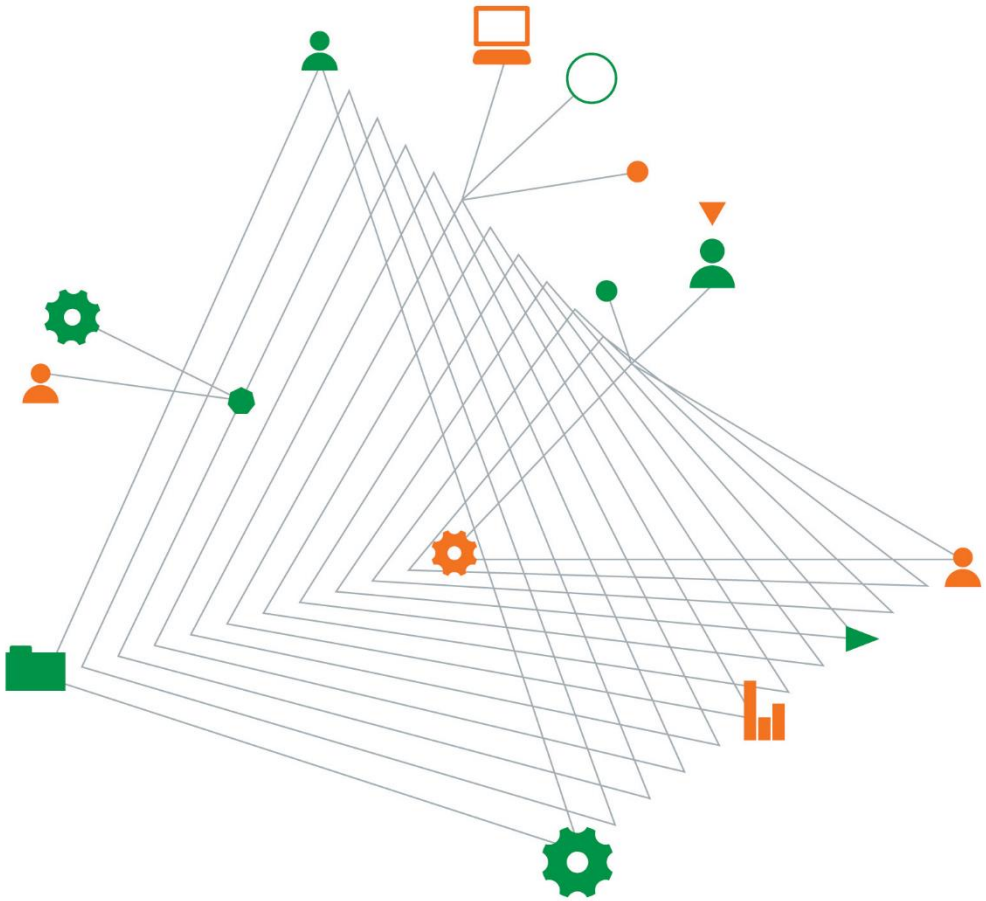
Hamptons by Rose Pty Ltd ATF Northern Beaches Trust
15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
SYDGE271604AA

28 April 2020



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15-23 Fisher Road, Dee Why - Geotechnical Investigation Report

Prepared for
Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

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1. Introduction

A geotechnical investigation for a proposed building development at 15-23 Fisher Road, Dee Why, was commissioned by Hamptons by Rose Pty Ltd ATF Northern Beaches Trust (Rose) in general accordance with Coffey proposal SYDGE217604, dated 19 February 2020. The purpose of the investigation is to gather information to inform design for a proposed mixed-use, multi-storey development at the site.

The geotechnical investigation, comprising a walkover inspection followed by four intrusive boreholes, was carried out in March 2020.

This report presents the results of the geotechnical investigation carried out at the site. It includes desk study information, site description, borehole logs and laboratory test results, a summary of the findings from the investigation as well a technical commentary with recommendations to aid the design of foundations, earthworks, retaining structures and groundwater observations.

2. Proposed Development

Based on the supplied plans by Rose attached in Appendix A, Coffey understands that the proposed development includes the demolition of existing residential structures and construction of three multi-storey buildings with two levels of basement carparking. A historical building, the Pacific Lodge, located within the centre of site, will be retained as part of the development. Figure 1 is an extract from the DA approved architectural plans provided by Rose, illustrating the proposed development.

