the subgrade level should also take cognisance of contaminated materials, as well as any flooding issues.

9.2 Excavation Conditions

Excavation for the basement is currently planned to around RL 73 m assuming a 150 mm sub-slab drainage layer and 150 mm thick floor slab (FFL RL 73.3). Excavation is expected to encounter Fill, residual soils, laminite and sandstone up to medium and high strength. A possible dyke was

encountered in BH01 between RL 68.7 and 69.1, which if subvertical, may be encountered during excavation.

9.2.1 Excavatability

Excavation in Fill and residual soil (Unit 1), low strength rock (lower end of Unit 2) and possible dyke should be readily achievable using conventional earthmoving equipment such as a hydraulic excavator with bucket attachment.

Excavation of the bedrock will largely be dependent on the rock's strength and discontinuity spacing encountered. Excavation of medium strength laminite (Unit 2), which was fractured in the borehole logs, will require the use of light ripping / rock breaking / rock sawing equipment. Excavation of medium and high strength sandstone (Unit 3), which was generally thickly bedded and unbroken in the boreholes, will require heavy ripping (D10/D11 Dozer), large excavators equipped with hydraulic rock hammers and excavators with rock saws.

It is expected that ripping in massive high strength sandstone will be very difficult even when using a D10 or D11 bulldozer and production rates are expected to be very low. Large excavators with hydraulic rock hammers will need to be used, with due care to avoid potential vibration induced damage to adjacent buildings (refer Section 8.2.5). Rock saws may also be required to reduce the risk of vibration affecting adjacent structures and inhabitants.

Given the above factors, it is critical that excavation contractors carry out independent excavatability assessments prior to tendering.

9.2.2 Trafficability

Problems may be experienced with Site trafficability during wet weather in areas where high plasticity residual clays are found at working level. For general construction machinery, tracked vehicles should be used, or alternatively a layer of good quality granular rockfill, roadbase gravel or recycled crushed concrete, could be placed over all or part of the Site.

If larger plant such as piling rigs, heavy cranes etc. are used on Fill or residual soils, a working platform is likely to be required. A working platform assessment should be carried out, based on the track loads for the different rigs/cranes. A separate bearing capacity assessment should be carried out for outriggers pads.

9.2.3 Excavation Induced Ground Movement (Stress Relief)

Locked-in stresses are present within rock in the Sydney Basin. During excavation, these stresses are released which generally results in lateral movement of the rock face towards the excavation, dragging the soil (and any shoring) with it as movement occurs. Generally, units of stiffer rock (medium strength or stronger rock) will have higher horizontal locked-in stresses and experience more displacement. The degree of displacement is also dependent on rock excavation depth, bedding planes and jointing 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 the most stress relief movement. Although the east-west locked-in stress is less, the east and west faces can still experience substantial stress relief displacement.

From numerical modelling and Site monitoring at similar Sites in the Sydney area, stress relief movement can vary from 0.5 to 2 mm/m depth in medium strength or stronger rock. Maximum movement occurs at the crest and midpoint of the face, reducing to near zero in the corners of the excavation. Stress relief movement decreases horizontally with distance away from the excavation.

Horizontal stress relief movement can be expected to occur (albeit very minor) to distances back from the excavation of up to the equivalent of 2 times the length of the excavated face. Careful consideration of the effects of stress relief will be needed when considering the existing neighbouring structures, buildings and surrounding services. It is noted that the basement structure is set back by 6 to 8 m which will help to reduce any impact on adjacent buildings.

These lateral movements may cause cracking of adjacent buildings. They may also cause increases in the loads on shoring anchors, if installed.

Any future basement excavation adjacent to the Site may leave a sliver of rock between the two excavations as the Site excavation outline is set back from the Site boundary. Depending on the depth and resultant slenderness together with any adverse defects in the rock and predicted movement, additional rock support measures may be required.

9.2.4 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 reuse on Site;
- 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,
- 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 excavated material.

9.2.5 Ground-borne Vibration

The use of excavation equipment such as heavy rock hammers in bedrock will generate vibration and, depending on the proximity, could possibly cause damage to nearby structures and in-ground services and effect the comfort of building inhabitants. It will be necessary to use appropriate excavation methods and equipment to keep ground-borne vibration at these structures/services 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-borne 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 PPV for human comfort.

Based on Douglas’ experience of and with reference to AS/ISO 2631.2, it is suggested that a maximum Vector Sum Peak Particle Velocity (VSPPV) of 8 mm/s (measured at the first occupied level of the neighbouring building) be employed at this Site for both architectural and human comfort considerations. The vibration limit may need to be reduced if there are sensitive buildings or equipment in the area.

Douglas maintains an extensive construction vibration database. As a preliminary estimate, the information in Table 9 provides approximate minimum buffer distances for selected equipment, based on a set vibration limit of VSPPV 8 mm/s (assuming that plant is appropriately sized for the ground conditions).

Table 9: Approximate buffer distances for selected Plant (VSPPV 8 mm/s)

Excavation Plant		Distance from plant at which vibration attenuates to 8 mm/s	
Type	Operating Weight	From Douglas Trial Maxima ¹	From Douglas 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
	>2000 kg	>13 m	>5 m

Notes:

1. Shorter 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 excavation saw cuts with few exceedances.

As the magnitude of vibration transmission is Site specific, it is recommended that a vibration trial is carried out using the planned equipment prior to bulk excavation in medium strength rock commencing. This trial may indicate that smaller or different types of excavation equipment or operation approach are required to reduce vibration at the adjacent structure to acceptable levels. Monitoring of adjacent building footings may also be required depending on the proposed excavation equipment.

9.3 Excavation Support

Careful consideration must be given to the planning and design of excavations and excavation retention systems, especially along boundaries where excessive deformation or failure can cause damage to nearby buildings, road infrastructure, footpaths, services, etc. All surcharge loads from adjacent structures, including construction loads, stockpiles etc., should be taken into account

when assessing the stability of batters, rock faces and shoring. Temporary surcharges should be kept well clear (at least 3 m) of the crest of the faces and batters, unless designed to accommodate the loads.

If the potential dyke is encountered during excavation, then this must be assessed by the geotechnical engineer.

9.3.1 **Batters/Excavation Faces**

Battering of the soils may be possible due to the proposed setback of the excavation to the boundary. Vertical excavation may then be possible in the medium strength or stronger rock (subject to assessment).

Battering of the excavation sides at safe angles may be possible where there is sufficient distance to the boundary. Temporary and permanent batters <3 m in height in Fill/ soils (Unit 1) should be cut no steeper than 2:1 (H:V) and 1.5:1 (H:V) respectively. Temporary and permanent batters <3 m in height in low strength material (low end of Unit 2) should be cut no steeper than 1:1 (H:V) and 0.5:1 (H:V) respectively. Temporary and permanent batters <3 m in height in siltstone and laminate (Unit 3), even if high strength, should be cut no steeper than 0.75:1 (H:V). Note that siltstone and laminite can contain random low-angled joints (around 45°) which can adversely affect the stability of rock faces. Progressive inspection during excavation will therefore be required to confirm that the faces are not adversely affected by jointing.

Temporary and permanent batters over 3 m in height in any material should be designed individually.

Where there is insufficient space for battering, excavation in the Fill/soils, very low strength rock and low strength rock will require temporary and permanent retention. The retention system should be designed to support the soil and weak rock and all surcharge loads, taking into account the allowable deformation limits for adjacent structures and surrounding services. Temporary retention of vertical cut faces is usually provided by shoring, typically comprising piles, sometimes with infill shotcrete panels, temporarily anchored until the building provides permanent support.

Vertical faces in medium strength or stronger sandstone are feasible, except where adversely affected by jointing. Where affected by adversely oriented joints, rock mass support such as rockbolts will be required. The location of these spot bolts can only be finalised during excavation once the actual defect location, strike and dip have been determined.

All batters/faces should be inspected/geotechnically mapped every 1.5 m drop in excavation to confirm the ground profile is as anticipated and that the rock is not adversely affected by joints or soft seams.

9.3.2 **Retention Systems (Shoring Walls)**

Where required, shoring should be designed to support the Fill, soil, very low to low strength rock and any surcharge loads. Shoring piles may only need to extend to medium strength or stronger rock (subject to assessment). Allowance should be made for ground anchors, rockbolt and shotcrete support.

Soldier piles in conjunction with reinforced shotcrete panels are commonly used for excavation support in cohesive soils and weak rocks. The exposed soil and rock profile between the soldier

piles is expected to be temporarily self-supporting for panel depths of up to about 1.5 m, until the reinforced infill panels are constructed. A maximum drop in excavation of 1.5 m is also recommended for excavation in soil and extremely low strength rock.

All clay seams and weak shale layers 100 mm to 200 mm thick in free-standing sandstone will need to be treated to prevent fretting, with larger seams shotcreted and bolted to an engineer's specification.

Where exposed in the excavation face, the dyke material is likely to be highly weathered to a clay and will require support. Support is likely to comprise shotcrete with mesh held in place by dowels.

9.3.3 Shoring Design

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

It is suggested that the earth pressure acting against cantilevered shoring systems or shoring systems with one row of anchors be based on a triangular earth pressure distribution, calculated using the earth pressure coefficients provided in Table 10. '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.

Table 10: Preliminary Design Parameters for Shoring Systems

Material	Unit Weight (kN/m ³)	Earth Pressure Coefficient		
		Active (K_a) Temporary	Active (K_a) Permanent	At Rest (K_o)
Filling and residual clay (Unit 1)	20	0.3	0.40	0.50
Very low to low strength laminate (Unit 2)	22	0.2	0.25	0.35
Medium strength or stronger sandstone (Unit 3)	24	0	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. One method of calculating these pressures is where the support pressure is 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., near adjacent structures, buildings or services) the lateral earth pressure can be calculated using 6H kPa. For movement-sensitive structures, where it is critical that deformation is limited, it may be necessary to calculate the pressure using 8H kPa.

Note these earth pressure distributions are “pressure envelopes”, selected to ensure that no row of anchors is overloaded during the temporary support phase. The actual magnitude and distribution of lateral earth pressures for the building in its final (long term) condition may differ from the uniform distributions given above. The final condition earth pressures can be assessed using numerical methods.

In all cases, additional surcharge loads such as new and existing footings, construction loads, etc., must be allowed for in the design, applied as a rectangular earth pressure distribution over the depth of influence.

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 to account for the buoyant condition.

Passive resistance for piles founded below bulk excavation level may be based on the ultimate passive pressure shown in Table 11, provided the rock mass is not adversely affected by discontinuities (joints, weak seams, etc.).

It should be noted that the ultimate passive pressure values shown should be appropriately factored and are considered to only act below a depth of one pile diameter beneath detailed excavation level or 0.5 m, whichever is greater. Piles should also be founded at least one pile diameter or 1.0 m below the lowest level of any nearby excavation (including perimeter drainage trenches, detailed service or footing excavations, or any excavation in the zone of influence that could allow movement along a bedding plane).

Table 11: Preliminary Design Parameters for Shoring Piles

Material Description	Ultimate Passive Pressure (kPa)
Medium strength laminite/sandstone	2,000
Medium strength or better sandstone (Unit 3)	3,500

Note: Only at levels below bulk/detailed excavation level, as stated in the text, and where jointing is favourable.

Piles may be socketed into the top of free-standing medium strength or stronger sandstone provided adequate retention and toe support are provided. In this case, however, detailed geotechnical assessment will be required.

Soldier piles supporting structural loads should be designed based on the allowable foundation pressures given in Section 8.4.

Shoring will generally require tie-back anchors to ensure that stability is maintained, particularly where limiting ground movement behind the wall is essential. The legal implications of the use of rock anchors extending onto neighbouring properties and public land will need to be considered. Approval should be sought from Council and adjacent property owners prior to installing any anchors. Due consideration should also be given to any below-ground excavations, services, etc beyond the Site boundary.

The final or detailed design of shoring walls is normally undertaken using interactive computer programs such as WALLAP, PLAXIS or FLAC, which can take soil-structure interaction into account during the progressive stages of wall construction, anchoring and excavation.

9.3.4 Ground Anchors and Rockbolts

Ground anchors, rockbolts and dowels (support elements) can be used to laterally support new shoring and rock faces, where unstable rock slivers, blocks, wedges and feather edged joints are present. It is anticipated that the building will support any shoring and basement rock face (except where free-standing) in the long term and therefore, any ground anchors are expected to be temporary only. Any support of adversely oriented joints or potentially unstable wedges in the rock faces can be supported by permanent rockbolts such as Double Corrosion Protect bolts, CT-Bolts etc. The use of permanent rockbolts and ground anchors, if required, will need careful attention to corrosion protection for which further geotechnical advice should be sought. All ground anchors and rockbolts used to support retaining structures should be designed in accordance with AS4678.

Pre-stressed, permanent ground anchors can be used for shoring and to hold-down building core foundations where uplift loads are present. Hold-down anchors should be designed in accordance with AS4678. For hold-down anchors the designer should check the combined cone and pull-out failure mechanism by assuming a 90° cone in medium strength or stronger sandstone, slightly fractured sandstone (or better). The cone apex should be positioned at the mid-point of the anchor bond length. The mass of the cone must be sufficient to resist uplift. The dead load of the rock mass should be calculated using a unit weight of 24 kN/m³ for the rock. A buoyant unit weight of 14 kN/m³ should be used for any portion of the cone below the water table. It will be necessary to determine the extent to which adjacent cones intersect and share rock mass, with the capacity reduced accordingly. Where cones intersect it is usually necessary to use 3D CAD to determine the cone volumes.

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, as required.

Ground anchors, rockbolts and dowels should be bonded in the strong rock, inclined as required, but preferably not steeper than 30° below the horizontal. Table 12 provides ultimate and allowable bond stresses for preliminary assessment purposes.

Table 12: Preliminary Anchor Bond Stresses

Material	Allowable Bond Stress (kPa)	Ultimate Bond Stress (kPa)
Medium strength laminite/sandstone	350	600
Medium to high strength sandstone (Unit 3)	600	1500

The values in Table 12 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 support elements have been installed, they should be proof tested to 125% to 150% of their working load for temporary support and 150% of their working load for permanent support. For post-tensioned rockbolts/anchors, suitability and acceptance testing should be carried out followed by lift-off tests 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. Where stress relief or further unavoidable movement of shoring is expected, it is recommended that the support elements are locked-off between 70% and 90% of their working loads to accommodate the additional movement and subsequent increase in stress in the support elements. The lock-off for hold-down anchors will likely be higher.

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. Inspections by a qualified geotechnical engineer/engineering geologist are required after each drop to determine if additional support is required.

It should be noted that permission will be required from adjacent property owners or relevant authorities prior to installing rockbolts/ground anchors into or below their land or into any utility easements. In such cases where anchors are not permitted, alternative methods such as internal propping etc may be required. Due consideration should also be given to below-ground services and infrastructure etc.

9.4 Foundations

The proposed foundation arrangement and loading is currently not known. Based on a bulk excavation of RL 73, the boreholes indicate that medium to high strength or stronger sandstone will be exposed in the base of the excavation. Shallow footings such as pads and strips would be an appropriate foundation system. Design of pad or strip footings on medium and medium to high strength sandstone may be carried out using the values given in Table 13.

Table 13: Preliminary Design Parameters for Foundation Design (after Pells, Moyston and Walker²)

Foundation Stratum	Class	Ultimate End Bearing Pressure (kPa)		Allowable End Bearing Pressure (kPa)		Young's Modulus, E (MPa)	Minimum Testing Requirements
		End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)	End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)		
Medium Strength Sandstone	Class III	20,000	800	3,500	350	600	Minimum 4 cored bores, with spoon testing or cores in at least 33% of footings
Medium to High Strength Sandstone (Unit 3)	Class II	60,000	1,500	6,000	600	1200	Cored bores at max 10 m grid spacing or cored bores for 50% of footings and spoon testing of remainder.

*Notes about this Table:

- Ultimate parameters are mobilised at large settlements (i.e. >5% of minimum foundation width).
- Allowable end bearing pressures to cause settlement of less than 1% of minimum footing dimension.
- Shaft adhesion applicable to the design of bored piles, uncased over the rock socket length, where adequate sidewall cleanliness and roughness are achieved

The drawings provided (Appendix B) indicate that none of the building structure will be founded on high-level foundations (i.e. near surface level). For lightly loaded surface features such as light posts, fences, bollards, or similar installations, footings must extend down at least to residual soil or deeper depending on their loading. Uncontrolled fill material is unsuitable for foundation purposes. The allowable bearing pressure for a residual stiff clay can generally be considered as 200 kPa, subject to confirmation through inspection/testing by a geotechnical engineer. All proposed foundations in the soils will need to be reviewed by the geotechnical engineer as there could be shrink/swell movement in the clay.

To adopt an allowable bearing pressure value of 3.5 MPa for design, spoon testing or cores in at least a third of footings will be required across the Site during construction. If allowable bearing

² Design Values for Foundations on Sandstone and Shale in the Sydney Region, Pells, Moyston and Walker. Australian Geomechanics December 1998.

pressures of 6 MPa are used in design, then cored bores at a maximum 10 m grid spacing or cored bores for 50% of footings and spoon testing carried out on the remaining footings are required. 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 the sidewall of the hole to check for the occurrence of defects such as weak seams, fragmented zones, clay bands etc. (which form part of the criteria for the Pells Classification systems).

Note, where foundations loads allow it, the footings could be designed for the values corresponding to medium strength sandstone (3.5 MPa) to reduce the amount of additional testing required. The additional testing to prove the higher bearing pressures corresponding to medium to high strength sandstone are fairly onerous and results in additional costs and time required during construction.

All foundations should be taken down to below the zone of influence of any proposed service trenches running beneath the basement floor. Generally, the zone of influence can be defined by a plane extending upwards at 45° from the base of the service trench (all footings affected to be assessed individually).

The foundation design parameters given in Table 13 assume that the foundation excavations are clean and free of loose debris, water etc prior to concrete placement. Foundations proportioned on the basis of the allowable bearing pressures in Table 13 would be expected to experience total settlements of less than 1% of the minimum foundation width under the applied working load, with differential settlement between adjacent columns expected to be less than half of this value.

For design of piles using the ultimate values provided in Table 13, a geotechnical strength reduction factor (ϕ_g) should be determined by the designer in accordance with the piling code AS 2159-2009. Serviceability criteria will also need to be met when using ultimate design parameters. All laterally loaded pile designs should be individually assessed by the geotechnical engineer.

The allowable bearing pressure is generally reduced by approximately half for any high-level footings bearing on competent, self-supporting (i.e. not affected by defects) medium strength or stronger sandstone near the edge of a vertical excavation. Inspection of the excavated face below the footing will be necessary to confirm that there are no observable defects or adversely dipping joints that may affect footing performance. Investigation comprising horizontal core holes may be required to establish whether an adversely oriented joint is present behind the face and to determine the extent of such defect in the rock mass.

If the dyke is exposed linearly in the excavation base where footings are proposed, the footings should either be moved or designed to bridge over the dyke material.

All footings should be inspected by a geotechnical engineer to confirm that founding conditions are suitable for the design parameters, and cored or spoon tested as appropriate. Drilling of all pile sockets should be witnessed by a geotechnical engineer to confirm that foundation conditions are suitable for the design parameters. If weak seams or other defects are encountered, footings may need to be deepened until suitable founding material is reached.

If required, numerical analysis can be used to calculate the modulus of subgrade reaction for individual footings or building core base.

9.5 Ground Slabs

If a tanked basement is designed, floor slabs at basement level can be designed as a slab on ground, assuming proper compaction is given to the subgrade on which the slabs are cast (if not on rock). Only suitable material should be used to backfill over-excavated areas, compacted to a minimum 98% standard maximum density prior to the casting of the slabs. In these areas CBR testing will be required for slab design, unless the slabs are suspended.

If a drained basement is designed, it will be necessary to provide a sub-slab drainage layer with drainage trenches and sumps to safeguard against uplift pressures.

9.6 Seismic Design and Site Classification

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 level is considered to be Class B_e (rock) and potentially Class C_e (shallow soil) areas may also exist where the soil surface layer is more than 3 m in depth.

It is recommended that the building is not designed to rely on passive resistance from the excavated rock faces surrounding the Site to account for any removal of this rock by future excavation or neighbouring developments (this would also confirm a Class B_e).

9.7 Soil Classification

The Soil Classification in accordance with AS 2870 is Class P due to clay fill being deeper than 0.4 m. Again, uncontrolled fill material is unsuitable for foundation purposes. If concrete slabs and footings are proposed at surface level, then they must be on engineered fill or the residual soil. The residual clay soil will need to consider the effect of soil reactivity and settlement with each of the footings be assessed individually by a geotechnical engineer.

9.8 Groundwater

Groundwater levels measured at the end of the investigation were between RL 80 m and RL 84 m. Long-term monitoring is underway using data-loggers installed in the three wells to assess the fluctuations and to determine a suitable design water level.

As a preliminary value, we suggest a groundwater level of RL 84 along the higher ground on the northwest side of Site, between RL 84 m and RL 81 m along the southwest side, between RL 81 and RL 80 along the southeast side of the Site and between RL 84 and RL 80 along the northeast side. Note that these levels should be used with caution as subsequent monitoring may not indicate similar water levels. Re-establishment of the pre-drilling water level due to the use of drilling fluid can take some time. In addition, groundwater levels can be transient and can fluctuate with time, particularly, following periods of heavy rainfall. The levels do not include any allowance due to climate change.

Groundwater flow is expected to follow topography which slopes towards a surface gully which trends towards the east. Flow is likely to occur along the top of rock (particularly after periods of wet weather) and through the network of discontinuities (joints and bedding planes) in the rock mass. Inflow is expected to take the form of seepage which may be relatively minor during dry periods and will increase following and during wet periods. Around the perimeter of the

excavation, most seepage is likely to occur through the upslope faces. Initially, higher inflow may be experienced due to excavation and then reduce with time. SiteNote that subvertical dykes can form a barrier to groundwater flow, ponding water on the upside of the dyke and lowering levels on the downside.

The initial groundwater level measurements indicate the basement will extend below the water table. Inflow into the basement will be a function of groundwater recharge in the catchment area, the water levels and the permeability of the rock mass (itself a function of the occurrence of defects such as bedding planes, joints, fracturing, faults etc.). It is therefore difficult to accurately estimate inflows prior to excavation. A standard approach is to provide an estimate based on assumed values using modelling/assessment and refine the estimate during construction. Methods to reduce groundwater inflows (grouting fractured zones) can be carried out if inflows are significant.

During construction and in the long-term, it is anticipated that seepage from the rock into the excavation could be readily controlled by perimeter drains, connected to a sump-and-pump system typically installed for drained basements. Any groundwater drawdown from temporary and permanent sump and pump system is likely to be entirely within the bedrock and is likely to have a minimal effect on adjacent properties.

A groundwater inflow assessment using numerical modelling should be carried out to predict likely inflows, drawdown and drawdown extent. The amount of seepage into the excavation during and just after construction should be monitored as this will give an indication of likely inflows for the long-term condition.

Approval from WaterNSW that the drained basement meets the water laws and policy set by the Department of Climate Change, Energy, the Environment and Water (DCCEE), however, will be required prior to designing and constructing a drained basement. A drained basement, if approved, will require permanent subfloor drainage to direct seepage to the stormwater drainage system for which Council approval will be required. The disposal requirements of water collected on-Site will be dependent on the chemical composition of the water. Note that a drained basement will act as a low point to which groundwater will flow. Therefore, if present, any contamination within the surrounding groundwater system could flow into the basement, eventually adversely affecting the quality of the water collected on Site.

A tanked basement would avoid the need for considering inflow into the basement but is likely to be more expensive than a drained basement. A tanked basement would need to be designed to resist uplift forces associated with groundwater pressure.

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 and/or "baffle" pits.

9.9 Acid Sulphate Soil Risk

In addition to the mapped low probability of ASS occurrence, three soil samples were tested for pH as shown in Table 5. According to the Department of Land and Water Conservation³, the primary criterion for identification of an actual acid sulphate soil has a pH below 4. The pH of the tested soil samples was all above this value.

9.10 Salinity Risk

Three soil samples were tested for electrical conductivity (an indicator of salt) as part of aggressivity testing. The test results are shown in Table 5.

According to the NSW Department of Primary Industries and Regional Development⁴ 1000 $\mu\text{S}/\text{cm}$ is equivalent to 1 dS/m. According to the Department of Infrastructure, Planning and Natural Resources (DIPR)⁵, raw EC 1:5 data from laboratory tests can provide an indication of the movement of salts within a soil profile. The EC 1:5 values for soil salinity must be converted using multiplication factors from their guidelines (DIPR). If a conservative factor of 8.5 for light clays is used, the converted ECe values are as shown in Table 14.