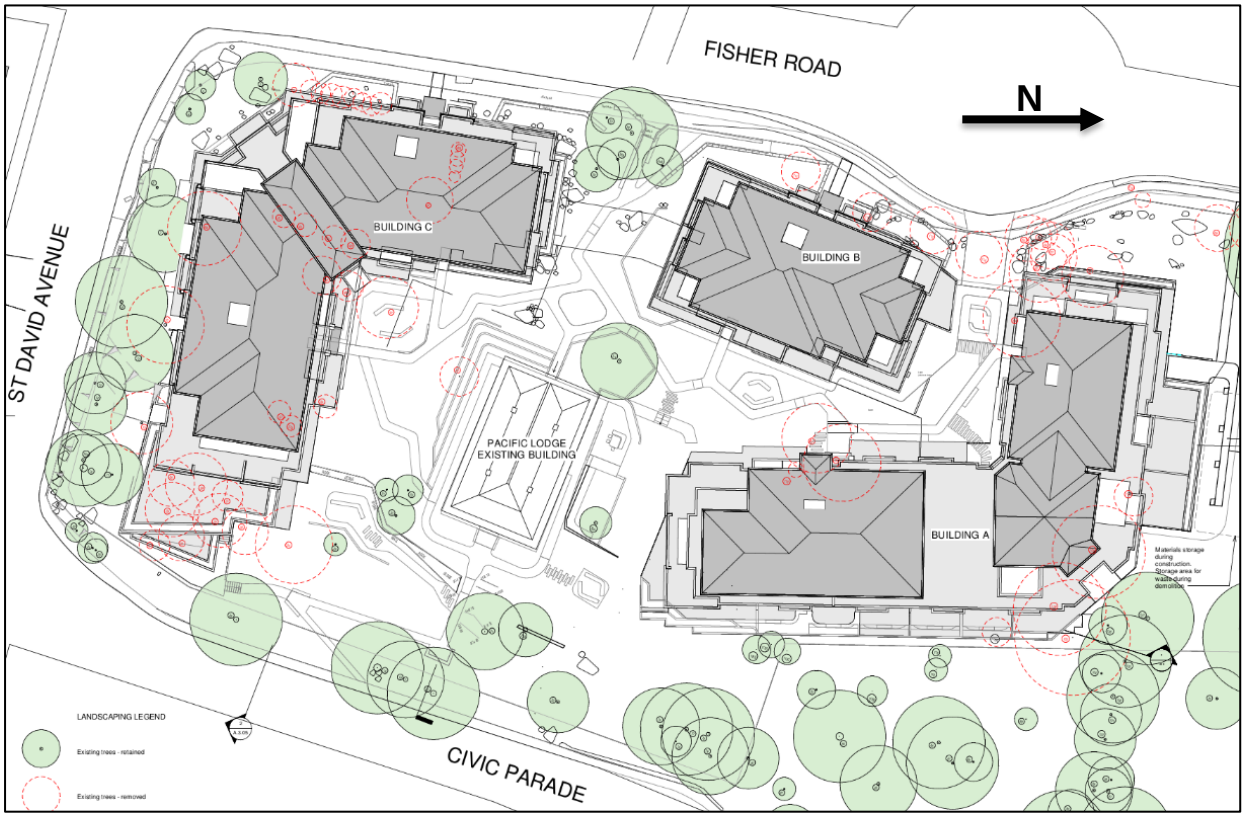

Figure 1 Proposed Development Plan

The three buildings, Buildings A, B and C comprise four to five storeys. A basement carpark will connect each of the three buildings, up to two levels below ground. The finished surface level (FSL)

beneath Building A is at 32.20 m AHD, Building B at 30.80 m AHD and Building C grading from 32.30 to 29.30 m AHD.

3. Site Description

The site is approximately 10,660 m^2 in area, bounded by Fisher Road to the west, St David Avenue to the south, and Civic Parade to the east. Apartment residences are located to the north of site, while a small, densely vegetated reserve is located along the northeast boundary.