Table 14: Soil Salinity (Converted Electrical Conductivity Laboratory Test Results, as per DIPR)

Borehole	Material	Soil Salinity (ECe)
		dS/m
BH01	Clay	0.1
BH05	Clay	0.3
BH06	Clay	0.5

The classification of soil salinity as per DIPR based on ECe is presented in Table 15.

Table 15: Soil Salinity Classification

Classification	ECe (dS/m)	Description
Non-saline	< 2	Salinity effects mostly negligible
Slightly saline	2 - 4	Yields of sensitive crops affected
Moderately saline	4 - 8	Yields of many crops affected
Very saline	8 - 16	Only tolerant crops yield satisfactorily
Highly saline	> 16	Only a few very tolerant crops yield satisfactorily

³ NSW Department of Environment and Conservation. (2008). Acid sulfate soils maps: Guidelines for the use of the acid sulfate soils risk maps. NSW Government. <https://www.environment.nsw.gov.au/resources/acidsulfatesoil/assmapsguide.pdf>

⁴ NSW Department of Primary Industries. (n.d.). *How salinity is measured*. NSW Government. Retrieved October 8, 2024, from <https://www.dpi.nsw.gov.au/agriculture/soils/more-information/salinity/general-information/measuring>

⁵ Department of Infrastructure, Planning and Natural Resources, NSW (DIPNR) (2002c), Site Investigation for Urban Salinity.

The tested samples of clay at the Site are within the non-saline classification using the E_{Ce} values obtained from laboratory testing.

9.11 Geotechnical Monitoring and Inspection

It is suggested that the following be carried out either prior to or during the construction phase, as appropriate.

9.11.1 Monitoring

Survey points and possibly inclinometers may be required to monitor movement of the excavation faces. The results can be compared with predicted values (from modelling) to ensure displacements are within the expected range. Survey points should be installed at the top of capping beams, prior to commencing excavation, to monitor wall deflection during the works. Monitoring targets will also be required on any sensitive structures adjacent to the excavation. At least three sets of base readings should be taken prior to proceeding with any excavation. Readings will need to be taken at intervals during and after excavation works (readings to be forwarded to the geotechnical engineer/structural engineer for assessment).

It is recommended to carry out dilapidation surveys of adjacent buildings prior to any demolition or excavation, where they are within the zone of influence of the excavation.

9.11.2 Geotechnical Inspections

The following geotechnical inspections are recommended during construction:

- inspection of batters, exposed soil faces and rock faces every 1.5 m drop in excavation level (unless otherwise recommended);
- observing a percentage (% depends on design) of temporary ground anchor drilling, installation and stressing;
- observing all permanent ground anchor drilling, installation, grouting and stressing;
- inspection of a percentage (% depends on design) of shoring piles drilling;
- inspection of all foundations (piles, pad and strip footings) and associated cored boreholes/spoon testing.

An should be prepared once design has been finalised, prior to commencing with construction.

10. Further Geotechnical Work

Permeability testing in the 3 groundwater monitoring wells and long-term monitoring of groundwater will be carried out over the next three-months. This report will be updated with the results from testing and monitoring. Note that ongoing groundwater monitoring may be required by DCCEEW.

Further geotechnical work would comprise:

- Geotechnical review of the foundation and shoring design will be required.

- A Geotechnical Monitoring Plan (GMP) and an Inspection and Test Plan (ITP) will be required to outline monitoring requirements, inspection, testing, and verification requirements for geotechnical works.
- A Dewatering Management Plan (DMP) is required outlining the procedures for managing groundwater during excavation and construction, for complying with environmental regulations and for submission to Council for approval to discharge into the stormwater system.
- During the investigation, two boreholes at the back of 24 and 26 Middle Harbour Road were unable to be accessed. These two boreholes are still recommended to confirm the ground profile in those areas. Additional deeper boreholes may be required depending on the structural design. An additional borehole(s) may be required prior to bulk excavation commencing to investigate the extent of the dyke in BH01. This will also be dependent on the foundation requirements in that area.

11. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 24, 26 and 28 Middle Harbour Road, Lindfield NSW in line with Douglas' proposal dated 14 February 2025 and acceptance received from Gabrielle Chidiac of The Trustee for MHR LINDFIELD TRUST dated 11 March 2025. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of The Trustee for MHR LINDFIELD 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 Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

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

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

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for

interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

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

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

Appendix A

About This Report and Explanatory Notes

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.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the 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

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, 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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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

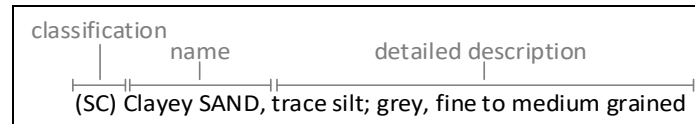
Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has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

Component proportions

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.

Composite Materials

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”.

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
	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 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.

Soil Descriptions

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”.





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).

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:

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

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

Terminology
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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:

SAMPLE			DEPTH (m)	TESTING	
SAMPLE REMARKS	TYPE	INTERVAL		TEST TYPE	RESULTS AND REMARKS
	SPT		1.0 1.45	SPT	4,9,11 N=20

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(L)
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

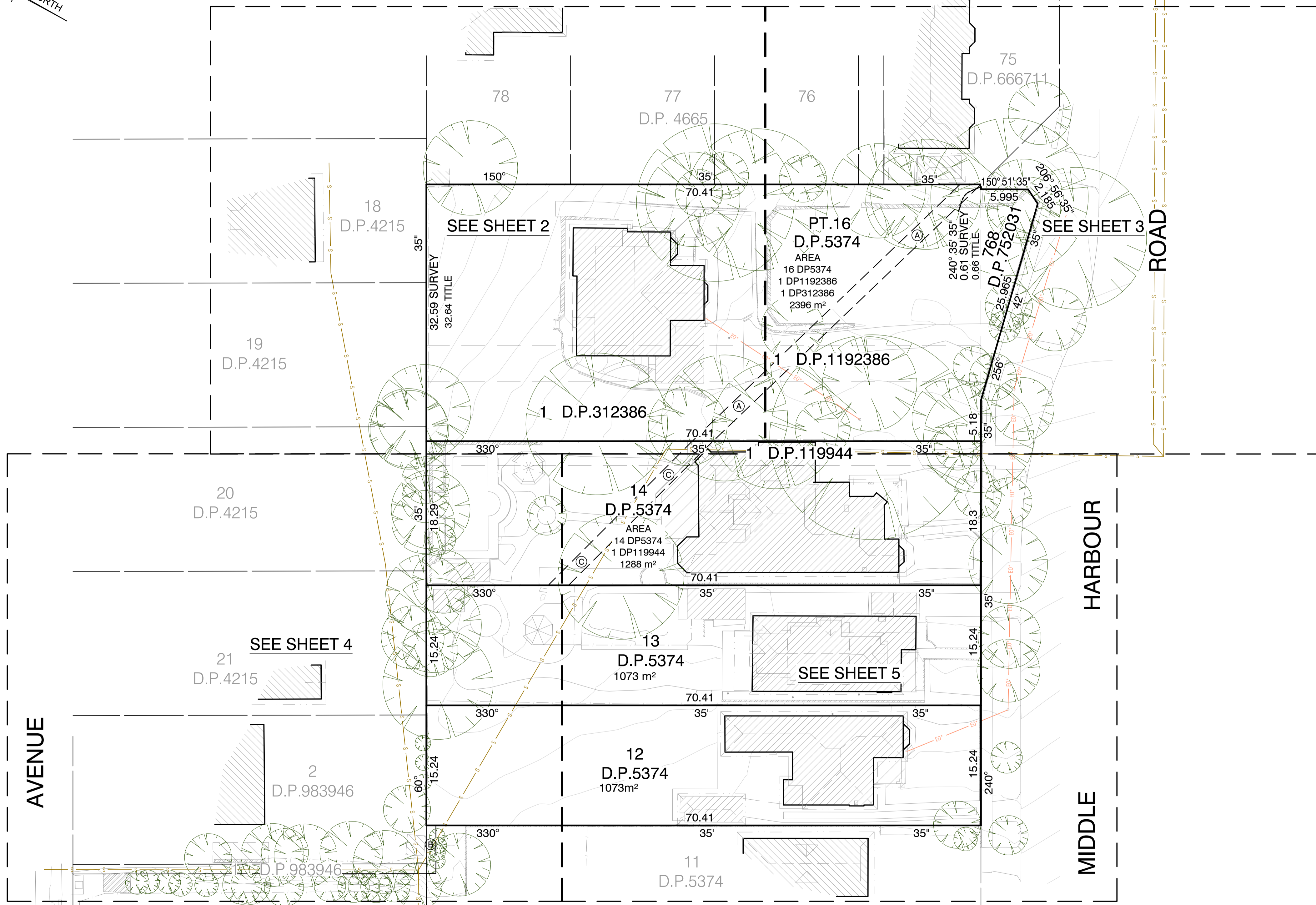
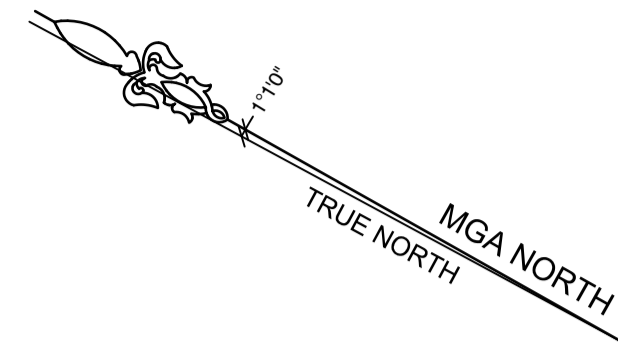
The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

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
Pre drilled	PD
Diatube	DT ¹
Hollow flight auger	HSA ¹
Vacuum excavation	VE

¹ – numeric suffixes indicate tool diameter/width in mm

Appendix B

Drawings



TITLE INDICATES THAT AUTO CONSOL 3762-21 IS SUBJECT TO:
 - RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
 - A62578 COVENANT AFFECTING LOT 1 IN DP312386 AND LOT 1 IN DP1192386 (NOT INVESTIGATED)
 - A168568 COVENANT (NOT INVESTIGATED)
 (A) - B468406 DRAINAGE EASEMENT 1.83 METRE(S) WIDE AFFECTING THE PART(S) SHOWN SO BURDENED IN DP183415

NOTE: AUTO CONSOL 3762-21 INCLUDE LOT 16 IN DP5374 & LOT 1 IN DP312386 & LOT 1 IN DP1192386

TITLE INDICATES THAT AUTO CONSOL 7420-213 IS SUBJECT TO:
 - RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
 - 601168 COVENANT AS REGARDS LOT 14 DP5374 (NOT INVESTIGATED)
 - A62578 COVENANT AS REGARDS LOT 1 DP119944 (NOT INVESTIGATED)
 (C) - B978533 EASEMENT FOR DRAINAGE AFFECTING THE PART OF THE LAND ABOVE DESCRIBED SHOWN SO BURDENED IN VOL 7420 FOL 213

NOTE: AUTO CONSOL 7420-213 INCLUDE LOT 14 IN DP5374 & LOT 1 IN DP119944

TITLE INDICATES THAT LOT 12 IN D.P. 5374 IS SUBJECT TO:
 - RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
 - 546081 COVENANT (NOT INVESTIGATED)
 (B) - C292088 RIGHT OF WAY APPURTENANT TO THE LAND ABOVE DESCRIBED AFFECTING THE LAND SHOWN SO BURDENED IN VOL 4664 FOL 66

TITLE INDICATES THAT LOT 13 IN D.P. 5374 IS SUBJECT TO:
 - RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
 - 588158 COVENANT (NOT INVESTIGATED)

LEGEND:

- BB = BOTTOM OF BANK
- BBO = BARBEQUE
- BIT = BITUMEN
- BLD = EXTERNAL BUILDING
- BOK = BACK OF KERB
- BW = BOTTOM WALL
- CH = CHIMNEY
- CL = CENTRELINE
- COL = COLUMN
- CON = CONCRETE
- D3 = DSH DRAIN
- DK = DECK
- DS = DOOR SILL LEVEL
- ELO = ELECTRICITY LINE OVERHEAD
- FCE = FENCE
- GAFI = GARAGE FLOOR LEVEL
- GAR = GARAGE
- GDN = GARDEN
- GF = GUTTER LEVEL
- GM = GAS METER
- GPIT = GAS PIT
- GRT = GRATE
- HL = HOOD LEVEL
- IL = INVERT LEVEL
- INS = INSPECTION PIT
- LID = MISCELLANEOUS PIT LID
- LN = LINTEL
- LIP = KERB LIP
- NS = NATURAL SURFACE
- PAR = PARAPET
- PAT = PATIO
- PAV = PAVING
- RF = TOP OF ROOF
- RR = ROOF RIDGE
- SGN = SIGN
- SIP = SEWER INSPECTION PIT
- SMH = SEWER MAN HOLE
- STR = STAIRS
- T3 = TOP OF BANK
- TER = TERRACE
- TFCE = TOP OF FENCE
- TG = TOP OF GUTTER
- TKB = TOP OF KERB
- TLE = TREE LINE
- TPIT = TELSTRA PIT
- TR = TREE
- TW = TOP OF WALL
- VC = VEHICLE CROSSING
- VNT = VENT
- WM = WATER METER

= ELECTRICITY OVERHEAD
 = SEWER UNDERGROUND
 = TREE
 = SPREAD-DIAMETER-HEIGHT
 = MULTIPLE TRUNKS

- NOTES:**
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- KARL ROBERTSON
 REGISTERED SURVEYOR BOSSI NUMBER 7835
- "SEE SHEET 1 FOR LEGEND & NOTES"**

1	FIRST ISSUE	23/08/2024
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Zero Damage - Zero Harm

SCALE 1:300

HORIZONTAL DATUM:
 CO-ORDINATE SYSTEM: MGA 2020 (GROUND)
 MARKS ADOPTED: SSM 163011, 163012 & 163013

VERTICAL DATUM:
 DATUM: AUSTRALIAN HEIGHT DATUM (AHD)
 B.M. ADOPTED: SSM 163012
 R.L. 88.51 (CLASS D)
 SOURCE: S.C.I.M.S. (09/08/2024)

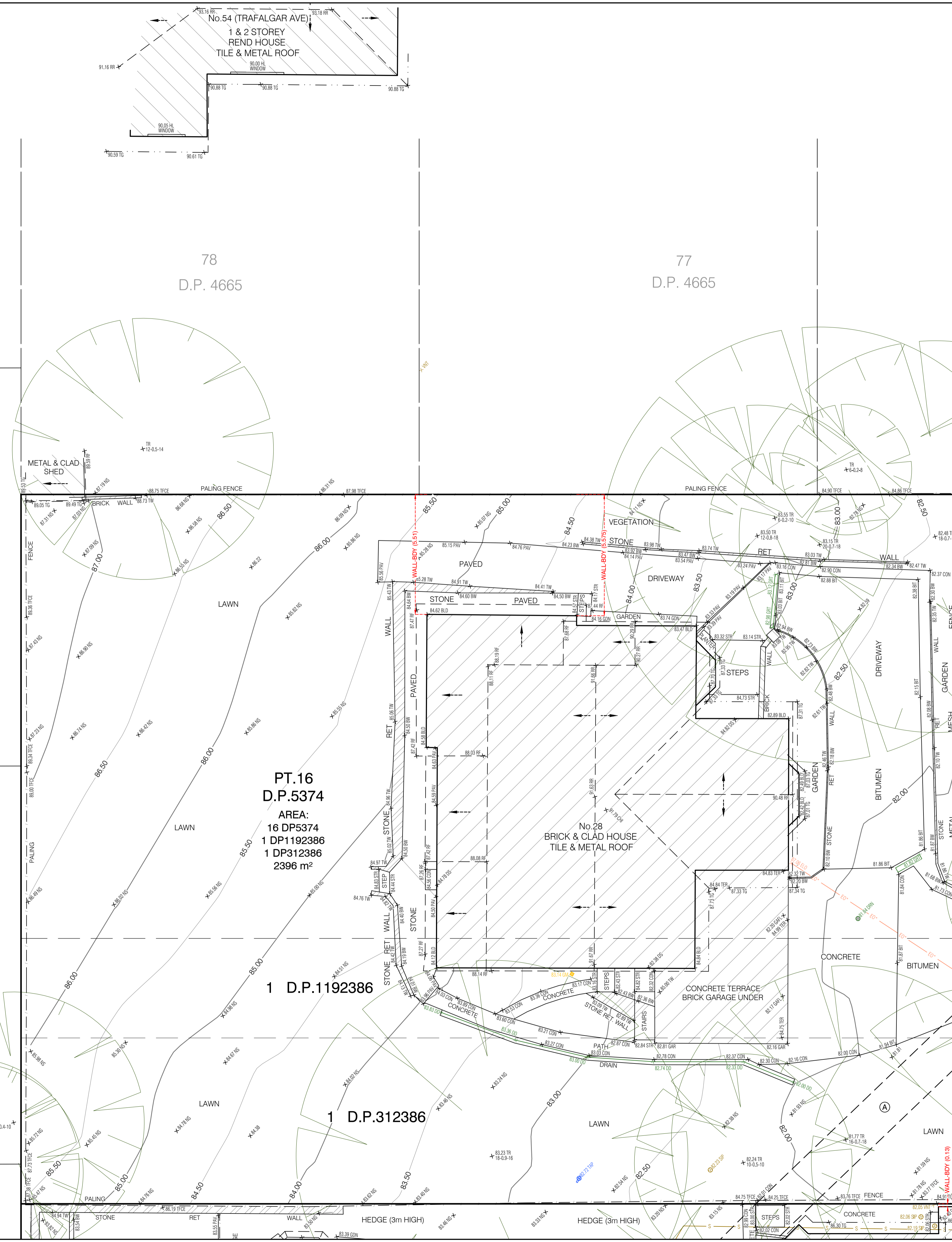
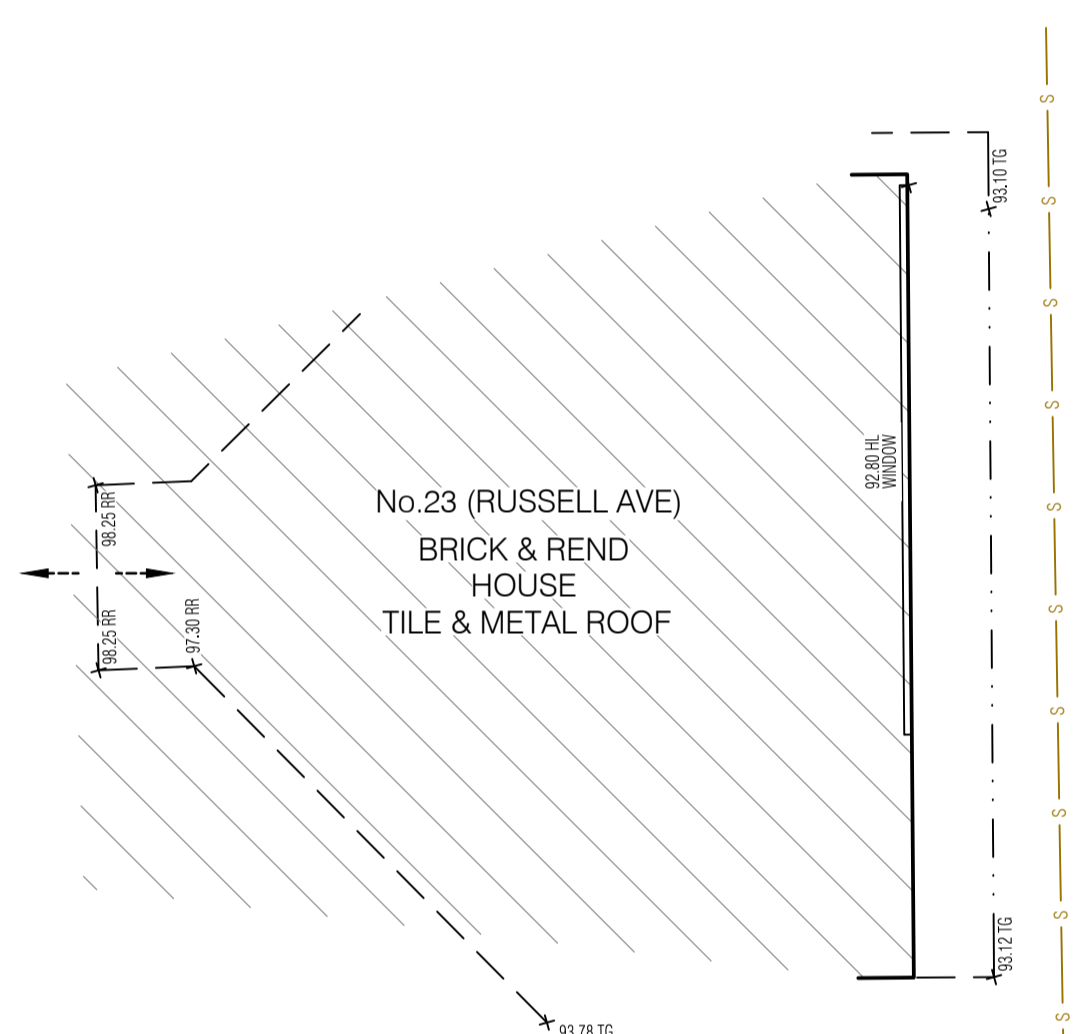
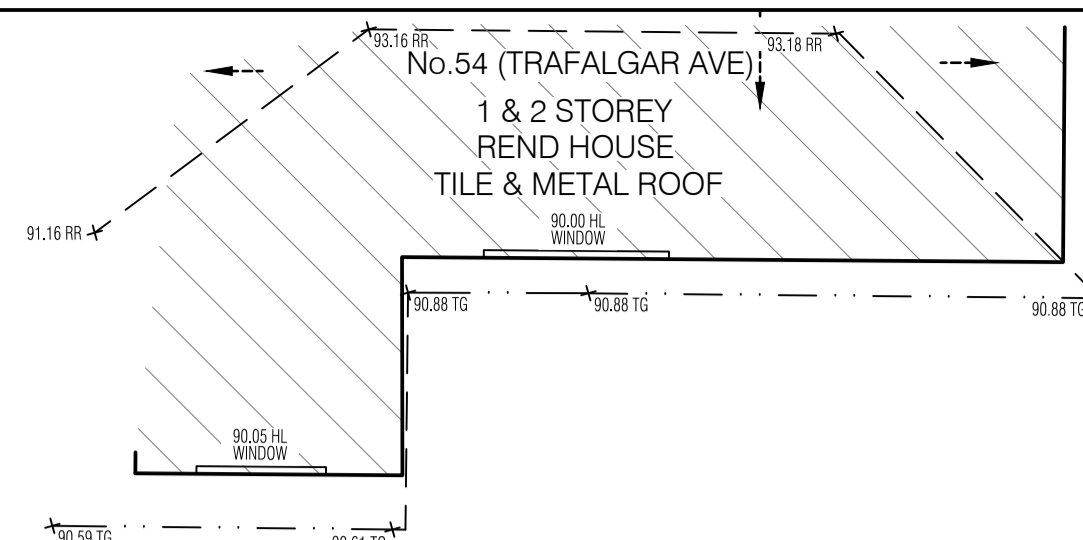
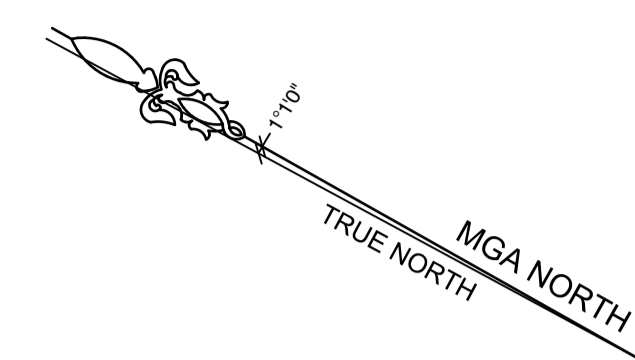
CLIENT:
 THE OWNERS OF No.22, 24, 26 & 28

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 info@cmssurveyors.com.au
 www.cmssurveyors.com.au

SURVEYED LP	DRAWN GP	CHECKED LP	APPROVED BS
SURVEY INSTRUCTION 23693	SCALE 1:300@A1	DATE OF SURVEY 13/08/2024	
DRAWING NAME 23693detail		SHEET 1 OF 5	ISSUE 1
CAD FILE 23693detail 1.dwg			



78
D.P. 4665

77
D.P. 4665

18
D.P. 4215

19
D.P. 4215

PT.16
D.P.5374
AREA:
16 DP5374
1 DP1192386
1 DP312386
2396 m²

1 D.P.1192386

1 D.P.312386

NOTES:

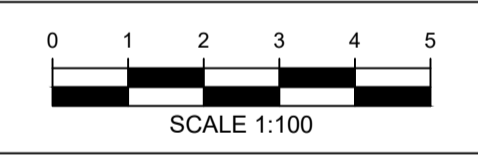
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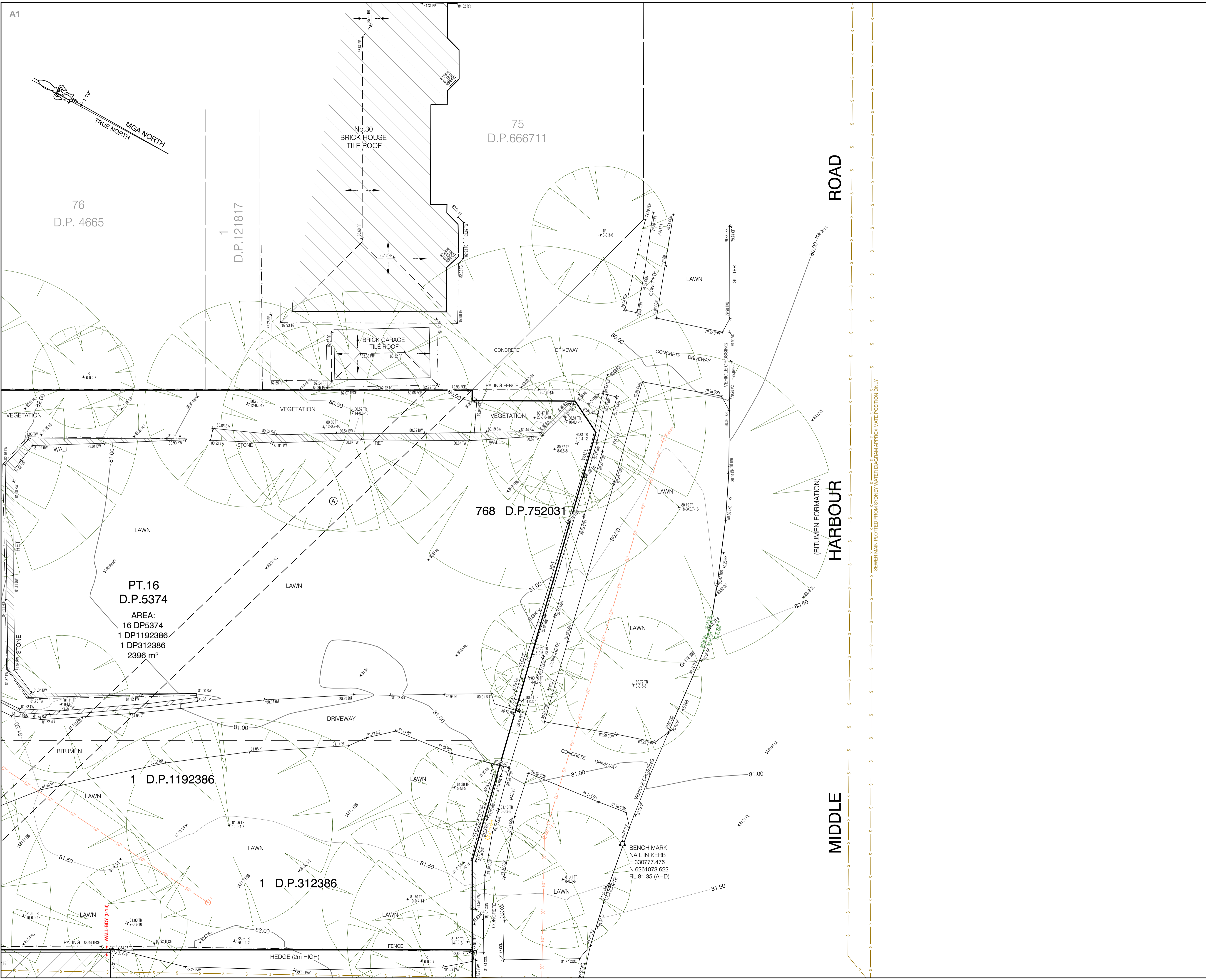
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SURVEY INSTRUCTION 23693	SCALE 1:100@A1	DATE OF SURVEY 13/08/2024	
DRAWING NAME 23693detail		SHEET 2 OF 5	ISSUE 1
CAD FILE 23693detail 1.dwg			



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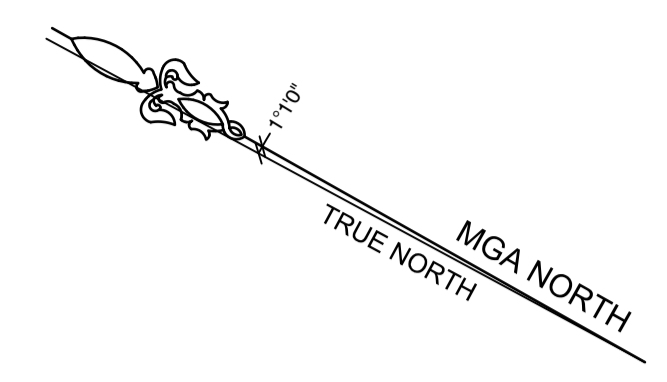
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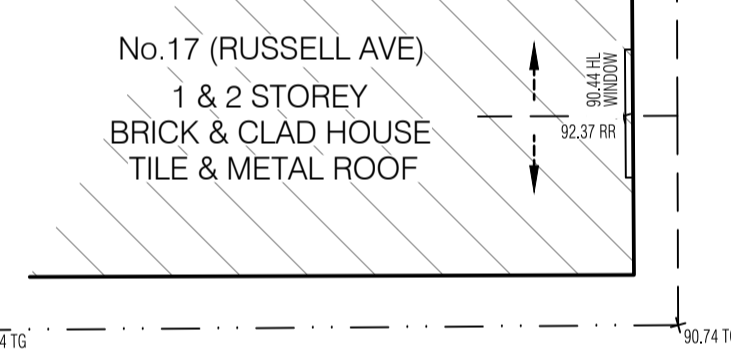
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DRAWING NAME 23693detail	SHEET 3 OF 5		ISSUE 1
CAD FILE 23693detail 1.dwg			



20
D.P.4215

21
D.P.4215



No.15 (RUSSELL AVE)
1 & 2 STOREY
BRICK HOUSE
TILE & METAL ROOF

2
D.P.983946

RUSSELL AVENUE
(BITUMEN FORMATION)

14
D.P.5374
AREA:
14 DP5374
1 DP119944
1288 m²

13
D.P.5374
1073 m²

12
D.P.5374
1073 m²

11
D.P.5374

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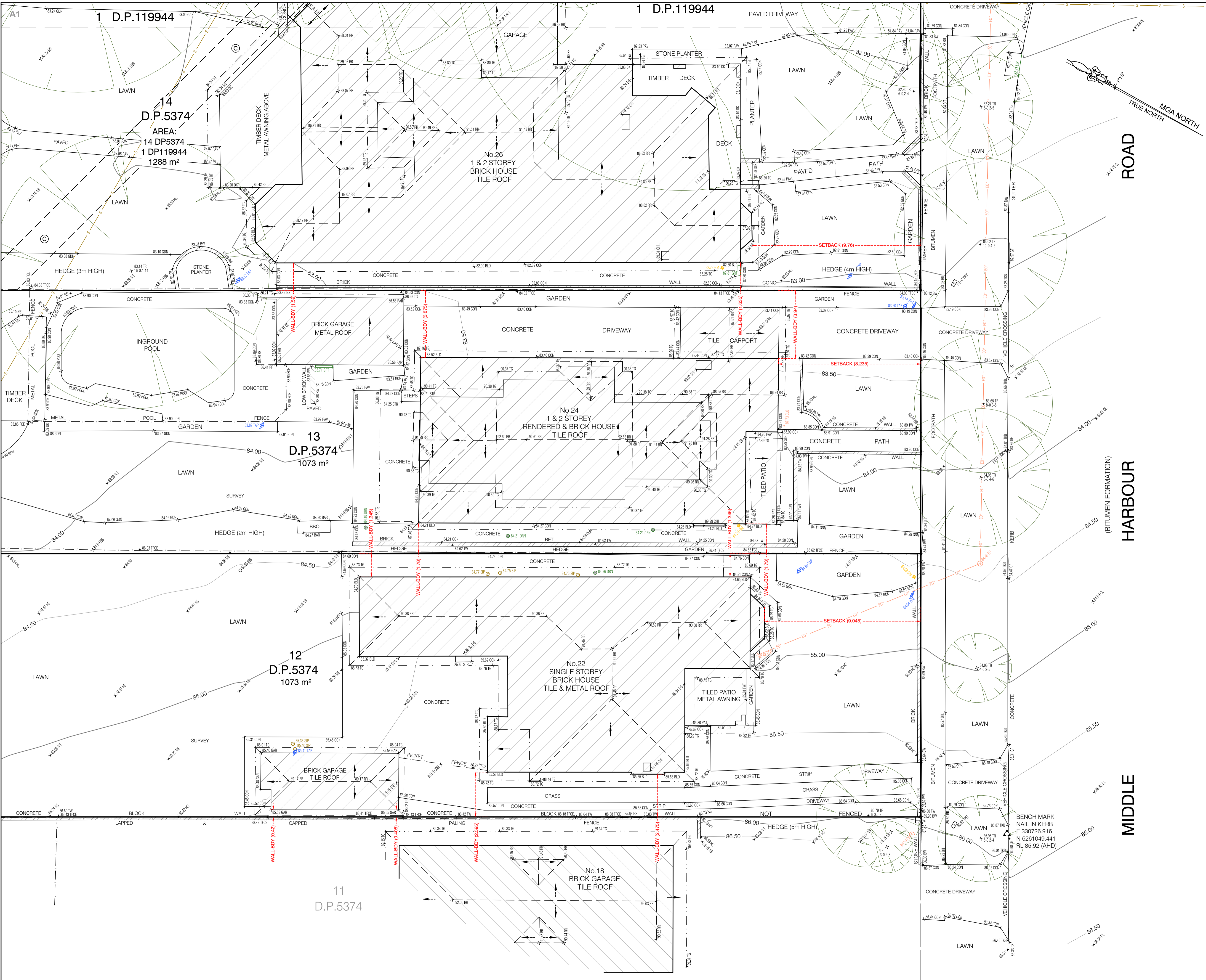
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DRAWING NAME 23693detail		SHEET 4 OF 5	ISSUE 1
CAD FILE 23693detail 1.dwg			



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- RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE OFFSETS ARE CRITICAL THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.
- EXCEPT WHERE SHOWN BY DIMENSION LOCATION OF DETAIL WITH RESPECT TO BOUNDARIES IS INDICATIVE ONLY.
- ONLY VISIBLE SERVICES HAVE BEEN LOCATED. UNDERGROUND SERVICES HAVE NOT BEEN LOCATED. BEFORE YOU DIG AUSTRALIA (www.byda.com.au) SHOULD BE USED AND A FULL UTILITY INVESTIGATION, INCLUDING A UTILITY LOCATION SURVEY, SHOULD BE UNDERTAKEN BEFORE CARRYING OUT ANY CONSTRUCTION ACTIVITY IN OR NEAR THE SURVEYED AREA.
- SEWER MAIN PLOTTED FROM SYDNEY WATER SEWER DIAGRAM. LOCATION SHOULD BE MARKED ON SITE IF CRITICAL.
- CRITICAL SPOT LEVELS SHOULD BE CONFIRMED WITH SURVEYOR.
- CONTOURS SHOWN DEPICT THE TOPOGRAPHY. THEY DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION.
- CONTOUR INTERVAL - 0.5 metre. - SPOT LEVELS SHOULD BE ADOPTED.
- POSITION OF RIDGE LINES ARE DIAGRAMMATIC ONLY (NOT TO SCALE).
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Karl Robertson
 KARL ROBERTSON
 REGISTERED SURVEYOR BOSSI NUMBER 7835

"SEE SHEET 1 FOR LEGEND & NOTES"

1	FIRST ISSUE	23/08/2024
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BEFORE YOU DIG
 www.byda.com.au
 Zero Damage - Zero Harm

0 1 2 3 4 5
 SCALE 1:100

HORIZONTAL DATUM:
 CO-ORDINATE SYSTEM: MGA 2020 (GROUND)
 MARKS ADOPTED: SSM 163011, 163012 & 163013

VERTICAL DATUM:
 DATUM: AUSTRALIAN HEIGHT DATUM (AHD)
 B.M. ADOPTED: SSM 163012
 R.L. 86.51 (CLASS D)
 SOURCE: S.C.I.M.S. (09/08/2024)

CLIENT:
 THE OWNERS OF No.22, 24, 26 & 28

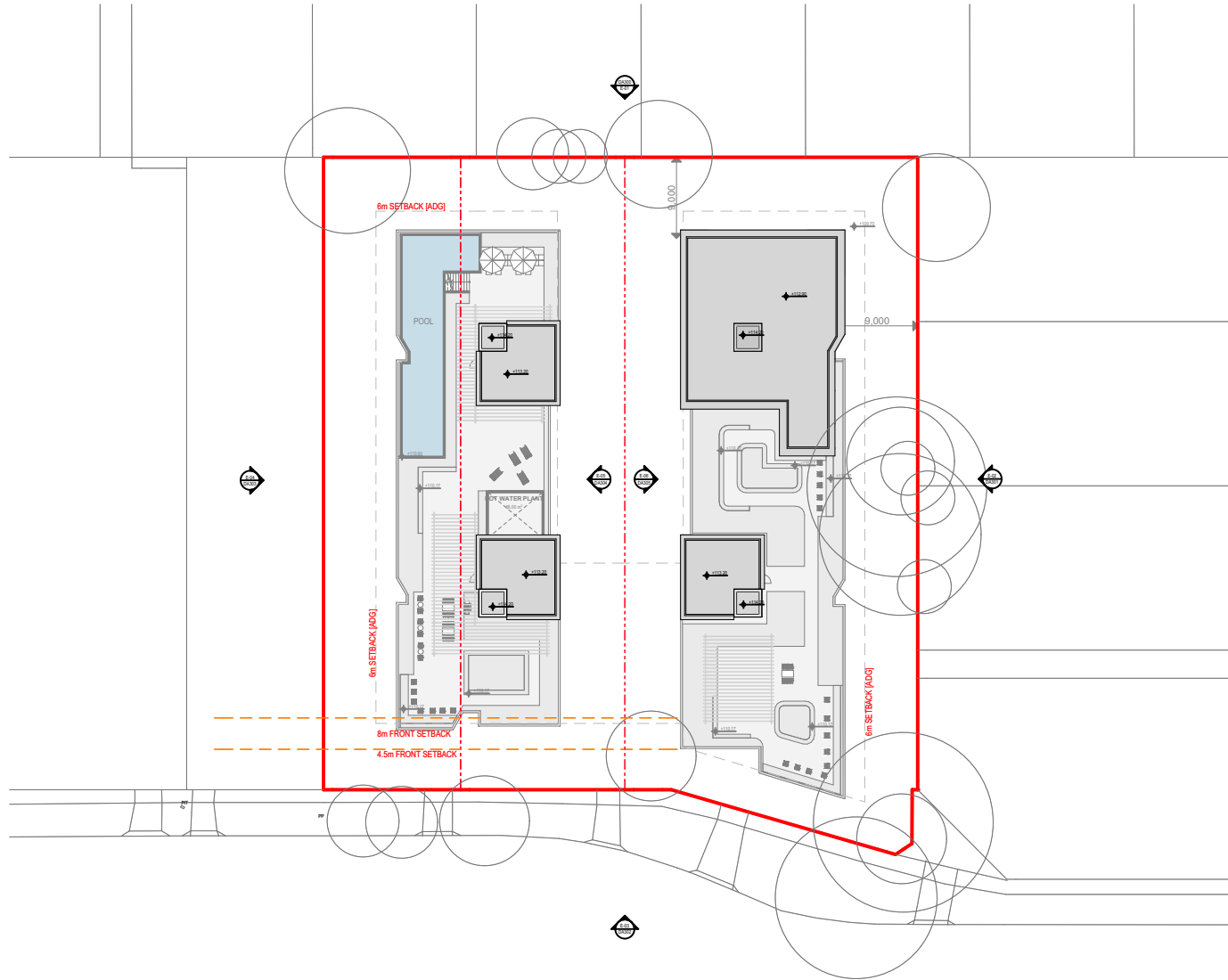
LGA: KU-RING-GAI

BOUNDARY IDENTIFICATION AND DETAIL & LEVEL SURVEY OVER LOT 12, 13, 14 & 16 IN DP5374, LOT 1 IN DP312386, LOT 1 IN DP119944, LOT 768 IN DP 752031 & LOT 1 IN DP1192386 No.22, 24, 26, 28 MIDDLE HARBOUR ROAD LINDFIELD, NSW, 2070

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 2/99A South Creek Road, Dee Why, NSW, 2099
 (02) 9971 4802
 info@cmsurveyors.com.au
 www.cmsurveyors.com.au

SURVEYED LP	DRAWN GP	CHECKED LP	APPROVED BS
SURVEY INSTRUCTION 23693	SCALE 1:100@A1	DATE OF SURVEY 13/08/2024	
DRAWING NAME 23693detail		SHEET 5 OF 5	ISSUE 1
CAD FILE 23693detail 1.dwg			

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Country Darramurragal/ Darug - Australia

Drawing Name
Notification Plan

Drawing Scale

1:750 @ A4

Drawing No.
DA00

Revision
01



01 SOUTH ELEVATION
1:600



02 NORTH ELEVATION
1:600

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Project Address

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24-26 & 28 Middle Harbour Road
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Country

Darramurragal/ Darug - Australia

Drawing Name
Notification Elevation

Drawing Scale

1:600 @ A4

Drawing No.
DA01

Revision

01

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01 EAST ELEVATION
1:600



02 WEST ELEVATION
1:600

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Drawing Name
Notification Elevation

Drawing Scale 1:600 @ A4

Drawing No. Revision

DA02 01

STATE SIGNIFICANT DEVELOPMENT APPLICATION

24-28 MIDDLE HARBOUR ROAD, LINDFIELD, NEW SOUTH WALES, 2070

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	DA507	Adaptable and Livable Apartments	03
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Drawing Name
Cover Page

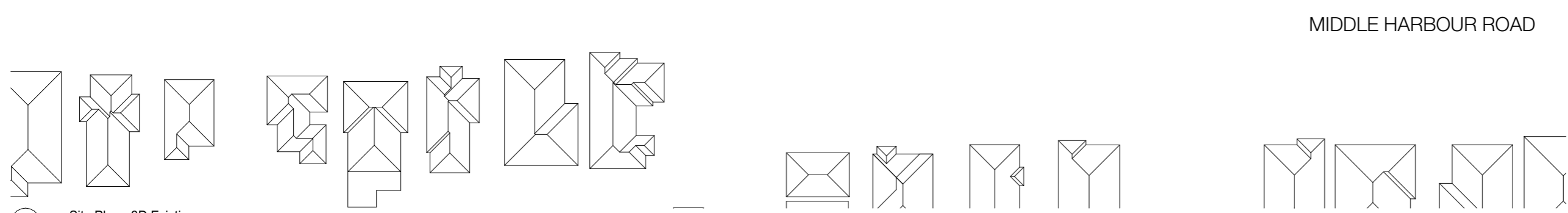
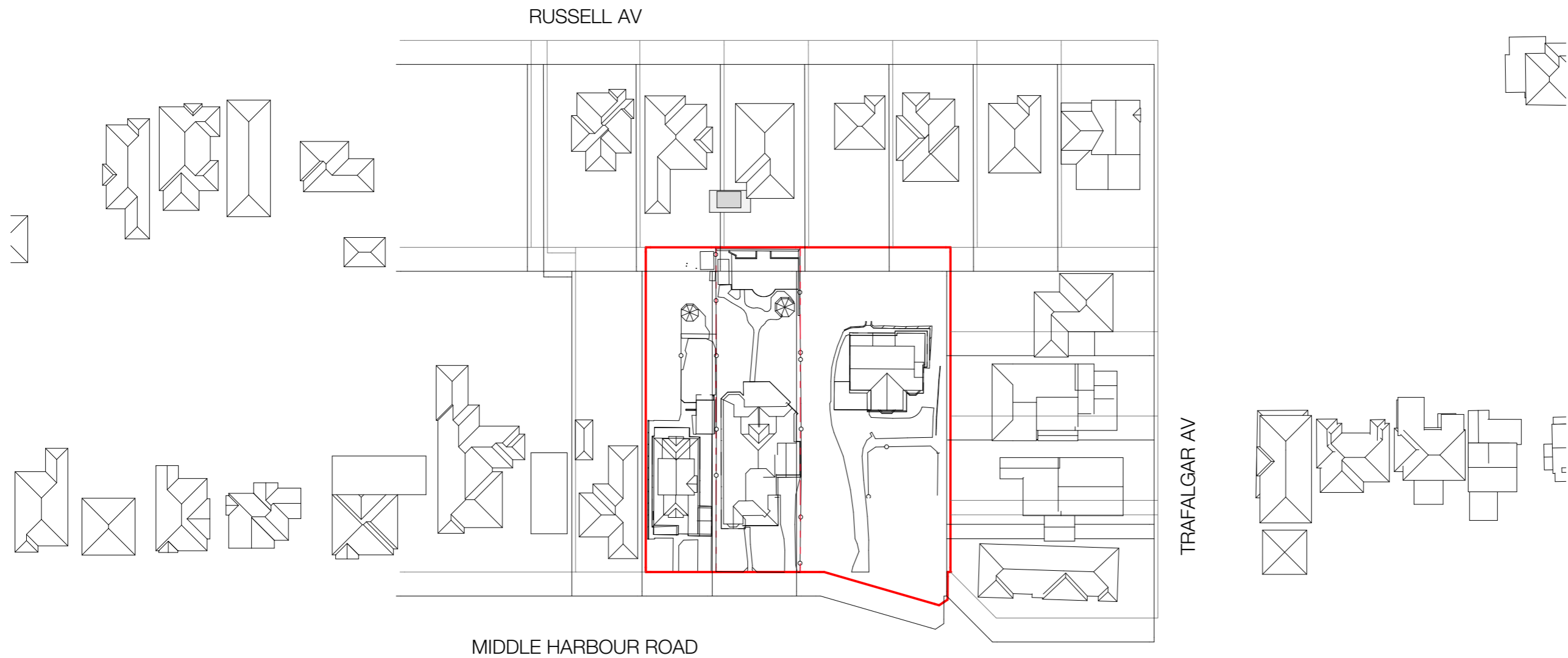
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@ A3
Revision

Drawing No.
DA000

03

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Site Plan - 3D Existing
1:1000



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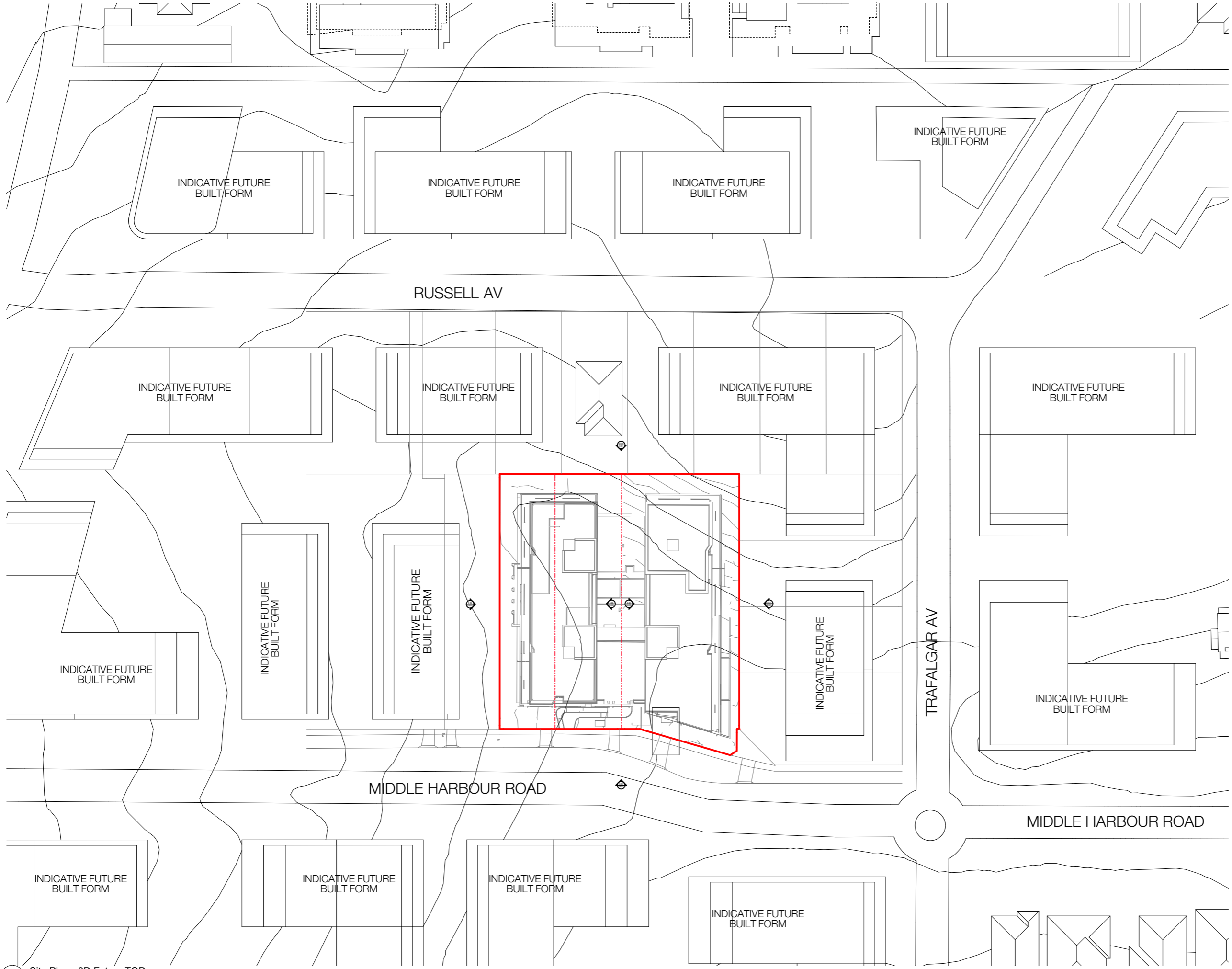
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Drawing Name
Site Plan Existing Context