The site resides on a sandstone knoll, rising above adjacent lands and properties. Elevation data obtained from the Intergovernmental Committee on Surveying and Mapping 1m LIDAR indicates ground levels vary substantially across the site. The south-east of site rises sharply from approximately 29 m AHD to approximately 36 m AHD in the south of site, then gently rising to a high of approximately 42 m AHD within the footprint of Building A.

As of this investigation, the site consists of several single-storey buildings and under-cover footpaths. The site is no longer operating. The buildings are becoming run-down with broken windows, downed canopies and weed growth. The Pacific Lodge heritage building within the centre of site is in cosmetically good condition.

Sandstone bedrock is seen to outcrop within the north-eastern and south-eastern portions of site. An area of potential filling is located near a few underground storage tanks in the central-northern portion of site.

4. Available Information

4.1. Previous Investigations

Coffey has previously completed several geotechnical and contamination assessments of the site, including:

- Geotechnical Study Proposed Residential Building Development 15 – 23 Fisher Road, Dee Why, NSW, dated 29 June 2011, REF: GEOTLCOV24292AA-AB
- Stage 1 Environmental Site Assessment – Proposed Development 23 Fisher Road Dee Why NSW, dated 8 July 2011, REF: GEOTLCOV24292AA-AC;
- Phase 1 Environment Site Assessment – Proposed Development – 23 Fisher Road, Dee Why NSW, dated 8 March 2018, REF: SYDEN216171-R01;
- Preliminary geotechnical study for Development Application at Fisher Rd, Dee Why NSW, dated 13 March 2018, REF: SYDEN216171-R02; and
- DA/2018/1574 Development Application – 23 Fisher Road, Dee Why – Groundwater Opinion, dated 1 February 2019, REF: GEOTLCOV24292AA-ZA.

Coffey has in its database library information on several previous geotechnical and contamination investigations and groundwater reporting completed for the nearby Dee Why Town Centre from 2006 until 2015, approximately 100 to 200 m east of site.

4.2. Geology

The NSW Seamless Geology GIS dataset indicates the site is underlain by Hawkesbury Sandstone comprising medium to coarse-grained quartz sandstone with very minor shale and laminite lenses.

Rock outcrops observed during the site walkover were noted to consist of medium to coarse grained, moderately to highly weathered, low to medium strength pebbly sandstone. Extremely weathered

clayey sand seams up to 150mm thick were visible between beds of sandstone. Bedding was mapped dipping between 8 – 26° towards the north. Prevalent joints were observed, dipping 80°to sub-vertical, towards north-west, typical of sandstone in the Sydney region.

4.3. Groundwater

A search of the Bureau of Meteorology's Australian Groundwater Explorer revealed one registered groundwater well within 500 m of the site used for monitoring purposes by WaterNSW, however no detail on water level was available.

Coffey's previous investigation at the nearby Dee Why Town Centre included a monitoring well in a council carpark, approximately 80 m east of site. The monitoring well was drilled from approximately 22 m AHD to 16.5 m AHD and did not encounter groundwater. Additional groundwater wells 200 m east of site, measured groundwater between 9.1 – 12.6 m AHD, with groundwater calculated in 2014 as flowing towards Dee Why Lagoon in the north-east.

5. Method of Investigation

5.1. Site Walkover

On 3 March 2020, Coffey attended site to complete a walkover of the proposed borehole locations. During this walkover, Coffey assessed the accessibility of the borehole locations, made notes on rock outcropping across the site and completed underground services locating by an accredited locator for each borehole location.

During the site visit, dimensions of the pedestrian walkways and roofs were measured to facilitate access of a drill rig for the borehole investigation. A number of potential borehole and backup locations were marked out onsite. Each borehole location was cross-referenced with 'Dial Before You Dig' (DBYD) plans and underground services located by an accredited utility locator.

Measurements of bedding and joint planes were taken from rock outcrops around the site.

During the walkover, it was noted that power and water had been cut to the site.

5.2. Subsurface Investigation

The field investigation consisted of four cored boreholes (BH1 to BH4) completed to depths between 10.03 metres below grade (mbg) and 13.07 mbg, or approximately between RL of 28.13 to 26.9 m AHD. These boreholes targeted a depth approximately 3 m below anticipated basement depths. Borehole locations were recorded in the field by hand-held GPS and are marked on the site plan in Appendix B – FIGURE 1. Drilling was undertaken over the 16th,17th, 27th and 30th of March 2020.

A track mounted drill rig with solid stem augers and tungsten-carbide (TC) drill bit was used to drill through concrete where present, surficial soils and extremely weathered bedrock. Standard Penetration Tests (SPTs) were undertaken during auger drilling at 1.5 m intervals to assess in-situ density/strength and obtain soil samples. Where TC-bit refusal was encountered within the proposed depth, the boreholes were advanced through rock using NMLC core drilling techniques (noted on borehole logs).

A Coffey geotechnical engineer was present during fieldwork to identify drilling locations, record test results, log the encountered ground conditions and box the rock core. The borehole logs and rock core photographs are attached as Appendix C, together with Coffey soil and rock description and explanation sheets.

Upon drilling the boreholes to target depth, standpipe piezometers were installed in boreholes BH1, BH3 and BH4, completed with metal gattic covers flush with the surface. Well construction details are included within Appendix C. Borehole BH02 was reinstated with sand and soil cuttings.

Following completion of fieldwork, selected soil and rock samples were sent to NATA accredited geotechnical laboratory for geotechnical testing.

One week from completion of the drilling programme, Coffey attended site to measure stabilised groundwater levels within the installed piezometers.

5.3. Laboratory Testing

Laboratory testing on selected samples comprised the following:

- Three moisture content of soils;
- Three particle size distribution (PSD);
- One Atterberg Limits;
- Four soil aggressivity;
- Two uniaxial compressive strength (UCS) of rock; and
- Point load $I_{S(50)}$ testing approximately every 1 m of rock core.

6. Geotechnical Model

6.1. Geotechnical Soil and Rock Units

For the purpose of geotechnical characterisation of the subsurface conditions, the soil and rock profiles encountered during Coffey's investigations have been characterise into the following geotechnical units shown in Table 1. Indicative cross-sections across the site illustrating the inferred ground profile based on the identified soil and rock units below are included in Appendix B – FIGURES 2 & 3.

Table 1 Geotechnical Model

Unit	Geological Unit	Typical Material Description	Rock Mass Classification [1]	Unit Thickness (m) [2]	Depth Range (m) [2]
1	Fill/Topsoil	Sand with trace clay, fine to medium grained	NA	0.3 – 5.25 [3]	0.3 – 5.25 [3]
2a	Low Strength Hawkesbury Sandstone	Moderately to slightly weathered, low strength, distinctly bedded at 0°-30°	V / IV	0.0 – 2.9	0.3 – 7.2
2b	Extremely Weathered and Low Strength Shale	Extremely weathered to Sandy CLAY or Fresh, very low to low strength SHALE, distinctly laminated at 0-10°	V / IV	0.4 – 0.6	7.2 – 9.75
2c	Medium to High Strength Hawkesbury Sandstone	Moderately weathered to fresh, medium strength, distinctly bedded at 0°-30°	III	0.0 -2.7	0.4 – 3.0, 7.7 – 11.0 [4]
2d	High strength Hawkesbury Sandstone	Moderately weathered to fresh, high strength, distinctly bedded at 0°-30°	II / I	0.0 – 6.2	2.6 – 9.3, 9.3 – 13.07 [4]

Notes
[1] Rock classified using the classification system by Pells, et al. (2019) "Classification of Sandstones and Shales in the Sydney Region: A Forty Year Review" Australian Geomechanics Journal, Vol 54, No. 2, June 2019.
[2] Only proven within boreholes.
[3] Depth to bedrock in borehole BH02 was significantly deeper than other boreholes. The borehole was located close to an underground service which may account for the depth of fill.
[4] Beds of this unit were encountered at two distinct depths.

Rock classification is based on the worst condition encountered within the unit. All units may contain zones of rock with greater strength and possessing fewer defects than the indicated rock mass classification. For specific borehole locations, reference should be made to the attached borehole logs.

Fill was generally surficial across the site, with sandstone very shallow or outcropping. Borehole BH02 encountered a deep fill profile of 5.25 m thick. This is potentially due to its proximity to an underground sewer/stormwater service which may have been trenched and filled around.