Drawing Scale 1:1000, 1:1213.57 @ A3
Drawing No. DA101
Revision 03



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Site Plan - 3D Future TOD
1:1000

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Drawing Name
Site Plan Future Context



Drawing Scale 1:1000, 1:1213.57
Drawing No. @ A3
Revision

DA102 03

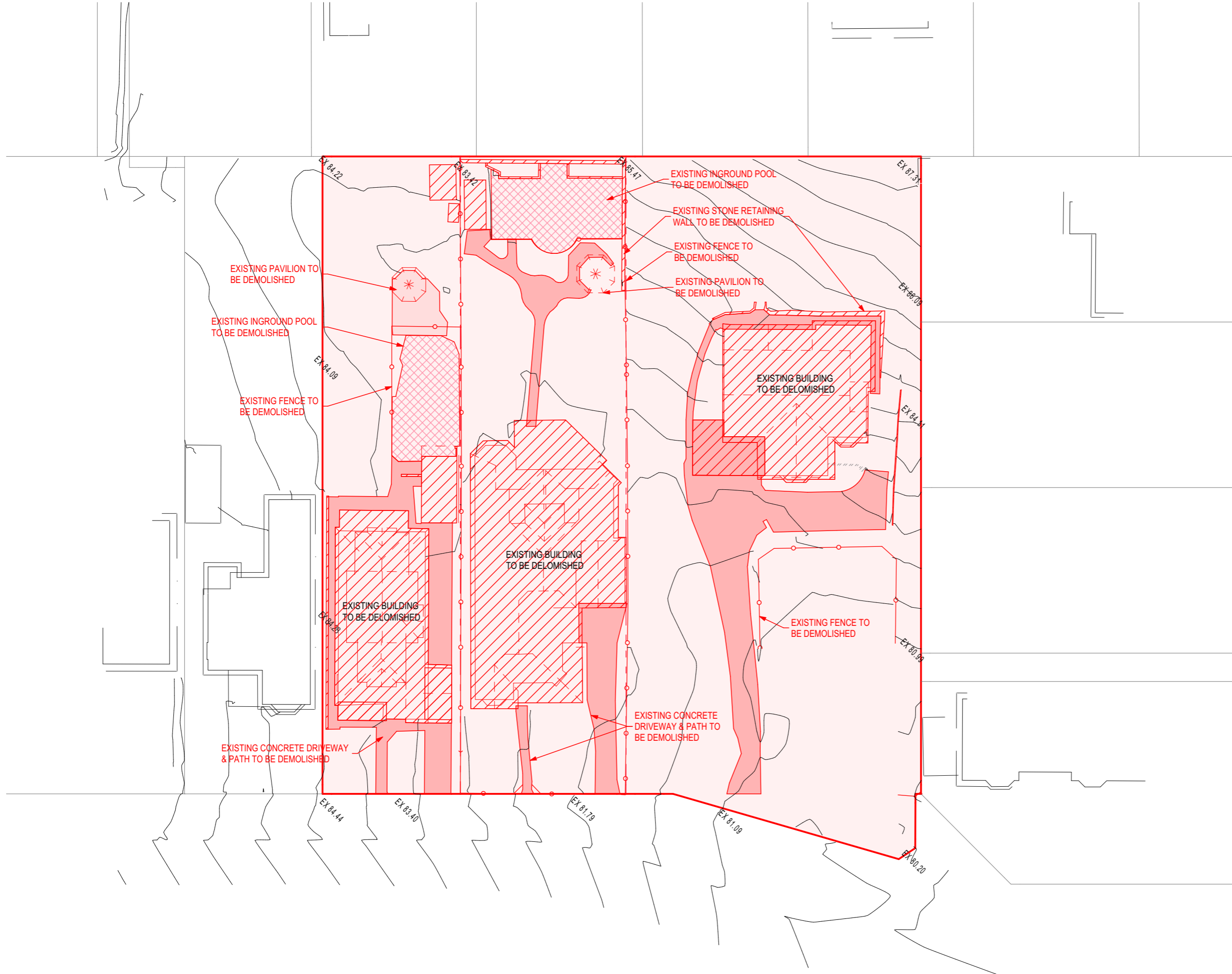
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KEY PLAN

-  AREA TO BE DEMOLISHED
-  EXISTING BUILDING TO BE DEMOLISHED

*REFER TO ARBORIST + LANDSCAPE PLAN FOR TREE RETENTION PLAN GENERALLY



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Drawing Name
Demolition Plan

Drawing Scale
Drawing No.

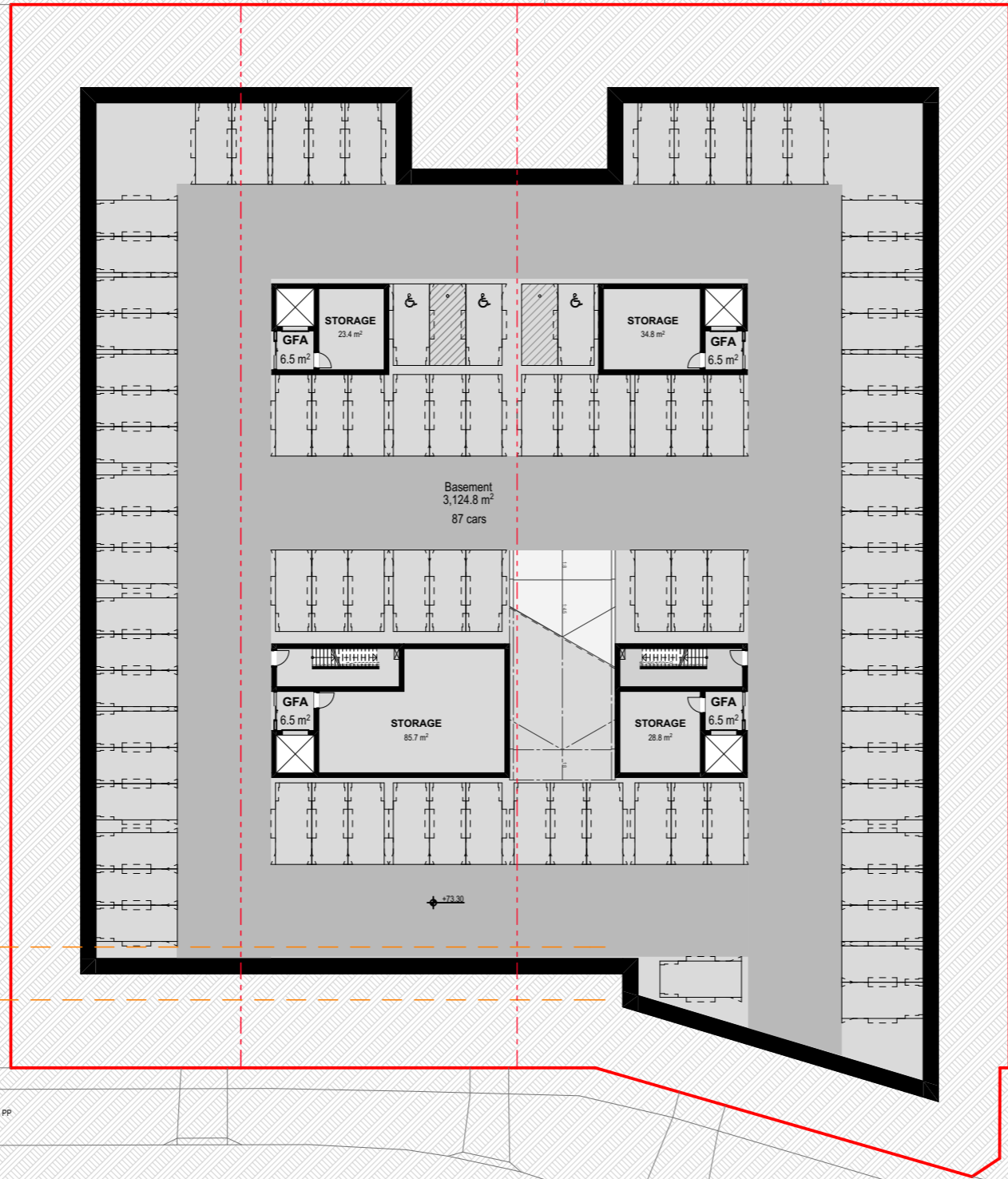
DA103

1:400 @ A3
Revision

03

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Drawing Name
Basement 03

Drawing Scale
Drawing No.
DA200

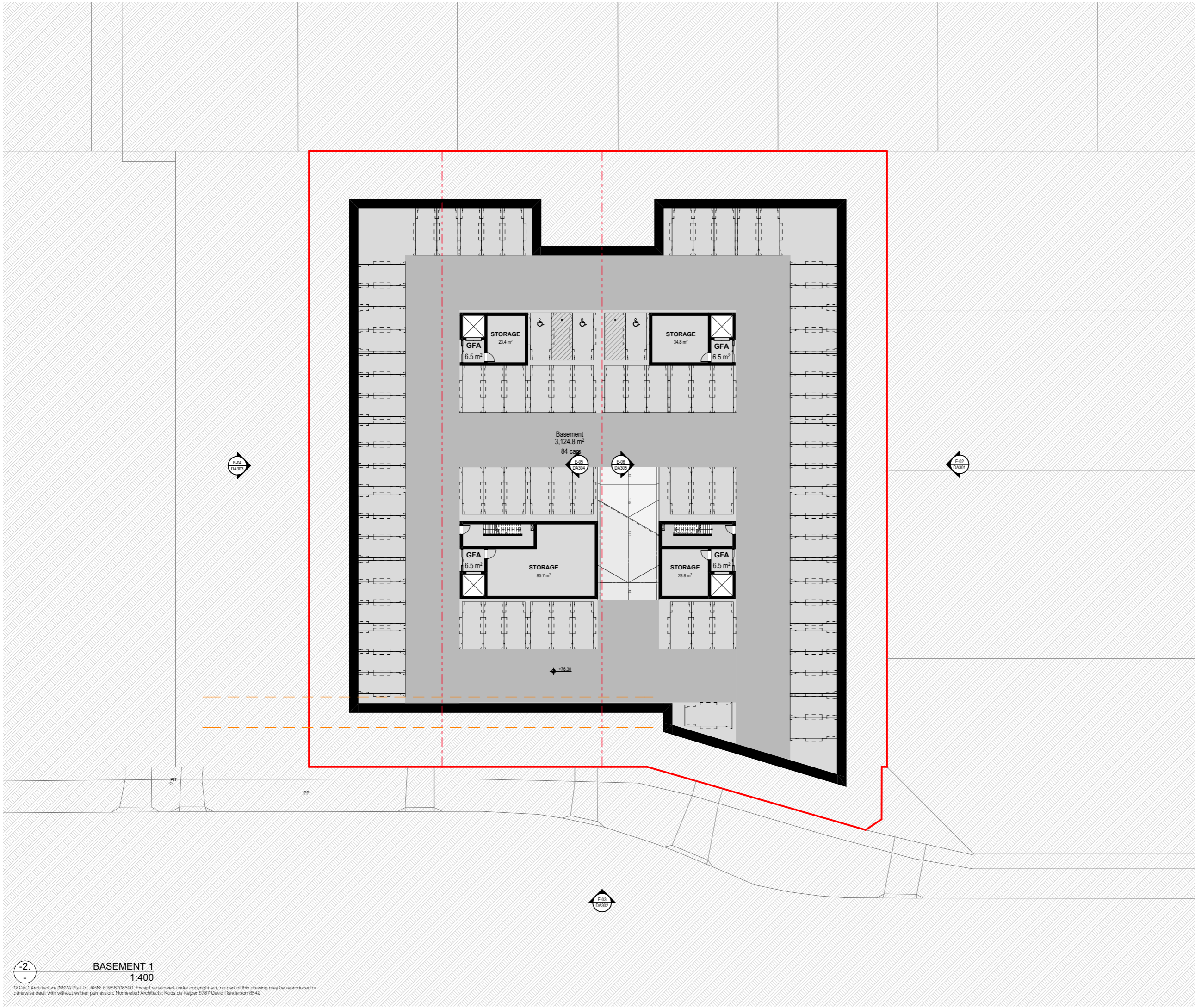
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Revision
03

-3.
-
BASEMENT 2
1:400

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Drawing Name
Basement 02

Drawing Scale

Drawing No.
DA201

1:400 @ A3

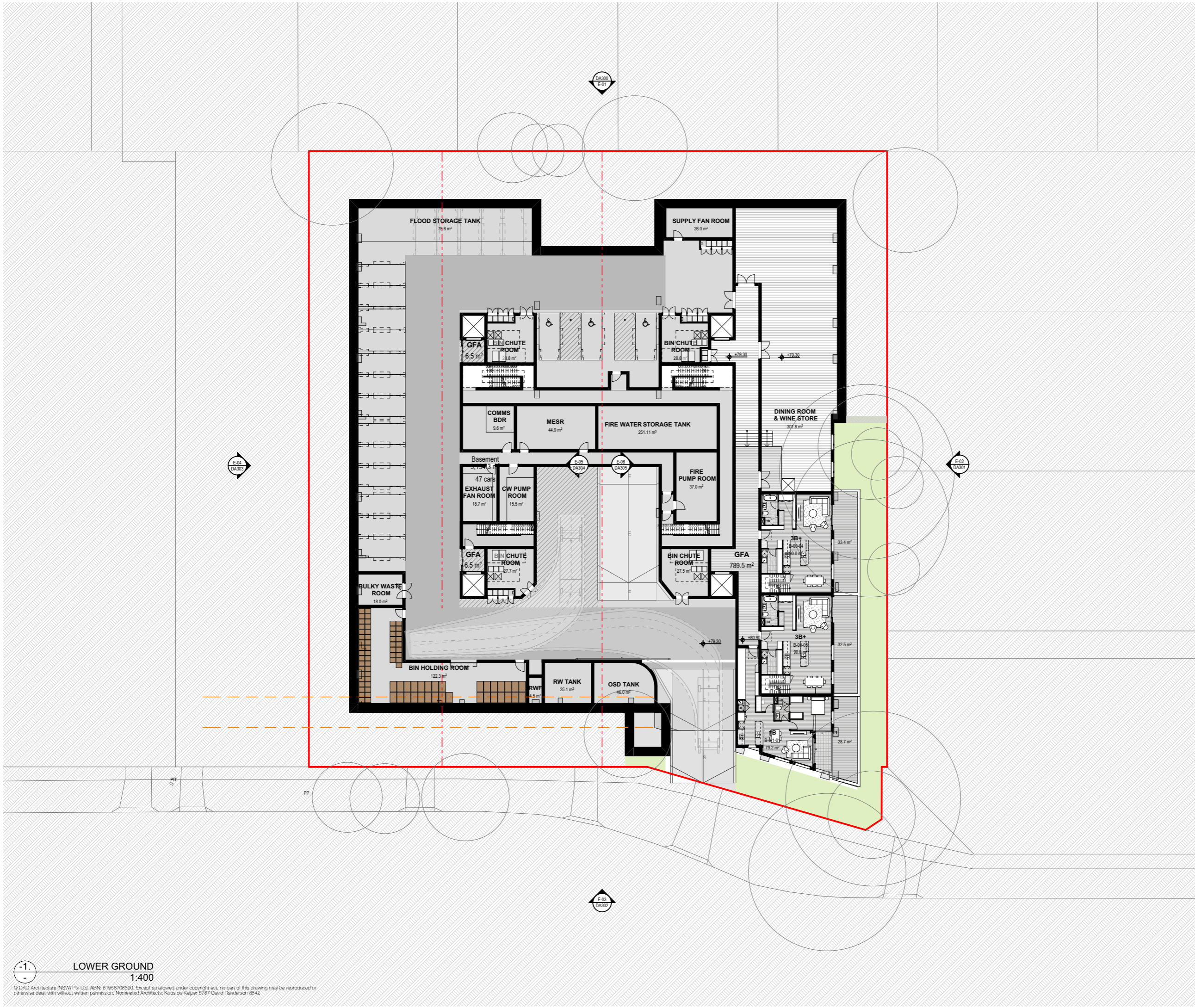
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-2.
-
BASEMENT 1
1:400

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Drawing Name
Lower Ground

Drawing Scale
Drawing No.
DA202

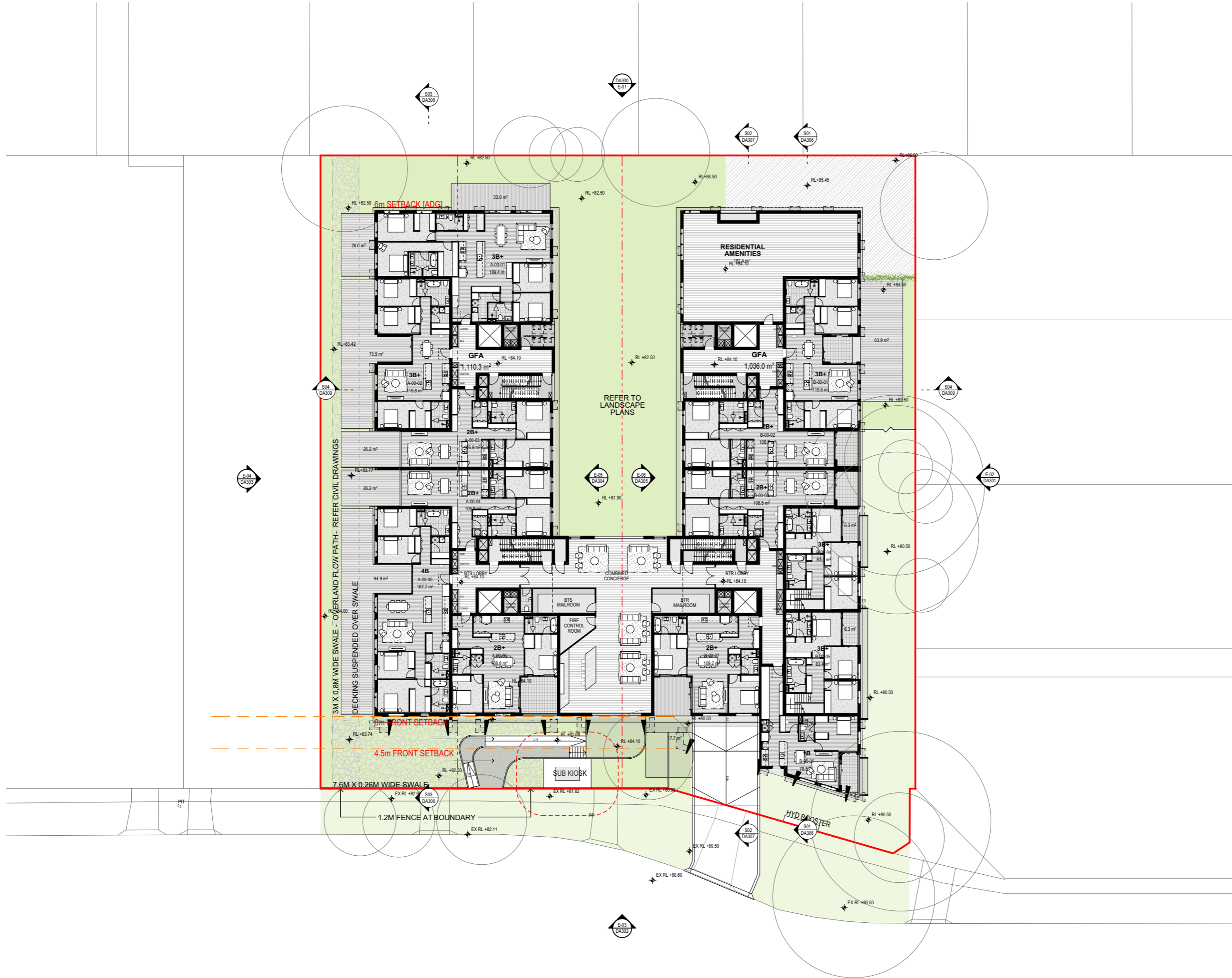
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Revision
03

-1.
LOWER GROUND
1:400

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Drawing Name
Ground

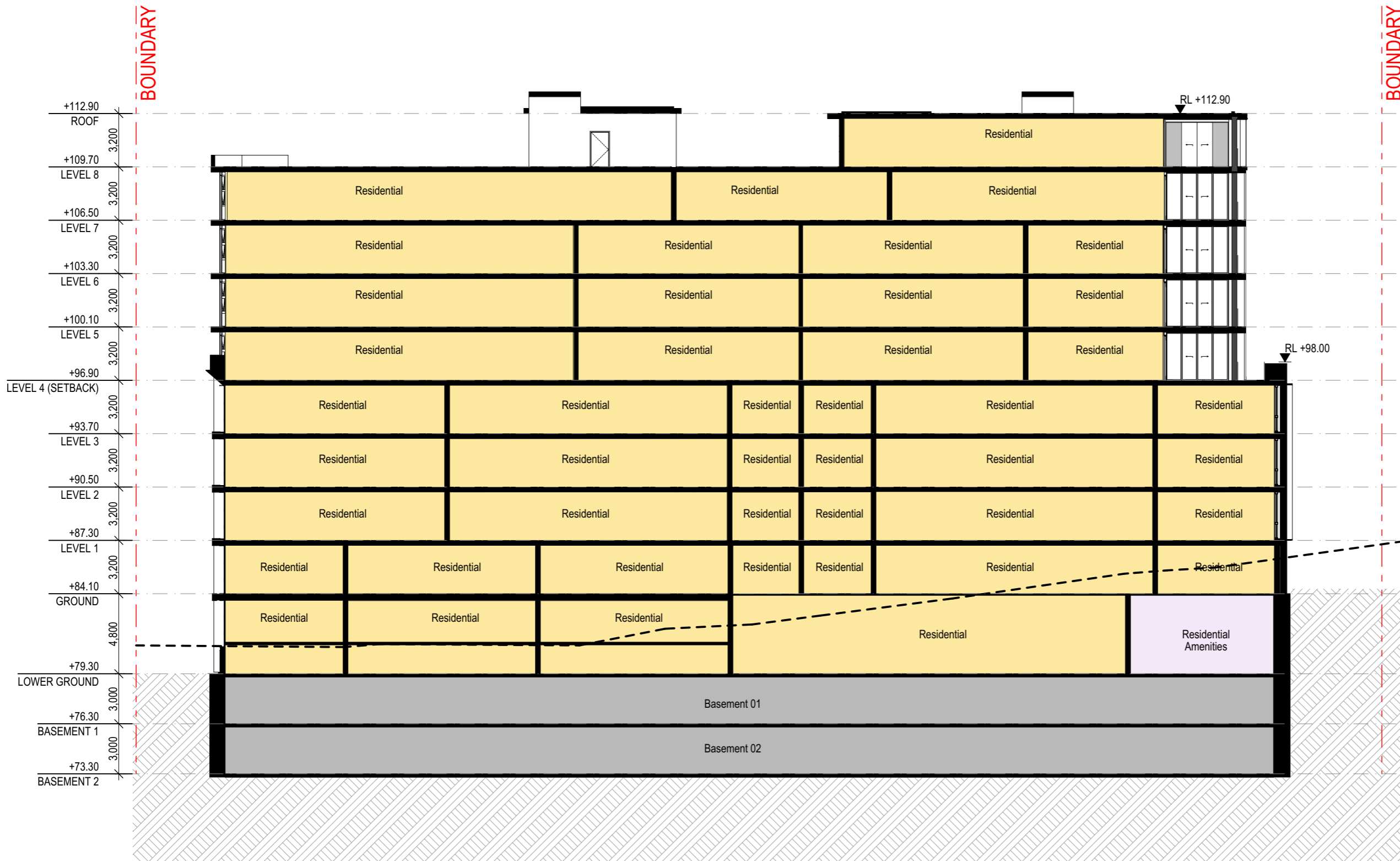
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Drawing No. DA203

Revision 03

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S01 BUILDING B SECTION
1:250

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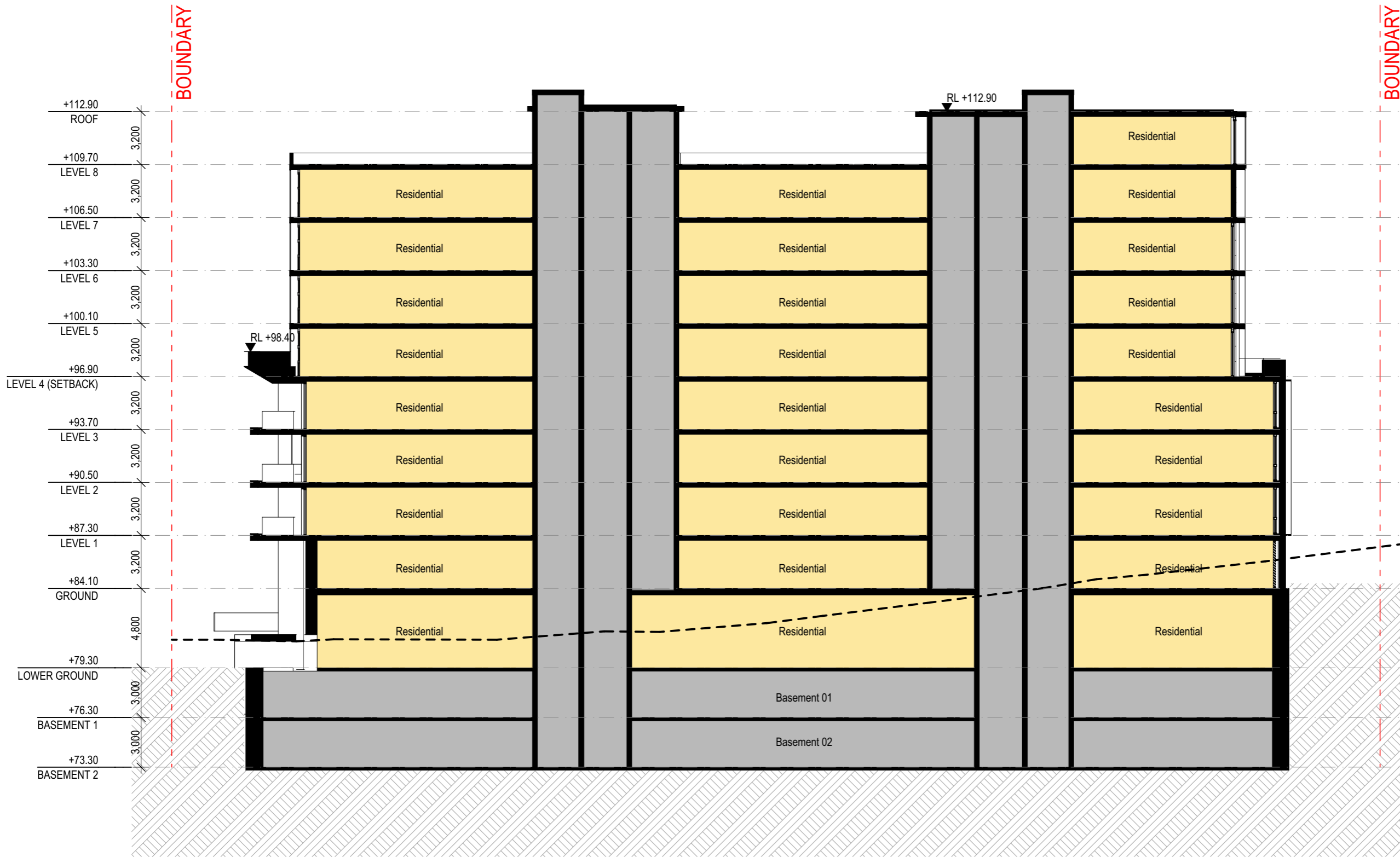
Drawing Name
Building B Section

Drawing Scale
Drawing No.
DA306

1:250 @ A3
Revision
03

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S02 BUILDING B RAMP SECTION
1:250

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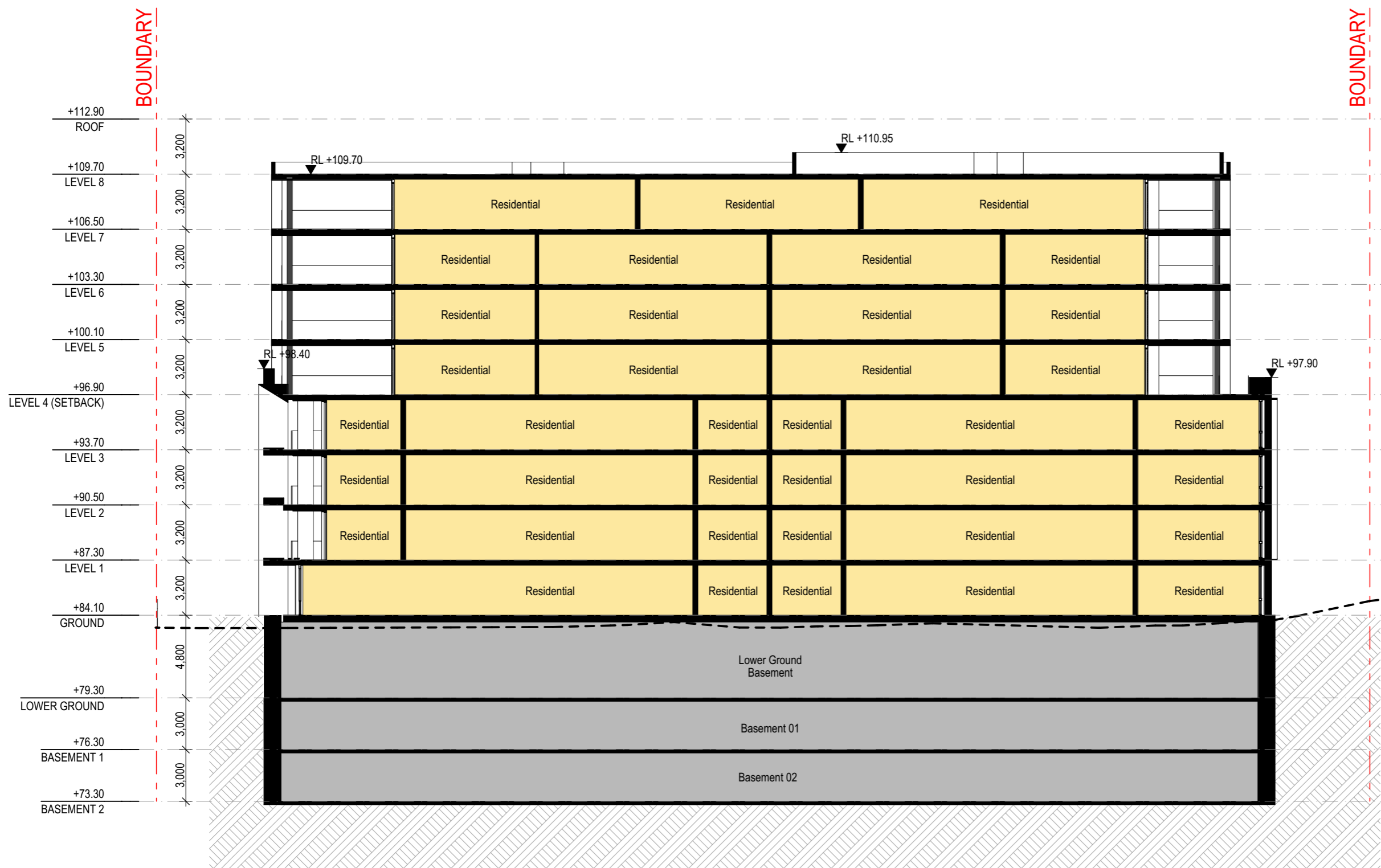
Drawing Name
Building B Ramp Section

Drawing Scale 1:250 @ A3
Drawing No. DA307

Revision
03

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

Rev	Date	By	Chk	Description
02	24/04/2025	LB DN HN		For Coordination
03	2/05/2025	LB DN HN		Draft DA Set



S03 BUILDING A SECTION
1:250

PRELIMINARY



Auckland
Brisbane
Ho Chi Minh
Melbourne
Perth
Sydney

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T +61 2 8346 4500

Project Name Middle Harbour Road, Lindfield
Project Number 13844
Project Address 24-26 & 28 Middle Harbour Road
Sydney NSW 2070

Country Darramurragal/ Darug - Australia

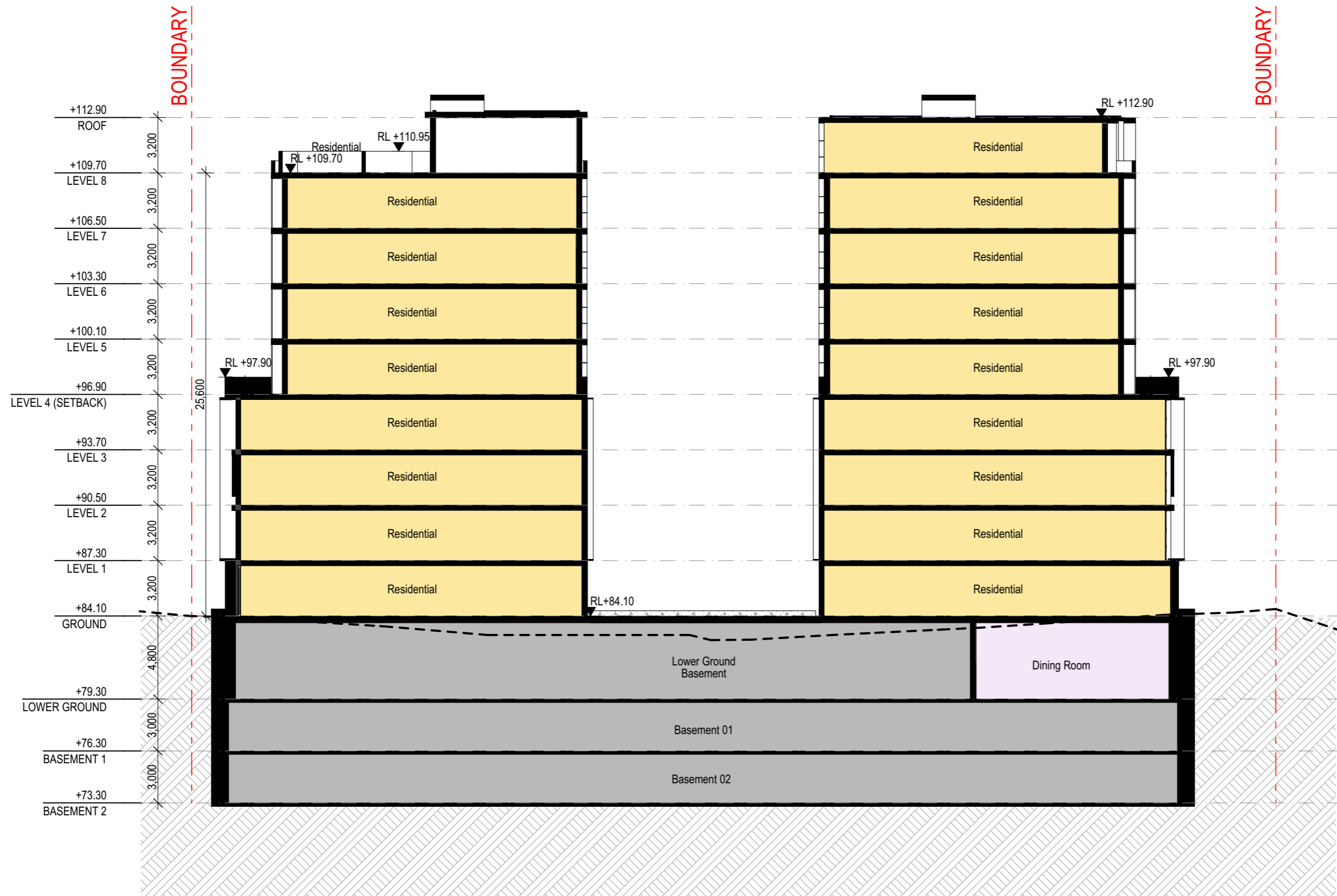
Drawing Name
Building A Section

Drawing Scale
Drawing No.
DA308

1:250 @ A3
Revision
03

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

Rev	Date	By	Chk	Description
02	24/04/2025	LB DN HN		For Coordination
03	2/05/2025	LB DN HN		Draft DA Set



S04 BUILDING SECTION LOOKING NORTH
1:250

PRELIMINARY

Auckland
Brisbane
Ho Chi Minh
Melbourne
Perth
Sydney



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Project Name Middle Harbour Road, Lindfield
Project Number 13844
Project Address 24-26 & 28 Middle Harbour Road
Sydney NSW 2070

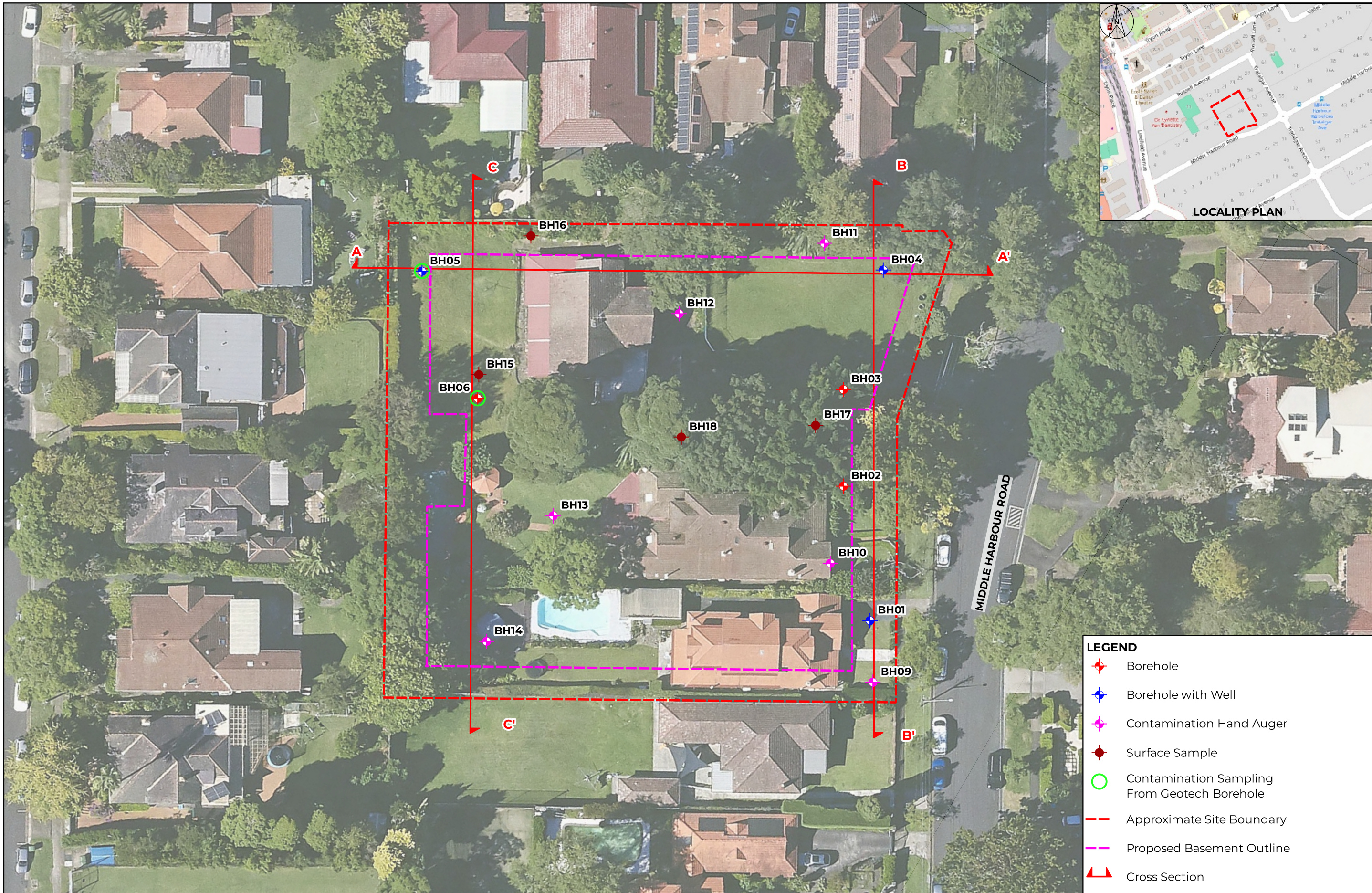
Country Darramurragal/ Darug - Australia

Drawing Name
Building Section Looking North

Drawing Scale 1:250 @ A3
Drawing No. DA309
Revision 03

Appendix C

Investigation Drawings and Borehole Logs Site



LEGEND

- Borehole
- Borehole with Well
- Contamination Hand Auger
- Surface Sample
- Contamination Sampling From Geotech Borehole
- Approximate Site Boundary
- Proposed Basement Outline
- Cross Section

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	30.04.2025	MN/EC

SCALE: 1:500 @ A3

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

CLIENT:
The Trustee for MHR LINDFIELD TRUST

NOTE:
 1: Basemap from Metromap (Dated 13.03.2025)
 2: Proposed basement outline from DKO, Drawing No.DA201, Revision 02 (Dated 24.04.2025)

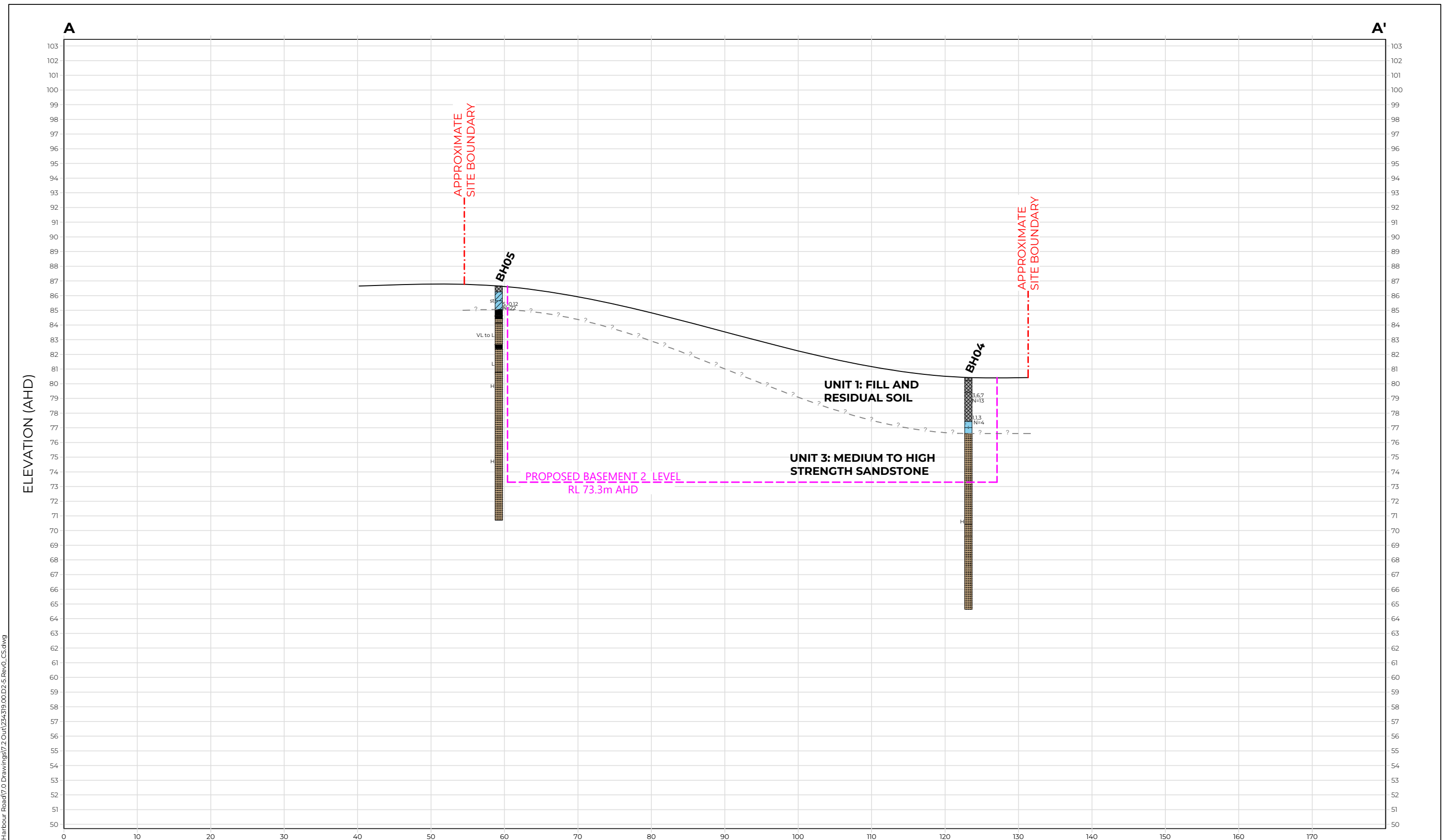
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Proposed Residential Development
 PROJECT ADDRESS:
28 Middle Harbour Road, Lindfield

DRAWING TITLE:
Test Location Plan

PROJECT NO:
234319.00
 DRAWING NO:
1
 REVISION:
0

\\dps\hna02\Projects\234319.00 - LINDFIELD, 28 Middle Harbour Road\7.0 Drawings\7.3 QC\15\234319.00.qgz



LEGEND

	CLAY		FILL
	SANDY CLAY		SANDSTONE
	NO CORE		

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

DISTANCE ALONG PROFILE (m)

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

SOIL CONSISTENCY
 vs - Very Soft
 s - Soft
 f - Firm
 st - Stiff
 vst - Very Stiff
 h - Hard

SOIL DENSITY
 vl - Very Loose
 l - Loose
 md - Medium Dense
 d - Dense
 vd - Very Dense

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	30.04.2025	MN

SCALE:
 Horizontal Scale 1:500
 Vertical Exaggeration = 2.0

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

CLIENT:
 The Trustee for MHR
 LINDFIELD TRUST

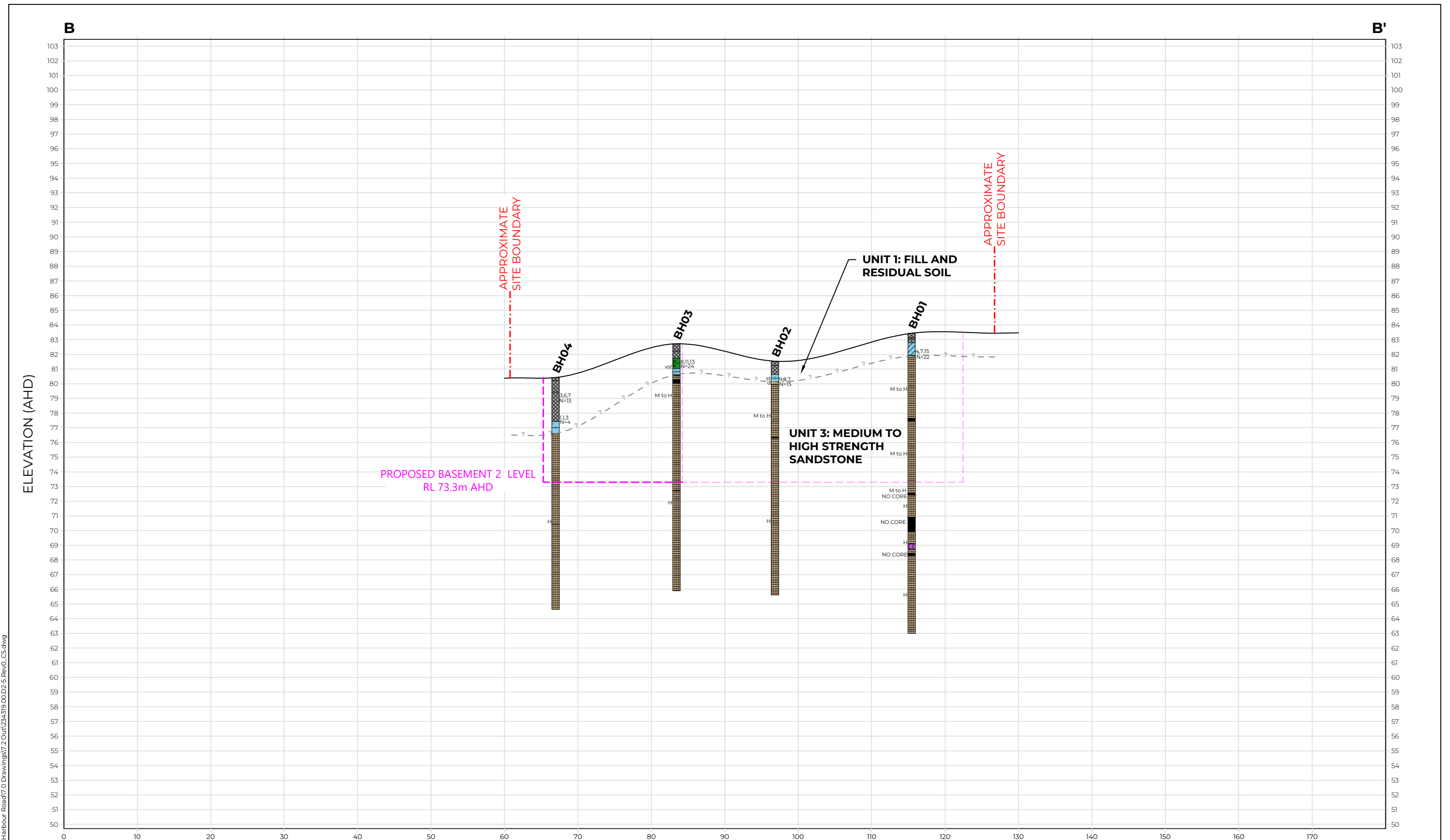
NOTES
 1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
 2. Summary logs only and should be read in conjunction with detailed logs.
 3. Horizontal and vertical scales are not equal.
 4. Basement levels from DKO, Drawing No. DA307, Revision 02 (Dated 24.04.2025)

PROJECT NAME:
 Proposed Residential
 Development
PROJECT ADDRESS:
 28 Middle Harbour Road,
 Lindfield

DRAWING TITLE:
 Geological Cross Section
 A-A'

PROJECT No:	234319.00
DRAWING No:	2
REVISION:	0

\\pspsnas02\Project\23431900 - LINDFIELD, 28 Middle Harbour Road\7.0 Drawing\7.2 Out\234319.00.D2.5.Rev0_Cs.dwg



LEGEND

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

DISTANCE ALONG PROFILE (m)

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

SOIL CONSISTENCY
 vs - Very Soft
 s - Soft
 f - Firm
 st - Stiff
 vst - Very Stiff
 h - Hard

SOIL DENSITY
 vl - Very Loose
 l - Loose
 md - Medium Dense
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REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	30.04.2025	MN

SCALE:
 Horizontal Scale 1:500
 Vertical Exaggeration = 2.0

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

CLIENT:
The Trustee for MHR LINDFIELD TRUST

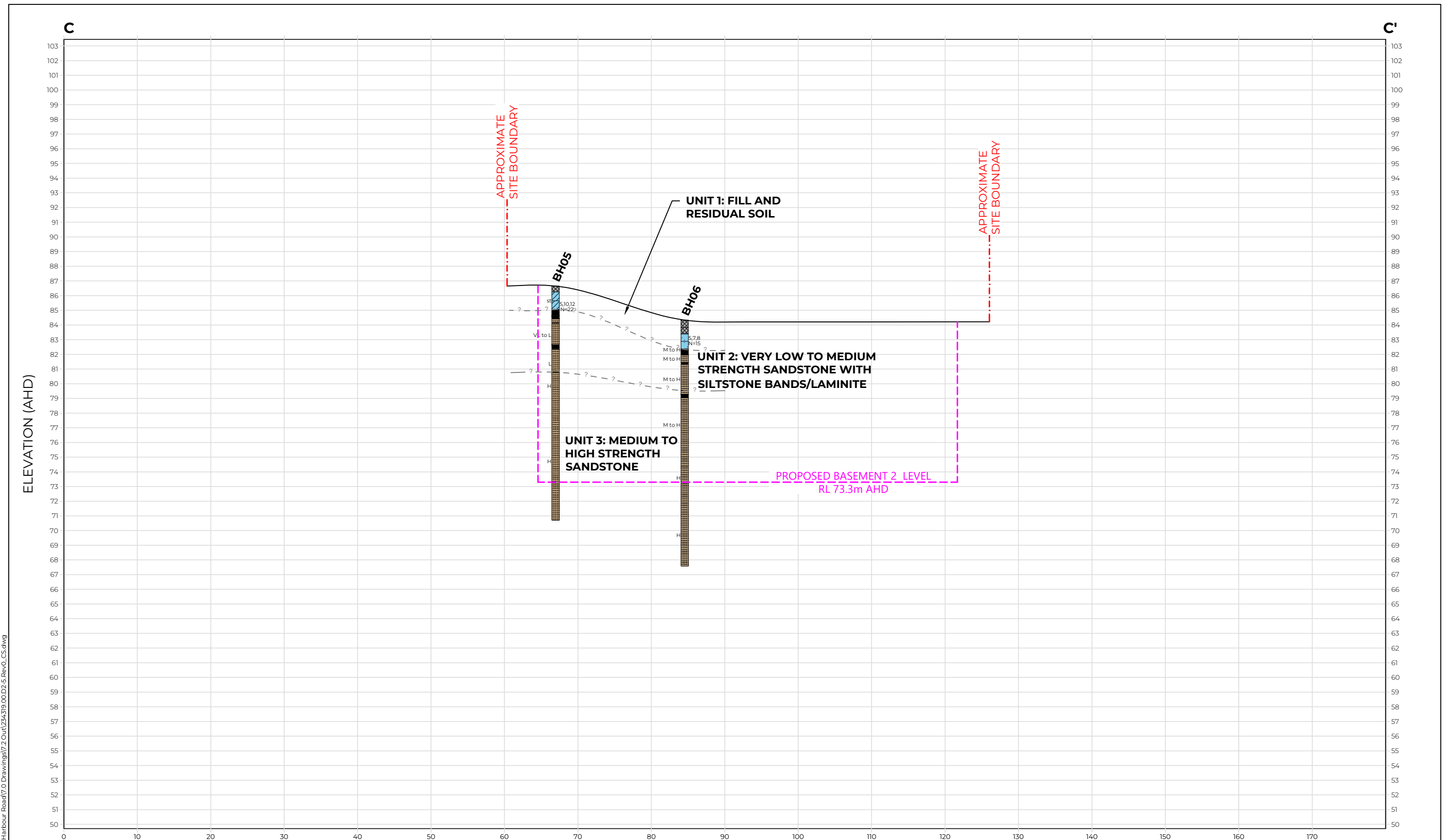
NOTES
 1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
 2. Summary logs only and should be read in conjunction with detailed logs.
 3. Horizontal and vertical scales are not equal.
 4. Basement levels from DKO, Drawing No. DA307, Revision 02 (Dated 24.04.2025)

PROJECT NAME:
Proposed Residential Development
 PROJECT ADDRESS:
28 Middle Harbour Road, Lindfield

DRAWING TITLE:
Geological Cross Section B-B'

PROJECT No:	234319.00
DRAWING No:	3
REVISION:	0

\\pspsnas02\Project\23431900 - LINDFIELD, 28 Middle Harbour Road\7.0 Drawing\7.2 Out\234319_00.D2.5_Rev0_Cs.dwg



LEGEND

	CLAY		FILL
	Sandy CLAY		SANDSTONE
	NO CORE		

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

DISTANCE ALONG PROFILE (m)

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

SOIL CONSISTENCY
 vs - Very Soft
 s - Soft
 f - Firm
 vst - Very Stiff
 h - Hard

SOIL DENSITY
 vl - Very Loose
 l - Loose
 md - Medium Dense
 d - Dense
 vd - Very Dense

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	30.04.2025	MN

SCALE:
 Horizontal Scale 1:500
 Vertical Exaggeration = 2.0

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

CLIENT:
The Trustee for MHR LINDFIELD 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.
 3. Horizontal and vertical scales are not equal.
 4. Basement levels from DKO, Drawing No. DA307, Revision 02 (Dated 24.04.2025)

PROJECT NAME:
Proposed Residential Development
 PROJECT ADDRESS:
28 Middle Harbour Road, Lindfield

DRAWING TITLE:
Geological Cross Section C-C'

PROJECT No:	234319.00
DRAWING No:	4
REVISION:	0

\\pspsnas02\Project\23431900 - LINDFIELD, 28 Middle Harbour Road\7.0 Drawing\7.2 Out\234319.00.D2.5.Rev0_Cs.dwg

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 83.4 AHD
COORDINATE: E:330746.2, N:6261069.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 234319.00
DATE: 25/03/25
SHEET: 1 of 4

CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS									
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%)	DENSITY. (g)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS			BACKFILL	WELL PIPE
													5	10	15		
25/03/25 no free ground water observed	0.30	FILL / Sandy SILT: dark brown; fine to medium sand; with rootlets.		FILL TOP	PC							<p>SPT 4,7,15 N=22</p>					
	0.40	FILL / Sandy CLAY: mid brown, red, and orange; fine to medium sand; with rootlets.		FILL	MC												
	0.65	FILL / Sandy CLAY: mid brown, red, yellow; fine sand.		FILL													
	1.00	CLAY trace sand trace gravel: mottled red, white, and orange; medium plasticity; fine sand; fine, sub-angular, ironstone gravel.		RS	St	M											
	1.55	SAND with clay with gravel: pale orange; coarse; coarse, rounded (up to 5mm), sandstone gravel.															
	2.00																
	3.00																
	4.00																
	5.00																
	6.00																
	7.00																
	8.00																
	9.00																
	9.60																

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: DT-250 **OPERATOR:** Ground Test (S Salib) **LOGGED:** CLB
METHOD: HA to 0.65m, AD to 1.5m, WB to 1.8m, then NMLC to 20.44m **CASING:** HW to 1.5m, then HQ to 1.8m
REMARKS: Hole reamed to 96mm diameter after coring for well installation.

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 83.4 AHD
COORDINATE: E:330746.2, N:6261069.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 234319.00
DATE: 25/03/25
SHEET: 2 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
25/03/25 no free ground water observed	83													1				
	82													2	PLT	PL(A)=0.14MPa		
	81	Continued from soil log SANDSTONE: pale grey, pale red, pale orange, medium grained; indistinctly and distinctly bedded, 0 to 30 degrees, very thinly bedded to thickly bedded, minor carbonaceous flecks and laminations. Hawkesbury Sandstone.			1.79		100	93		179-1.83m: EW 4mm 190m: B, 20°, PR, SN Fe, RF 205m: B, 0°, IR, CN, RF, root matter 222m: B, 0°, IR, TI, RF 237m: B, 20°, UN, SN Fe, RF				3	PLT	PL(A)=1.0MPa		
	80									288-2.90m: EW 20mm 3.12m: B, 20°, UN, SN Fe, RF				4	PLT	PL(A)=0.42MPa		
	79									3.60-3.84m: JT, 80°, UN, VNR Clay, RF 4.03m: B, 0°, IR, INF Clay, RF 4.05-4.07m: B x2, 0-20°, UN, CN, RF 4.39m: B, 20°, PR, SN Fe, RF 4.55-4.67m: B x2, 0-20°, PR, CN, RF				5	PLT	PL(A)=0.96MPa		
	78									5.61m: B, 20°, IR, VNR Clay, RF				6	PLT	PL(A)=1.0MPa		
	5.80				5.80					5.76-6.21m: B x4, 0°, IR, CN, RF 6.02m: JT, 0-10°, CN, possible drill break? 6.41-6.41m: JT, 0-10°, UN, TI				7	PLT	PL(A)=2.2MPa		
	6.00				6.00					6.66m: JT, 0°, IR, TI Clay				8	PLT	PL(A)=2.3MPa		
	77									6.31-8.21m: B x18, 20°, PR, CN, RF, some with SNFe				9	PLT	PL(A)=0.32MPa		
	76									8.26m: B, 0°, IR, TI Clay, RF								
	75	From 8.30m: pale grey			8.30		100	70		8.63m: B, 20°, IR, CN, RF 8.88m: B, 20°, PR, VNR Clay, RF								
	74	9.87m-14.67m: highly fractured								8.89-9.42m: B x3, 20°, PR, CN, RF 9.43-9.49m: JT x2, 40°, PR, VNR Clay, RF 9.54-9.80m: B x2, 20°, PR, CN, RF 9.81-9.89m: JT, 40°, PR, VNR Clay, RF								

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250 **OPERATOR:** Ground Test (S Salib) **LOGGED:** CLB
METHOD: HA to 0.65m, AD to 1.5m, WB to 1.8m, then NMLC to 20.44m **CASING:** HW to 1.5m, then HQ to 1.8m
REMARKS: Hole reamed to 96mm diameter after coring for well installation.



Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 83.4 AHD
COORDINATE: E:330746.2, N:6261069.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 234319.00
DATE: 25/03/25
SHEET: 3 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	9.99	SANDSTONE: pale grey, pale red, pale orange, medium grained; indistinctly and distinctly bedded, 0 to 30 degrees, very thinly bedded to thickly bedded, minor carbonaceous flecks and laminations. Hawkesbury Sandstone.	[Pattern]	SW	10.40	[Symbol]	90	66	[Diagram]	10.05m: B, 20°, PR, CN, RF 10.06-10.09m: JT, 40°, PR, VNR Clay, RF 10.09-10.21m: B x4, 20°, PR, CN, RF 10.40-10.75m: EW, Clay 250mm			11	PLT	PL(A)=0.47MPa	[Pattern]	[Symbol]	
	10.90			XW	10.75													FR
	11.03	10.40m-10.75m: extremely weathered. possible dolerite dyke	[Pattern]	FR	11.03	[Symbol]	74	19	[Diagram]	11.66-11.86m: B x8, 20°, PR, CN, RF 11.87-11.91m: JT, 40°, IR, CN, RF 12.10-12.50m: JT, 80°, IR, VNR Clay, RF, fragmented core			12	PLT	PL(A)=2.0MPa	[Pattern]	[Symbol]	
	12			FR	12.51													
	12.51	WEATHERED DOLERITE: pale grey; Extremely weathered clay, inferred dyke.	[Pattern]	FR	12.90	[Symbol]	75	0	[Diagram]	13.50-13.70m: FG, fragmented from surrounding joints 13.50-14.70m: JT, 80°, IR, VNR Clay, RF, fragmented core			13	PLT	PL(A)=0.87MPa	[Pattern]	[Symbol]	
	13			FR	13.50													
	13.50	SANDSTONE: pale grey, medium grained; indistinctly and distinctly bedded, 0 to 30 degrees, very thinly bedded to thickly bedded. Hawkesbury Sandstone.	[Pattern]	FR	14.35	[Symbol]	91	0	[Diagram]	14.35-14.70m: EW, Clay 450mm 14.80-14.70m: JT, 70°, IR, VNR Clay, RF 14.72m: B x2, 0°, PR, VNR Clay, RF			14	PLT	PL(A)=0.47MPa	[Pattern]	[Symbol]	
	14			FR	14.70													
	14.35	SANDSTONE: pale grey, medium grained; indistinctly and distinctly bedded, 0 to 30 degrees, very thinly bedded to thickly bedded. Hawkesbury Sandstone.	[Pattern]	FR	15.00	[Symbol]	100	73	[Diagram]	15.28-15.34m: B x3, 0-20°, PR, CN, RF 15.50-15.58m: B x2, 0-20°, IR, VNR Clay, RF 15.34-16.00m: JT, 80°, IR, CN, RF, fragmented core 15.70-16.55m: B x8, 0-20°, PR, CN, RF			15	PLT	PL(A)=1.0MPa	[Pattern]	[Symbol]	
	15			FR	15.17													
	15.00	From 19.10m: frequent carbonaceous laminations and clasts	[Pattern]	FR	16.65	[Symbol]	100	76	[Diagram]	16.65-16.80m: JT, 80°, PR, HE Py, fragmented core 16.82-16.87m: JT, 80°, UN, CN, RF 16.89-17.08m: B x4, 20°, PR, CN, RF 17.08-17.13m: JT, 40°, IR, CN, RF, fragmented core 17.37-17.63m: B x3, 0°, PR, CN, RF			16	PLT	PL(A)=1.5MPa	[Pattern]	[Symbol]	
	16			FR	16.88													
	15.17	From 19.10m: frequent carbonaceous laminations and clasts	[Pattern]	FR	17.93	[Symbol]	100	76	[Diagram]	17.93m: B, PR, CT Clay, RF 18.10m: B, 0°, IR, CN, RF, drill break?			17	PLT	PL(A)=2.0MPa	[Pattern]	[Symbol]	
	17			FR	17.93													
	16.88	From 19.10m: frequent carbonaceous laminations and clasts	[Pattern]	FR	19.10	[Symbol]	100	76	[Diagram]	19.10m: JT, 80°, IR, CN, RF 19.20-19.40m: B x2, 0°, IR, VNR CBS, RF 19.45-19.55m: JT, 80°, IR, CN, RF 19.51m: B, 0°, PR, CN, RF 19.64m: B, 0°, UN, VNR CBS, RF			18	PLT	PL(A)=2.9MPa	[Pattern]	[Symbol]	
	18			FR	19.10													
	17.93	From 19.10m: frequent carbonaceous laminations and clasts	[Pattern]	FR	19.10	[Symbol]	100	76	[Diagram]	19.10m: JT, 80°, IR, CN, RF 19.20-19.40m: B x2, 0°, IR, VNR CBS, RF 19.45-19.55m: JT, 80°, IR, CN, RF 19.51m: B, 0°, PR, CN, RF 19.64m: B, 0°, UN, VNR CBS, RF			19	PLT	PL(A)=2.9MPa	[Pattern]	[Symbol]	
	19			FR	19.10													

NOTES: *Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: HA to 0.65m, AD to 1.5m, WB to 1.8m, then NMLC to 20.44m
REMARKS: Hole reamed to 96mm diameter after coring for well installation.

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HW to 1.5m, then HQ to 1.8m

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 83.4 AHD
COORDINATE: E:330746.2, N:6261069.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 234319.00
DATE: 25/03/25
SHEET: 4 of 4

CONDITIONS ENCOUNTERED											SAMPLE			TESTING						
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE	
																				FR
	63				FR		H	100	76	---	19.66-19.91m: JT, 80°, IR, 0.00-20.22m: Bx4, 0°, UN, VNR CBS, RF					PLT	PL(A)=1.4MPa	Sand		
		21	Borehole discontinued at 20.44m depth. Target depth reached.																	
		62																		
		22																		
		61																		
		23																		
		60																		
		24																		
		59																		
		25																		
		58																		
		26																		
		57																		
		27																		
		56																		
		28																		
		55																		
		29																		
		54																		

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250 **OPERATOR:** Ground Test (S Salib) **LOGGED:** CLB
METHOD: HA to 0.65m, AD to 1.5m, WB to 1.8m, then NMLC to 20.44m **CASING:** HW to 1.5m, then HQ to 1.8m
REMARKS: Hole reamed to 96mm diameter after coring for well installation.

Refer to explanatory notes for symbol and abbreviation definitions



CORE PHOTO LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 83.4 AHD
COORDINATE: E:330746.2, N:6261069.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 234319.00
DATE: 25/03/25
SHEET: 1 of 1



Generated with CORE-GS by Geric - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 81.5 AHD
COORDINATE: E:330760.5, N:6261081.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 234319.00
DATE: 24/03/25
SHEET: 1 of 3

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS			
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
24/03/25, no free ground water observed	0.30	FILL / Sandy SILT trace gravel: dark brown; fine to coarse sand; (up to 3mm), ironstone gravel; with rootlets.	FILL TOP	FILL	MC to WC	M				0.30		5
	0.90	FILL / Sandy CLAY trace gravel: dark brown, yellow brown; fine sand; ironstone gravel; with rootlets.	FILL							0.90		10
	1.40	Sandy CLAY: orange; medium sand.		RS	St	D				1.40		15
	1.55	Clayey SAND: pale yellow; coarse; probable weathered bedrock material.		RS	D					1.55	SPT	9,8,7 N=15
	2	Continued as rock log								2		refusal 25

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: DT-250
METHOD: HA to 0.3m, AD 0.4-1.5m, then NMLC to 15.92m
REMARKS:

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HQ to 1.45m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 81.5 AHD
COORDINATE: E:330760.5, N:6261081.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 234319.00
DATE: 24/03/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRAC. SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
24/03/25, no free ground water observed	81																	
	1																	
	2	Continued from soil log SANDSTONE: pale grey, pale orange and red, medium grained; distinctly bedded 0-30°, very thinly bedded to thickly bedded, slightly fractured along bedding planes. Hawkesbury Sandstone.	MW		1.55		100	93		159m: B, 20°, IR, SN Fe, RF 164m: IS, 0°, IR, Clay, VN 180m: B, 20°, PR, SN Fe, RF				2	PLT	PL(A)=0.87MPa		
	3									242m: B, 0°, PR, SN Fe, RF				3	PLT	PL(A)=0.64MPa		
	4									3.17-3.25m: EW, Clay 80 mm 3.26m: B, 20°, PR, SN Fe, RF 3.75m: B, 0°, PR, SN Fe, RF				4	PLT	PL(A)=0.63MPa		
	5									4.34m: B, 20°, PR, CN, RF 4.56m: B, 0°, PR, SN Fe, RF 4.68-4.71m: B x 2, 0°, PR, CN, RF 4.73m: B, 0°, UN, SN Fe, RF 5.00-5.01m: EW, Clay 10 mm				5	PLT	PL(A)=0.57MPa		
	6	SANDSTONE: pale orange then pale grey, medium grained; distinctly bedded 0-30° slightly fractured along bedding planes. Hawkesbury Sandstone.			5.84		96	86		5.05-5.25m: B x 3, 0°, PR, SN Fe, RF 5.84m: B, 20°, PR, CN, RF 5.95m: B, 0°, IR, CN, RF				6	PLT	PL(A)=1.0MPa		
	7									6.15-7.09m: B x 5, 0-20°, PR, CN, RF				7	PLT	PL(A)=2.2MPa		
	8		FR											8	PLT	PL(A)=2.3MPa		
	9									8.86-8.93m: B x 2, 20°, IR, CT Clay, RF 9.16m: B, 0°, PR, CN, RF				9	PLT	PL(A)=1.6MPa		
	10									9.18-9.85m: B x 11, 20°, PR, CN, RF				10	PLT	PL(A)=0.95MPa		

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: HA to 0.3m, AD 0.4-1.5m, then NMLC to 15.92m
REMARKS:

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HQ to 1.45m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 81.5 AHD
COORDINATE: E:330760.5, N:6261081.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 234319.00
DATE: 24/03/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING								
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		BACKFILL	WELL PIPE	
																	RESULTS AND REMARKS	BACKFILL			
	71		[CONT] SANDSTONE: pale orange then pale grey, medium grained; distinctly bedded 0-30° slightly fractured along bedding planes. Hawkesbury Sandstone.								10.11m: B, 0°, IR, CT Clay, RF										
	11							100	98		10.31-11.20m: B x7, 20°, PR, CN, RF				11	PLT	PL(A)=2.0MPa				
	70																				
	12										11.91-12.25m: B x3, 20°, IR, CN, RF				12	PLT	PL(A)=2.1MPa				
	69		From 12.50m: frequent carbonaceous flecks and laminations		FR		H				12.66-12.87m: B x2, 0°, IR, CN, RF										
	13										13.04m: B, 0°, PR, TI Clay, RF, healed				13	PLT	PL(A)=1.8MPa				
	68																				
	14										13.16-14.80m: B x5, 0-20°/20°., IR, CN, RF				14	PLT	PL(A)=3.3MPa				
	67							100	98												
	15														15	PLT	PL(A)=1.6MPa				
	66																				
	16		Borehole discontinued at 15.92m depth. Target depth reached																		
	65																				
	17																				
	64																				
	18																				
	63																				
	19																				
	62																				

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: HA to 0.3m, AD 0.4-1.5m, then NMLC to 15.92m
REMARKS:

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HQ to 1.45m

Refer to explanatory notes for symbol and abbreviation definitions

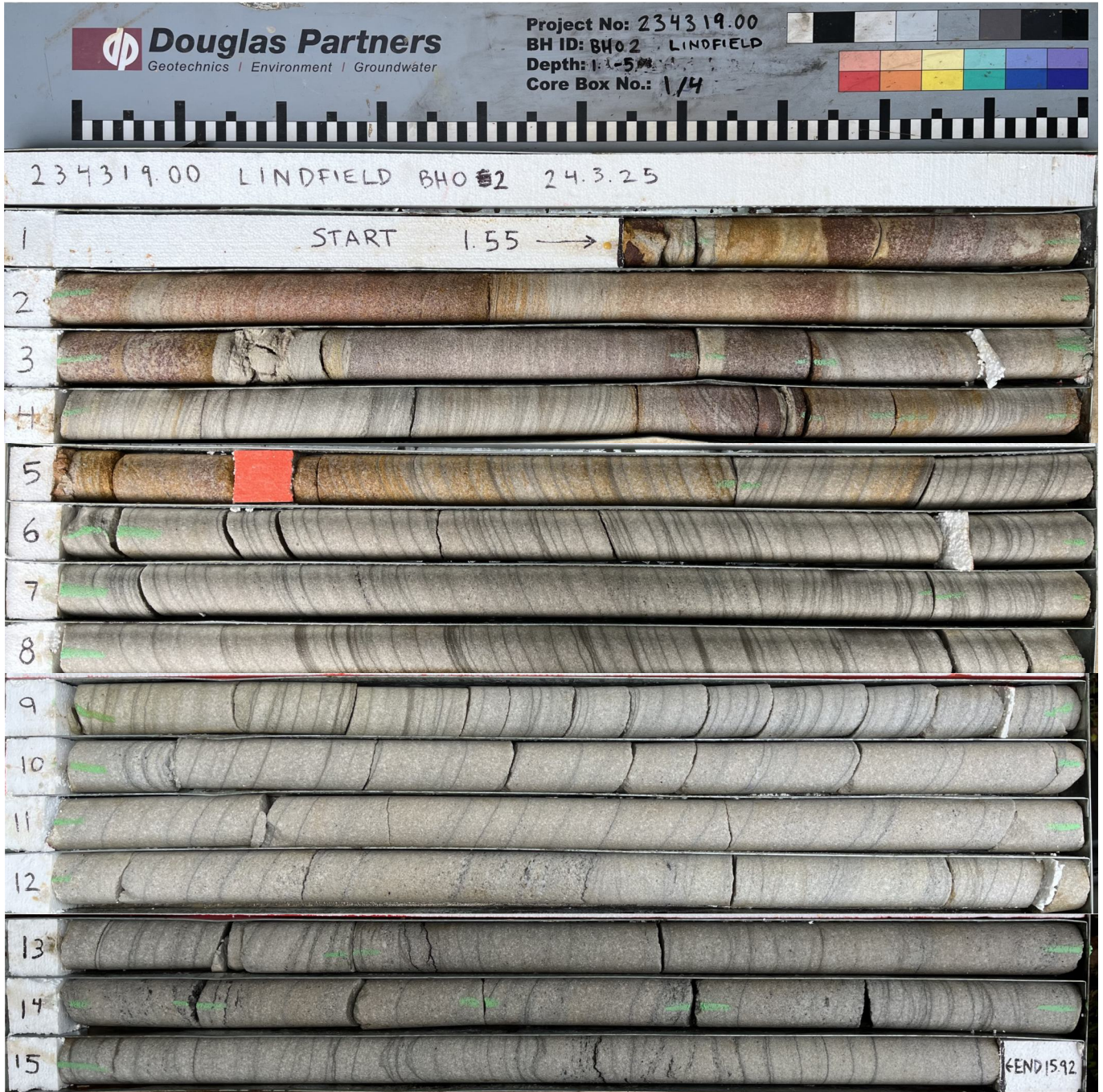


CORE PHOTO LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 81.5 AHD
COORDINATE: E:330760.5, N:6261081.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 234319.00
DATE: 24/03/25
SHEET: 1 of 1



Generated with CORE-GS by Geococ - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 82.7 AHD
COORDINATE: E:330772.1, N:6261088.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 234319.00
DATE: 18/03/25 - 19/03/25
SHEET: 1 of 3

CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS						
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
												PC	UK	W<PL
82.7	0.00	FILL / SILT with sand: brown; fine sand; trace rootlets.		FILL TOP	PC						DCP9/t150	5	10	15
	0.50	FILL / SILT with clay: brown; with trace fine sand.		FILL	UK									
	1.00	Clayey SILT (CL): dark grey, red and pale grey; low plasticity.		RS	VSt				SPT	1.00 - 1.45	SPT	8,11,13	N=24	
	1.70	Sandy CLAY (CL): dark grey, red and pale grey; low plasticity; fine to medium sand.		RS										
	2.10	SANDSTONE: yellow and pale grey, fine to medium grained, likely highly weathered sandstone, inferred from auger cuttings.		NA	NA	NA								
	2.20	Continued as rock log												

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: DT-250

OPERATOR: Ground Test (S Salib)

LOGGED: CLB

METHOD: AD to 2.2, then NMLC to 16.82

CASING: HW to 2.1m, then HQ to 2.2m

REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 82.7 AHD
COORDINATE: E:330772.1, N:6261088.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 234319.00
DATE: 18/03/25 - 19/03/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
19/03/25 no free ground water observed	82																	
	81																	
	2.43	Continued from soil log SANDSTONE: pale grey, dark red and orange, medium grained, indistinctly and distinctly bedded, 0 to 20°, thinly bedded to thickly bedded; fractured, fresh rock pale grey from 5.3m. Hawkesbury Sandstone.			2.20						233m: B, 20°, IR, CN, RF 237m: EW, 20mm							
	2.68						86	0			269m: EW, 30mm 280m: B, 0°, PR, VNR Clay, RF 295m: B, 0°, IR, VNR Clay, RF 303m: EW, 30mm				PLT	PL(A)=1.2MPa		
	3										353m: B, 0°, IR, SN Fe, RF 357m: EW, 30mm				PLT	PL(A)=0.48MPa		
	4										424m: B, 20°, PR, SN Fe, RF							
	4.79										480m: EW, 30mm 487m: B, 0°, PR, CN, RF				PLT	PL(A)=1.7MPa		
	5.22						100	90			518m: B, 0°, IR, CN, RF							
	5.90										531-6.04m: B x 6, 20°, PR, CN, RF				PLT	PL(A)=1.5MPa		
	6										631m: B, 0°, IR, CN, RF							
	7										649-6.64m: B x 2, 20°, PR, CN, RF				PLT	PL(A)=2.6MPa		
	8										742m: B, 10°, PR, VNR Clay, RF				PLT	PL(A)=1.7MPa		
	8						100	88			825m: B, 20°, PR, CN, RF							
	9										880m: B, 0°, IR, CN, RF 895m: B, 20°, PR, CN, RF				PLT	PL(A)=1.8MPa		
	9										916-9.28m: B x 2, 20°, PR, VNR Clay, RF 940-9.65m: B x 4, 20°, PR, CN, RF							
	9.74										974m: B, 20°, IR, CT Clay, RF				PLT	PL(A)=2.1MPa		

NOTES: *Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: AD to 2.2, then NMLC to 16.82
REMARKS:

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HW to 2.1m, then HQ to 2.2m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 82.7 AHD
COORDINATE: E:330772.1, N:6261088.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 234319.00
DATE: 18/03/25 - 19/03/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING																		
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE													
9.99	72	SANDSTONE: pale grey, medium grained, indistinctly and distinctly bedded, 0 to 20°, thinly bedded to thickly bedded; slightly fractured and fractured. Hawkesbury Sandstone.	[Pattern]	FR	[Scale]	[Scale]	100	88	[Scale]	11.10m B, 20°, PR, VNR Clay, RF				11	PLT	PL(A)=2.3MPa															
	71													12	PLT	PL(A)=2.2MPa															
	70													13	PLT	PL(A)=1.4MPa															
	69													14	PLT	PL(A)=2.3MPa															
	68													15	PLT	PL(A)=2.1MPa															
	67													16	PLT	PL(A)=1.7MPa															
	66													17	PLT	PL(A)=1.9MPa															
														17	Borehole discontinued at 16.82m depth. Target depth reached.																
	65																														
	64																														
	63																														

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: AD to 2.2, then NMLC to 16.82
REMARKS:

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HW to 2.1m, then HQ to 2.2m

Refer to explanatory notes for symbol and abbreviation definitions

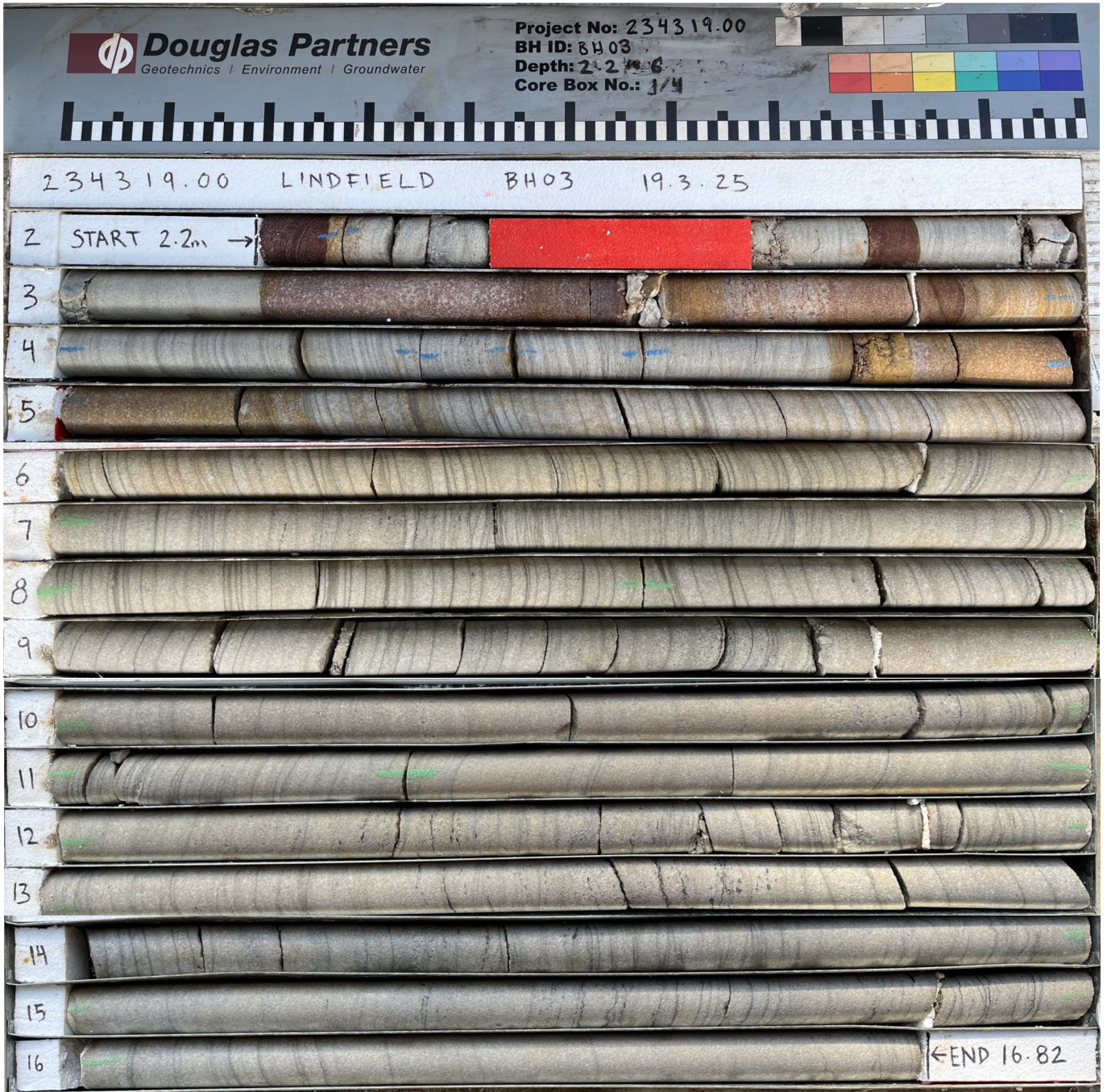


CORE PHOTO LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 82.7 AHD
COORDINATE: E:330772.1, N:6261088.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 234319.00
DATE: 18/03/25 - 19/03/25
SHEET: 1 of 1



BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 80.4 AHD
COORDINATE: E:330789.2, N:6261091.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 234319.00
DATE: 18/03/25 - 19/03/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
18/03/25 no free ground water observed	80																	
	79																	
	78																	
	77																	
	76	Continued from soil log SANDSTONE: pale grey, pale red and pale orange, medium grained, indistinctly and distinctly bedded, 0 to 30°, very thinly bedded to thickly bedded; slightly fractured. Hawkesbury Sandstone.			3.81													
	75		MW to SW				100	90		455-4.82m: B x4, 0-20°, UN, SN Fe, RF				PLT	PL(A)=0.64MPa			
	74				6.25					5.64m: B, 10°, PR, CN, RF				PLT	PL(A)=1.2MPa			
	73		SW				100	94		6.28-6.60m: B x4, 10-20°, PR, CN, RF				PLT	PL(A)=1.1MPa			
	72				8.29					6.84m: B, 20°, PR, SN Fe, RF				PLT	PL(A)=1.6MPa			
	71		FR				100	85		7.18m: EW, Clay 10mm 7.30-7.40m: B x2, 0-5°, UN, SN Fe, RF				PLT	PL(A)=1.3MPa			
										7.68m: B, 20°, PR, TI Clay 7.71m: B, 10°, IR, SN Fe, RF 7.76m: JT, 40-50°, UN, CN, RF				PLT	PL(A)=0.97MPa			
										8.46-10.34m: B x14, 10-20°, PR, CN, RF				PLT	PL(A)=2.0MPa			

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: AD to 2.5, WB to 3.8, then NMLC to 15.78
REMARKS: Hole reamed to 96mm diameter after coring for well installation.

OPERATOR: Ground Test (S Salib)

LOGGED: ECB/CLB
CASING: HW to 2.5m, then HQ to 3.8m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 80.4 AHD
COORDINATE: E:330789.2, N:6261091.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 234319.00
DATE: 18/03/25 - 19/03/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	10.00	SANDSTONE: see previous page.																
	10.80	SANDSTONE: pale grey, medium to coarse grained, indistinctly and distinctly bedded, 0 to 30°, thinly bedded to thickly bedded; slightly fractured to unbroken. Hawkesbury Sandstone.					100	95		11.09m: B, 0-10°, IR, CN, RF				11	PLT	PL(A)=2.9MPa	Sand	
	12	From 11.33m: with trace siltstone flecks, and carbonaceous flecks and laminations								11.90-11.94m: B x2, 10°, PR, CN, RF 12.06m: B, 20°, PR, CN, RF 12.10m: B, 10°, UN, VNR CBS, RF 12.14m: B, 20°, PR, VNR Clay, RF 12.36m: B, 20°, PR, CN, RF 12.51m: B, 5°, UN, CT Clay 2mm, RF 12.53-12.69m: JT, 80°, PR, healed				12	PLT	PL(A)=2.1MPa		
	13			FR		H								13	PLT	PL(A)=2.0MPa	Bentonite	
	14						100	100		13.33-13.49m: B x2, 20°, PR, CN, RF				14	PLT	PL(A)=2.0MPa		
	15									15.18m: B, 10°, UN, VNR CBS, RF				15	PLT	PL(A)=1.6MPa	Sand	
	16	Borehole discontinued at 15.78m depth. Target depth reached.													PLT	PL(A)=2.6MPa		
	17																	
	18																	
	19																	

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: AD to 2.5, WB to 3.8, then NMLC to 15.78
REMARKS: Hole reamed to 96mm diameter after coring for well installation.

OPERATOR: Ground Test (S Salib)

LOGGED: ECB/CLB
CASING: HW to 2.5m, then HQ to 3.8m

Refer to explanatory notes for symbol and abbreviation definitions



CORE PHOTO LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 80.4 AHD
COORDINATE: E:330789.2, N:6261091.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 234319.00
DATE: 18/03/25 - 19/03/25
SHEET: 1 of 1



Generated with CORE-GS by Geoc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 86.7 AHD
COORDINATE: E:330757.1, N:6261147.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 234319.00
DATE: 20/03/25 - 21/03/25
SHEET: 1 of 3

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
20/03/25 no free ground water observed	0.40	FILL / GRAVEL; 5mm quartz gravel, backfill for environmental hand auger. (See 234319.01 BH05).		FILL	NA	NA		ES		0.40		5, 10, 12 N=22		
	1.00	CLAY with gravel: dark orange-brown, red, and grey; fine to coarse (up to 5mm), ironstone gravel gravel.		RS	St	w<PL		ES		1.00				
	1.60	CLAY (CL) with sand: dark orange-brown, red and grey; low plasticity; fine sand.		RS				SPT		1.45				
	2.00	SANDSTONE: grey and yellow, fine sand, inferred very low strength sandstone.				NA	NA	B		1.60				
	2.00	Continued as rock log						ES		2.00				
	3.00									3.00				
	4.00									4.00				
	5.00									5.00				
	6.00									6.00				
	7.00									7.00				
	8.00									8.00				
	9.00									9.00				

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: DT-250
METHOD: AD to 2.0, then NMCL to 15.75
REMARKS: Hole reamed to 96mm diameter after coring for well installation.

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HW to 1.6m, then HQ to 2m

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 86.7 AHD
COORDINATE: E:330757.1, N:6261147.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 234319.00
DATE: 20/03/25 - 21/03/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
RL (m)	76	[CONT] SANDSTONE: pale grey, medium to coarse grained, indistinctly bedded, 0 to 20°, very thinly bedded to thickly bedded; slightly fractured to unbroken. Hawkesbury Sandstone.		FR	L	H	100	97	0.05-0.10	12.95m: B, 20°, PR, VNR Clay, RF			11	PLT	PL(A)=1.8MPa			
	75												12	PLT	PL(A)=2.4MPa			
	74												13	PLT	PL(A)=2.6MPa			
	73												14					
	72												15	PLT	PL(A)=1.3MPa			
	71				100	250			15.65m: EW, Clay 5mm 15.71-15.74m: B x2, 0°, IR, CT Clay 3mm, RF			16	PLT	PL(A)=2.6MPa				
	70	Borehole discontinued at 15.95m depth. Target depth reached.												PLT	PL(A)=1.9MPa			
	69																	
	68																	
	67																	

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: DT-250
METHOD: AD to 2.0, then NMCL to 15.75
REMARKS: Hole reamed to 96mm diameter after coring for well installation.

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HW to 1.6m, then HQ to 2m

Refer to explanatory notes for symbol and abbreviation definitions



CORE PHOTO LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 86.7 AHD
COORDINATE: E:330757.1, N:6261147.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 234319.00
DATE: 20/03/25 - 21/03/25
SHEET: 1 of 1



Generated with CORE-GS by Geoc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 84.3 AHD
COORDINATE: E:330745.7, N:6261131.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 234319.00
DATE: 21/03/25
SHEET: 1 of 3

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS					
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
												5	10	15
84	0.30	FILL / Silty SAND trace gravel: dark brown- orange; fine; (up to 5mm), ironstone gravel; with rootlets, 5mm quartz gravel from environmental hand auger. (See 234319.01 BH06).		FILL TOP		M		ES	0.30		DCP9/150 SPT 5,7,8 N=15			
	0.50	FILL / Sandy CLAY trace gravel: mottled orange; fine sand; (up to 3mm), ironstone gravel.		FILL		MC		ES	0.50					
	0.90	Sandy CLAY trace gravel: light brown, yellow and red; fine sand; fine, ironstone gravel; from 1.25m increase in fine pale sand, probable weathered bedrock.				D		B/ES	0.90					
	1.00					D		SPT	1.00					
	1.45			RS		UK			1.45					
	2.00	Continued as rock log				UK			2.00					
	2.00													
	3.00													
	4.00													
	5.00													
	6.00													
	7.00													
	8.00													
	9.00													
	10.00													

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: DT-250
METHOD: AD 2.0, then NMLC to 16.75m
REMARKS:

OPERATOR: Ground Test (S Salib)

LOGGED: CLB
CASING: HQ to 2m

CORE PHOTO LOG

CLIENT: The Trustee for MHR LINDFIELD TRUST
PROJECT: Proposed Residential Development
LOCATION: 24, 26, and 28 Middle Harbour Road, Lindfield, NSW

SURFACE LEVEL: 84.3 AHD
COORDINATE: E:330745.7, N:6261131.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: BH06
PROJECT No: 234319.00
DATE: 21/03/25
SHEET: 1 of 1



Generated with CORE-GS by Geoc - Split Soil-Frock Log

Appendix D

Permeability Test Results

Appendix E

Laboratory Results

Material Test Report

Report Number: 234319.00-1
Issue Number: 1
Date Issued: 23/04/2025
Client: The Trustee for MHR LINDFIELD TRUST
 C/ DPDS, Sydney NSW
Contact: Gabrielle Chidiac
Project Number: 234319.00
Project Name: Proposed Residential Development
Project Location: 28 Middle Harbour Road, Lindfield NSW
Work Request: 12273
Sample Number: SY-12273A
Date Sampled: 20/03/2025
Dates Tested: 09/04/2025 - 16/04/2025
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: BH01 (1.0-1.5m)
Material: CLAY trace sand trace gravel: mottled red, white, and orange,
 fine sand, fine, sub-angular ironstone gravel



Douglas Partners Pty Ltd
 Sydney Laboratory
 96 Hermitage Road West Ryde NSW 2114
 Phone: (02) 9809 0666
 Email: lujia.wu@douglaspartners.com.au



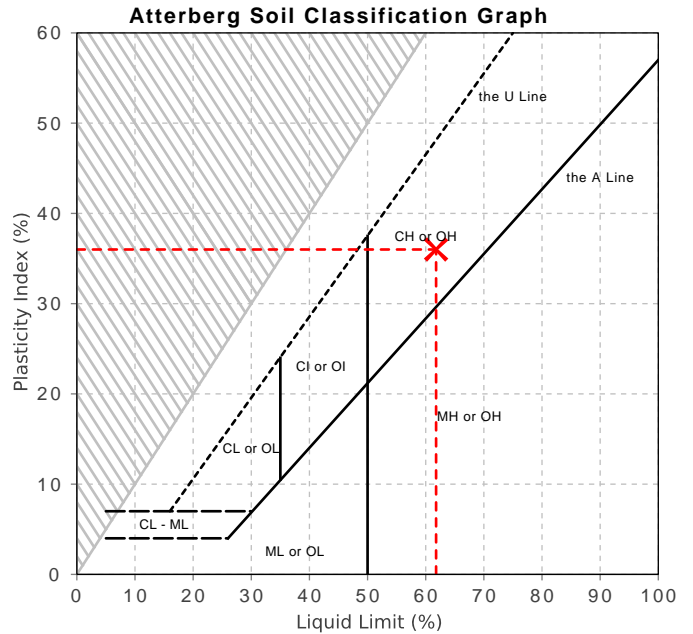
Accredited for compliance with ISO/IEC 17025 - Testing

Lujia Wu

Approved Signatory: Lujia Wu
 Soil Technician
 Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	62		
Plastic Limit (%)	26		
Plasticity Index (%)	36		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	16.0		
Cracking Crumbling Curling	None		



Material Test Report

Report Number: 234319.00-1
Issue Number: 1
Date Issued: 23/04/2025
Client: The Trustee for MHR LINDFIELD TRUST
 C/ DPDS, Sydney NSW
Contact: Gabrielle Chidiac
Project Number: 234319.00
Project Name: Proposed Residential Development
Project Location: 28 Middle Harbour Road, Lindfield NSW
Work Request: 12273
Sample Number: SY-12273B
Date Sampled: 20/03/2025
Dates Tested: 09/04/2025 - 16/04/2025
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: BH05 (1.0-2.0m)
Material: Sandy CLAY: dark orange-brown, red and grey, with low strength sandstone



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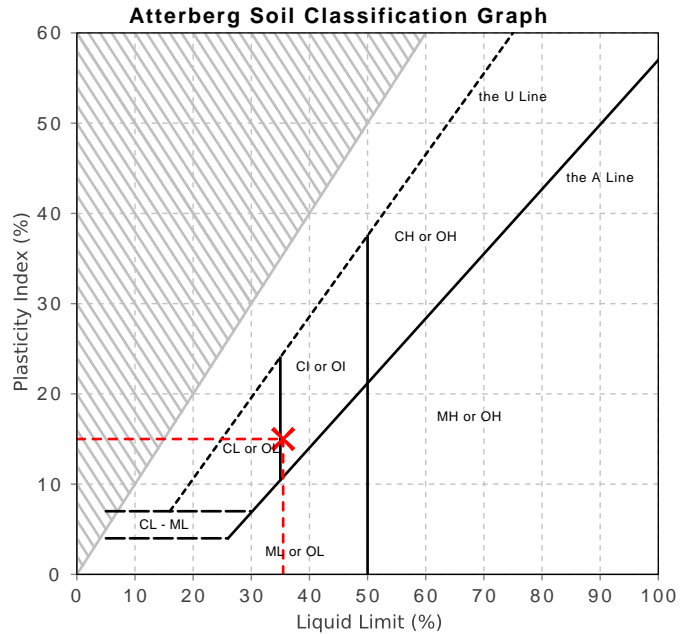
Accredited for compliance with ISO/IEC 17025 - Testing

Lujia Wu

Approved Signatory: Lujia Wu
 Soil Technician
 Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	35		
Plastic Limit (%)	20		
Plasticity Index (%)	15		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	8.5		
Cracking Crumbling Curling	None		



Material Test Report

Report Number: 234319.00-1
Issue Number: 1
Date Issued: 23/04/2025
Client: The Trustee for MHR LINDFIELD TRUST
 C/ DPDS, Sydney NSW
Contact: Gabrielle Chidiac
Project Number: 234319.00
Project Name: Proposed Residential Development
Project Location: 28 Middle Harbour Road, Lindfield NSW
Work Request: 12273
Sample Number: SY-12273C
Date Sampled: 20/03/2025
Dates Tested: 09/04/2025 - 16/04/2025
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: BH06 (0.9m)
Material: Sandy CLAY, trace gravel: light brown, yellow and red, fine sand, fine, ironstone gravel



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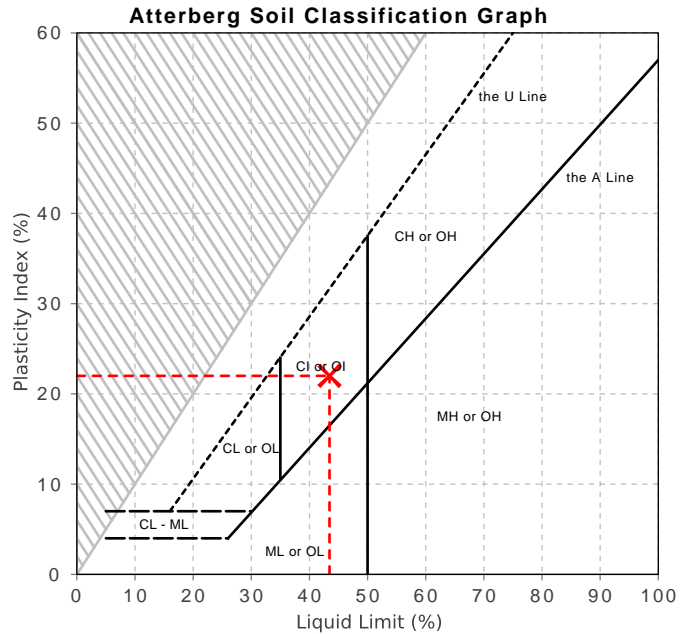
Accredited for compliance with ISO/IEC 17025 - Testing

Lujia Wu

Approved Signatory: Lujia Wu
 Soil Technician
 Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	43		
Plastic Limit (%)	21		
Plasticity Index (%)	22		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	12.0		
Cracking Crumbling Curling	None		





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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 377836

Client Details

Client	Douglas Partners Pty Ltd
Attention	Craig Stemp
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	<u>234319.00 Linfield</u>
Number of Samples	3 Soil
Date samples received	09/04/2025
Date completed instructions received	09/04/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. 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	16/04/2025
Date of Issue	15/04/2025

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Results Approved By

Diego Bigolin, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Soil Aggressivity				
Our Reference		377836-1	377836-2	377836-3
Your Reference	UNITS	BH01	BH05	BH06
Depth		1	1-2	1
Date Sampled		25/03/2025	20/03/2025	21/03/2025
Type of sample		Soil	Soil	Soil
Date prepared	-	11/04/2025	11/04/2025	11/04/2025
Date analysed	-	11/04/2025	11/04/2025	11/04/2025
pH 1:5 soil:water	pH Units	5.6	5.1	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	15	32	58
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	20	39	99

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. 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.
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.

Client Reference: 234319.00 Linfield

QUALITY CONTROL: Soil Aggressivity				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			11/04/2025	[NT]	[NT]	[NT]	[NT]	11/04/2025	[NT]
Date analysed	-			11/04/2025	[NT]	[NT]	[NT]	[NT]	11/04/2025	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	110	[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/EC - Samples were out of the recommended holding time for this analysis.



CERTIFICATE OF ANALYSIS 377453

Client Details

Client	Douglas Partners Pty Ltd
Attention	Nerilee Edwards
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	<u>234319.01, Lindfield</u>
Number of Samples	6 Water
Date samples received	04/04/2025
Date completed instructions received	04/04/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. 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	11/04/2025
Date of Issue	11/04/2025
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Amanda Chui, LC/Air Toxics Supervisor
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Greta Petzold, Operation Manager
Jack Wallis, Senior Chemist
Priya Samarawickrama, Senior Chemist
Timothy Toll, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water						
Our Reference		377453-1	377453-2	377453-3	377453-4	377453-5
Your Reference	UNITS	GWBH1	GWBH4	GWBH5	RB/20250403	TB/20250403
Date Sampled		03/04/2025	03/04/2025	03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	09/04/2025	09/04/2025	09/04/2025	09/04/2025	09/04/2025
Date analysed	-	10/04/2025	10/04/2025	10/04/2025	10/04/2025	10/04/2025
TRH C ₆ - C ₉	µg/L	<10	<10	<10	<10	<10
TRH C ₆ - C ₁₀	µg/L	<10	<10	<10	<10	<10
TRH C ₆ - C ₁₀ less BTEX (F1)	µg/L	<10	<10	<10	<10	<10
Benzene	µg/L	<1	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2	<2
o-xylene	µg/L	<1	<1	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	99	98	100	99	100
Surrogate Toluene-d8	%	100	99	99	100	99
Surrogate 4-Bromofluorobenzene	%	98	98	101	99	100

vTRH(C6-C10)/BTEXN in Water		
Our Reference		377453-6
Your Reference	UNITS	TS/20250403
Date Sampled		03/04/2025
Type of sample		Water
Date extracted	-	09/04/2025
Date analysed	-	10/04/2025
Benzene	µg/L	101%
Toluene	µg/L	113%
Ethylbenzene	µg/L	118%
m+p-xylene	µg/L	118%
o-xylene	µg/L	119%
Surrogate Dibromofluoromethane	%	103
Surrogate Toluene-d8	%	101
Surrogate 4-Bromofluorobenzene	%	100

svTRH (C10-C40) in Water					
Our Reference		377453-1	377453-2	377453-3	377453-4
Your Reference	UNITS	GWBH1	GWBH4	GWBH5	RB/20250403
Date Sampled		03/04/2025	03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	07/04/2025	07/04/2025	07/04/2025	07/04/2025
Date analysed	-	08/04/2025	08/04/2025	08/04/2025	08/04/2025
TRH C ₁₀ - C ₁₄	µg/L	<50	<50	<50	<50
TRH C ₁₅ - C ₂₈	µg/L	<100	<100	<100	<100
TRH C ₂₉ - C ₃₆	µg/L	<100	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	<50	<50	<50
TRH >C ₁₀ - C ₁₆	µg/L	<50	<50	<50	<50
TRH >C ₁₀ - C ₁₆ less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH >C ₁₆ - C ₃₄	µg/L	120	<100	<100	<100
TRH >C ₃₄ - C ₄₀	µg/L	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	120	<50	<50	<50
Surrogate o-Terphenyl	%	84	82	78	84

PAHs in Water					
Our Reference		377453-1	377453-2	377453-3	377453-4
Your Reference	UNITS	GWBH1	GWBH4	GWBH5	RB/20250403
Date Sampled		03/04/2025	03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	07/04/2025	07/04/2025	07/04/2025	07/04/2025
Date analysed	-	08/04/2025	08/04/2025	08/04/2025	08/04/2025
Naphthalene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate <i>p</i> -Terphenyl-d14	%	87	86	96	97

OCPs in Water - Trace Level				
Our Reference		377453-1	377453-2	377453-3
Your Reference	UNITS	GWBH1	GWBH4	GWBH5
Date Sampled		03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water
Date extracted	-	07/04/2025	07/04/2025	07/04/2025
Date analysed	-	08/04/2025	08/04/2025	08/04/2025
alpha-BHC	µg/L	<0.001	<0.001	<0.001
HCB	µg/L	<0.001	<0.001	<0.001
beta-BHC	µg/L	<0.001	<0.001	<0.001
gamma-BHC	µg/L	<0.001	<0.001	<0.001
Heptachlor	µg/L	<0.001	<0.001	<0.001
delta-BHC	µg/L	<0.001	<0.001	<0.001
Aldrin	µg/L	<0.001	<0.001	<0.001
Heptachlor Epoxide	µg/L	<0.001	<0.001	<0.001
gamma-Chlordane	µg/L	<0.001	<0.001	<0.001
alpha-Chlordane	µg/L	<0.001	<0.001	<0.001
Endosulfan I	µg/L	<0.002	<0.002	<0.002
pp-DDE	µg/L	<0.001	<0.001	<0.001
Dieldrin	µg/L	<0.001	<0.001	<0.001
Endrin	µg/L	<0.001	<0.001	<0.001
Endosulfan II	µg/L	<0.002	<0.002	<0.002
pp-DDD	µg/L	<0.001	<0.001	<0.001
Endrin Aldehyde	µg/L	<0.001	<0.001	<0.001
pp-DDT	µg/L	<0.001	<0.001	<0.001
Endosulfan Sulphate	µg/L	<0.001	<0.001	<0.001
Methoxychlor	µg/L	<0.001	<0.001	<0.001
Surrogate 4-Chloro-3-NBTF	%	94	94	96

OP in water LL ANZECCF/ADWG				
Our Reference		377453-1	377453-2	377453-3
Your Reference	UNITS	GWBH1	GWBH4	GWBH5
Date Sampled		03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water
Date extracted	-	07/04/2025	07/04/2025	07/04/2025
Date analysed	-	08/04/2025	08/04/2025	08/04/2025
Dichlorvos	µg/L	<0.05	<0.05	<0.05
Mevinphos	µg/L	<0.05	<0.05	<0.05
Phorate	µg/L	<0.05	<0.05	<0.05
Dimethoate	µg/L	<0.1	<0.1	<0.1
Diazinon	µg/L	<0.01	<0.01	<0.01
Disulfoton	µg/L	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	µg/L	<0.05	<0.05	<0.05
Parathion-Methyl	µg/L	<0.05	<0.05	<0.05
Ronnel	µg/L	<0.05	<0.05	<0.05
Fenitrothion	µg/L	<0.05	<0.05	<0.05
Malathion	µg/L	<0.05	<0.05	<0.05
Chlorpyrifos	µg/L	<0.009	<0.009	<0.009
Fenthion	µg/L	<0.05	<0.05	<0.05
Parathion	µg/L	<0.004	<0.004	<0.004
Bromophos ethyl	µg/L	<0.05	<0.05	<0.05
Methidathion	µg/L	<0.05	<0.05	<0.05
Fenamiphos	µg/L	<0.05	<0.05	<0.05
Ethion	µg/L	<0.05	<0.05	<0.05
Phosalone	µg/L	<0.05	<0.05	<0.05
Azinphos-methyl (Guthion)	µg/L	<0.02	<0.02	<0.02
Coumaphos	µg/L	<0.05	<0.05	<0.05
Surrogate 4-Chloro-3-NBTF	%	94	94	96

PCBs in Water - Trace Level				
Our Reference		377453-1	377453-2	377453-3
Your Reference	UNITS	GWBH1	GWBH4	GWBH5
Date Sampled		03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water
Date extracted	-	07/04/2025	07/04/2025	07/04/2025
Date analysed	-	08/04/2025	08/04/2025	08/04/2025
Aroclor 1016	µg/L	<0.01	<0.01	<0.01
Aroclor 1221	µg/L	<0.01	<0.01	<0.01
Aroclor 1232	µg/L	<0.01	<0.01	<0.01
Aroclor 1242	µg/L	<0.01	<0.01	<0.01
Aroclor 1248	µg/L	<0.01	<0.01	<0.01
Aroclor 1254	µg/L	<0.01	<0.01	<0.01
Aroclor 1260	µg/L	<0.01	<0.01	<0.01
Surrogate 2-Fluorobiphenyl	%	79	79	84

HM in water - dissolved					
Our Reference		377453-1	377453-2	377453-3	377453-4
Your Reference	UNITS	GWBH1	GWBH4	GWBH5	RB/20250403
Date Sampled		03/04/2025	03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water	Water
Date prepared	-	07/04/2025	07/04/2025	07/04/2025	07/04/2025
Date analysed	-	07/04/2025	07/04/2025	07/04/2025	07/04/2025
Arsenic-Dissolved	µg/L	2	1	<1	<1
Cadmium-Dissolved	µg/L	0.2	0.2	<0.1	<0.1
Chromium-Dissolved	µg/L	1	3	<1	<1
Copper-Dissolved	µg/L	160	<1	11	<1
Iron-Dissolved	µg/L	8,600	18,000	7,200	<10
Lead-Dissolved	µg/L	3	2	2	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Manganese-Dissolved	µg/L	690	720	590	<5
Nickel-Dissolved	µg/L	36	47	24	<1
Zinc-Dissolved	µg/L	180	280	160	<1

Metals in Waters - Acid extractable		
Our Reference		377453-2
Your Reference	UNITS	GWBH4
Date Sampled		03/04/2025
Type of sample		Water
Date prepared	-	07/04/2025
Date analysed	-	07/04/2025
Phosphorus - Total	mg/L	<0.05

Miscellaneous Inorganics				
Our Reference		377453-1	377453-2	377453-3
Your Reference	UNITS	GWBH1	GWBH4	GWBH5
Date Sampled		03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water
Date prepared	-	04/04/2025	04/04/2025	04/04/2025
Date analysed	-	04/04/2025	04/04/2025	04/04/2025
pH	pH Units	4.5	3.9	4.8
Electrical Conductivity	µS/cm	1,700	2,000	350
Total Dissolved Solids (grav)	mg/L	[NA]	1,400	[NA]
Ammonia as N in water	mg/L	[NA]	0.056	[NA]
Nitrate as N in water	mg/L	[NA]	<0.005	[NA]
Nitrite as N in water	mg/L	[NA]	<0.005	[NA]
Total Nitrogen in water	mg/L	[NA]	0.1	[NA]
NOx as N in water	mg/L	[NA]	<0.005	[NA]
Organic Nitrogen as N	mg/L	[NA]	<0.2	[NA]
TKN in water	mg/L	[NA]	0.1	[NA]
Phosphate as P in water	mg/L	[NA]	<0.005	[NA]

Ion Balance				
Our Reference		377453-1	377453-2	377453-3
Your Reference	UNITS	GWBH1	GWBH4	GWBH5
Date Sampled		03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water
Date prepared	-	[NA]	04/04/2025	[NA]
Date analysed	-	[NA]	04/04/2025	[NA]
Calcium - Dissolved	mg/L	[NA]	2	[NA]
Potassium - Dissolved	mg/L	[NA]	2	[NA]
Sodium - Dissolved	mg/L	[NA]	280	[NA]
Magnesium - Dissolved	mg/L	[NA]	33	[NA]
Hardness (calc) equivalent CaCO ₃	mg/L	[NA]	140	[NA]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	[NA]	<5	[NA]
Bicarbonate Alkalinity as CaCO ₃	mg/L	[NA]	<5	[NA]
Carbonate Alkalinity as CaCO ₃	mg/L	[NA]	<5	[NA]
Total Alkalinity as CaCO ₃	mg/L	[NA]	<5	[NA]
Sulphate, SO ₄	mg/L	180	200	58
Chloride, Cl	mg/L	360	480	54
Ionic Balance	%	[NA]	-9.0	[NA]

PFAS in Water TRACE Short				
Our Reference		377453-1	377453-2	377453-3
Your Reference	UNITS	GWBH1	GWBH4	GWBH5
Date Sampled		03/04/2025	03/04/2025	03/04/2025
Type of sample		Water	Water	Water
Date prepared	-	08/04/2025	08/04/2025	08/04/2025
Date analysed	-	08/04/2025	08/04/2025	08/04/2025
Perfluorobutanesulfonic acid	µg/L	0.0009	<0.0004	0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0067	0.002	0.0022
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	0.013	0.0057	0.0027
6:2 FTS	µg/L	<0.0004	0.002	0.002
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004
Surrogate ¹³ C ₈ PFOS	%	111	104	100
Surrogate ¹³ C ₂ PFOA	%	117	96	108
Extracted ISTD ¹³ C ₃ PFBS	%	55	66	61
Extracted ISTD ¹⁸ O ₂ PFHxS	%	79	84	81
Extracted ISTD ¹³ C ₄ PFOS	%	60	64	64
Extracted ISTD ¹³ C ₄ PFOA	%	77	98	84
Extracted ISTD ¹³ C ₂ 6:2FTS	%	112	114	107
Extracted ISTD ¹³ C ₂ 8:2FTS	%	102	109	104
Total Positive PFHxS & PFOS	µg/L	0.0066	0.002	0.0022
Total Positive PFOS & PFOA	µg/L	0.013	0.0057	0.0027
Total Positive PFAS	µg/L	0.021	0.0095	0.0077

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. 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.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:- TDS = EC * 0.6
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-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.
Metals-020	Determination of various metals by ICP-AES. Total Phosphate determined stoichiometrically from Phosphorus (assumed to be present as Phosphate). Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
Metals-021	Determination of Mercury by Cold Vapour AAS.

Method ID	Methodology Summary
Metals-022	<p>Determination of various metals by ICP-MS.</p> <p>Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.</p> <p>Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.</p>
Org-020	<p>Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.</p>
Org-021/022/025	<p>Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS.</p>
Org-021/022/025	<p>Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS.</p> <p>Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PCBs" is simply a sum of the positive individual PCBs.</p>
Org-022/025	<p>Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.</p>
Org-022/025	<p>Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.</p>
Org-023	<p>Water samples are analysed directly by purge and trap GC-MS.</p>
Org-023	<p>Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.</p>
Org-029	<p>Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3.</p> <p>Analysis is undertaken with LC-MS/MS.</p> <p>PFAS results include the sum of branched and linear isomers where applicable.</p> <p>Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Encicarb (or similar) is used discretionally to remove interfering matrix components.</p> <p>Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.</p>

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			10/04/2025	1	09/04/2025	10/04/2025		10/04/2025	[NT]
Date analysed	-			11/04/2025	1	10/04/2025	11/04/2025		11/04/2025	[NT]
TRH C ₆ - C ₉	µg/L	10	Org-023	<10	1	<10	<10	0	115	[NT]
TRH C ₆ - C ₁₀	µg/L	10	Org-023	<10	1	<10	<10	0	115	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	111	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	115	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	116	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	117	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	102	[NT]
Naphthalene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	103	1	99	103	4	101	[NT]
Surrogate Toluene-d8	%		Org-023	103	1	100	101	1	102	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	99	1	98	99	1	90	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			07/04/2025	[NT]	[NT]	[NT]	[NT]	07/04/2025	[NT]
Date analysed	-			08/04/2025	[NT]	[NT]	[NT]	[NT]	08/04/2025	[NT]
TRH C ₁₀ - C ₁₄	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	96	[NT]
TRH C ₁₅ - C ₂₈	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
TRH C ₂₉ - C ₃₆	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH >C ₁₀ - C ₁₆	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	96	[NT]
TRH >C ₁₆ - C ₃₄	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
TRH >C ₃₄ - C ₄₀	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate o-Terphenyl	%		Org-020	93	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: PAHs in Water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			07/04/2025	[NT]	[NT]	[NT]	[NT]	07/04/2025	[NT]
Date analysed	-			08/04/2025	[NT]	[NT]	[NT]	[NT]	08/04/2025	[NT]
Naphthalene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	66	[NT]
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	76	[NT]
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	74	[NT]
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	76	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	93	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: OCPs in Water - Trace Level				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			07/04/2025	[NT]	[NT]	[NT]	[NT]	07/04/2025	[NT]
Date analysed	-			08/04/2025	[NT]	[NT]	[NT]	[NT]	08/04/2025	[NT]
alpha-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	88	[NT]
HCB	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	85	[NT]
gamma-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
delta-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	95	[NT]
Heptachlor Epoxide	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	100	[NT]
gamma-Chlordane	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-Chlordane	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	µg/L	0.002	Org-022/025	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
Dieldrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	100	[NT]
Endrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	99	[NT]
Endosulfan II	µg/L	0.002	Org-022/025	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	106	[NT]
Endrin Aldehyde	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	100	[NT]
Methoxychlor	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	91	[NT]	[NT]	[NT]	[NT]	85	[NT]

QUALITY CONTROL: OP in water LL ANZECCF/ADWG					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-				[NT]	[NT]	[NT]	[NT]		[NT]
Date analysed	-				[NT]	[NT]	[NT]	[NT]		[NT]
Dichlorvos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	89	[NT]
Mevinphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Phorate	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dimethoate	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Disulfoton	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyrifos-methyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion-Methyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ronnel	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	86	[NT]
Fenitrothion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	87	[NT]
Malathion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	103	[NT]
Chlorpyrifos	µg/L	0.009	Org-022/025	<0.009	[NT]	[NT]	[NT]	[NT]	91	[NT]
Fenthion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion	µg/L	0.004	Org-022/025	<0.004	[NT]	[NT]	[NT]	[NT]	85	[NT]
Bromophos ethyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Methidathion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fenamiphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	92	[NT]
Phosalone	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Azinphos-methyl (Guthion)	µg/L	0.02	Org-022/025	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Coumaphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	91	[NT]	[NT]	[NT]	[NT]	85	[NT]

QUALITY CONTROL: PCBs in Water - Trace Level					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-				[NT]	[NT]	[NT]	[NT]		[NT]
Date analysed	-				[NT]	[NT]	[NT]	[NT]		[NT]
Aroclor 1016	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	90	[NT]
Aroclor 1260	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 2-Fluorobiphenyl	%		Org-021/022/025	79	[NT]	[NT]	[NT]	[NT]	69	[NT]

Client Reference: 234319.01, Lindfield

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	377453-2
Date prepared	-			07/04/2025	1	07/04/2025	07/04/2025		07/04/2025	07/04/2025
Date analysed	-			07/04/2025	1	07/04/2025	07/04/2025		07/04/2025	07/04/2025
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	2	[NT]		94	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	0.2	[NT]		95	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	1	[NT]		100	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	160	[NT]		100	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	1	8600	[NT]		84	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	3	[NT]		97	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	93	#
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	690	[NT]		100	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	36	[NT]		99	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	180	[NT]		107	[NT]

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	2	07/04/2025	07/04/2025		[NT]	[NT]
Date analysed	-			[NT]	2	07/04/2025	07/04/2025		[NT]	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	[NT]	2	1	1	0	[NT]	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	[NT]	2	0.2	0.2	0	[NT]	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	[NT]	2	3	3	0	[NT]	[NT]
Copper-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	<1	0	[NT]	[NT]
Iron-Dissolved	µg/L	10	Metals-022	[NT]	2	18000	17000	6	[NT]	[NT]
Lead-Dissolved	µg/L	1	Metals-022	[NT]	2	2	2	0	[NT]	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	2	<0.05	[NT]		[NT]	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	[NT]	2	720	700	3	[NT]	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	[NT]	2	47	46	2	[NT]	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	[NT]	2	280	270	4	[NT]	[NT]

Client Reference: 234319.01, Lindfield

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

Client Reference: 234319.01, Lindfield

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			04/04/2025	2	04/04/2025	04/04/2025		04/04/2025	[NT]
Date analysed	-			04/04/2025	2	04/04/2025	04/04/2025		04/04/2025	[NT]
pH	pH Units		Inorg-001	[NT]	2	3.9	[NT]		101	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	2	2000	[NT]		96	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	2	1400	1400	0	93	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	2	0.056	[NT]		99	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	2	<0.005	[NT]		98	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	2	<0.005	[NT]		99	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	2	0.1	[NT]		101	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	2	<0.005	[NT]		99	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	2	<0.2	[NT]		[NT]	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	2	0.1	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	2	<0.005	[NT]		98	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			04/04/2025	[NT]	[NT]	[NT]	[NT]	04/04/2025	[NT]
Date analysed	-			04/04/2025	[NT]	[NT]	[NT]	[NT]	04/04/2025	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	98	[NT]
Hardness (calc) equivalent CaCO ₃	mg/L	3	Metals-020	<3	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	105	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]

QUALITY CONTROL: PFAS in Water TRACE Short				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-				[NT]	[NT]	[NT]	[NT]		[NT]
Date analysed	-				[NT]	[NT]	[NT]	[NT]		[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
6:2 FTS	µg/L	0.0004	Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
8:2 FTS	µg/L	0.0004	Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Surrogate ¹³ C ₈ PFOS	%		Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Surrogate ¹³ C ₂ PFOA	%		Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Extracted ISTD ¹³ C ₃ PFBS	%		Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Extracted ISTD ¹⁸ O ₂ PFHxS	%		Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Extracted ISTD ¹³ C ₄ PFOS	%		Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Extracted ISTD ¹³ C ₄ PFOA	%		Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Extracted ISTD ¹³ C ₂ 6:2FTS	%		Org-029		[NT]	[NT]	[NT]	[NT]		[NT]
Extracted ISTD ¹³ C ₂ 8:2FTS	%		Org-029		[NT]	[NT]	[NT]	[NT]		[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

8 HM in water - dissolved - # Low spike recovery was obtained for this sample. The sample was re-digested and re-spiked and the low recovery was confirmed. This is due to matrix interferences.
However, an acceptable recovery was obtained for the LCS.