Rock quality generally improves with depth until encountering unit 2b shale, whereby the shale is significantly lower strength than the overlying sandstone. Underlying unit 2b, the sandstone quality is lower than the unit directly overlying the shale. However, with increasing depth, the quality of the sandstone is expected to increase as was seen in borehole BH03 which terminated in unit 2d, Class I sandstone. All other boreholes terminated in unit 2c, Class III sandstone.

6.2. Groundwater

Groundwater inflows were not encountered during auger drilling and due to the use of water as a drilling fluid, are unable to be observed during core drilling.

Groundwater levels were measured in the standpipes installed in boreholes BH1, BH3 and BH4 on 14 April 2020 between depths of 4.84 to 6.74 mbg, corresponding to elevations of approximately 30.86 to 32.91 m AHD.

A summary of the measured water levels in the piezometers is provided in Table 2.

Table 2 Summary of Groundwater Levels Observed on 14 April 2020

Borehole ID	Approximate Surface Level (m AHD)	Groundwater Level (mbg)	Groundwater Elevation (m AHD) *
		14 April 2020	
BH01	37.00	4.84	32.16
BH03	39.30	6.39	32.91
BH04	37.60	6.74	30.86

Notes:
* Elevation estimated from 2018 Survey plan of site held on record and NSW Spatial Services 1m LIDAR

7. Geotechnical Laboratory Test Results

7.1. Material Classification Results

The results of the particle size distribution and Atterberg Limit test results are summarised in Table 3 below with the laboratory report sheets attached in Appendix D.

Table 3 Geotechnical Soil Classification Laboratory Results

Borehole	Depth (m)	Material	Origin	Particle Size (%)			Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)
				Gravel	Sand	Fines				
BH01	0.2 – 0.3	SAND	FILL	1	89	10	10.0w	--	--	--
BH02	0.5 – 0.95	SAND	FILL	9	79	12	14.8	--	--	--
BH02	1.5 – 1.95	SAND	FILL	5	85	10	18.7	NP	N/A	NP

Notes::
NP denotes non-plastic
-- = test not conducted

7.2. Soil Aggressivity Test Results

The results of the soil aggressivity test results are summarised below in Table 4 with the laboratory report sheets attached in Appendix D.

Table 4 Soil Aggressivity Test Results

Unit	Hole IDBH	Depth (m)	Soil Type and (Groundwater Condition)	pH (1:5) (1) for concrete pile	EC (µS/cm)	Resistivity (Ωcm) (2)	Sulphate (mg/kg), Classification for concrete piles	Chloride (mg/kg), Classification for concrete piles
1	BH01	0.8-0.9	Sand Fill above groundwater	7.2	28	35714	10	<10
1	BH02	0.2-0.3	Sand Fill above groundwater	7.8	20	50000	<10	<10
1	BH03	0.2-0.3	Sand Fill above groundwater	8.8	76	13158	23	<10
1	BH04	1.5-1.95	Sand Fill above groundwater	8.7	17	58824	<10	<10

Notes:
a) Exposure classification for concrete piles based on pH, the exposure classification for steel piles are slightly different based on pH values and has been discussed in the respective section of this report
b) Aggressivity classification for Steel Piles based on resistivity

Scale of aggressivity obtained from AS2159 – 2009 (Australian Standard AS2159-2009, 2009) for concrete piles in soil

Non Aggressive
Mildly Aggressive
Moderately Aggressive
Severely Aggressive
Very Severely Aggressive
– Not Tested/ Not Applicable

7.3. Rock Strength Test Results

Point load test results are presented on the borehole logs. Table 5 presents the uniaxial compressive strengths (UCS) results. The results obtained are typical of Hawkesbury Sandstone strengths and are generally in the medium to high strength range (as per AS 1726:2017). Laboratory data sheets are attached in Appendix D.

Table 5 Rock UCS Laboratory Results

Borehole	Depth (m)	Rock Description	UCS (MPa)	Dry Density (t/m^3)	Inferred Rock Strength*
BH03	9.20 – 9.36	Sandstone	41.8	2.351	High
BH04	10.43 – 10.63	Sandstone	26.5	2.175	High

Notes:
* Based on AS1726:2017

8. Discussions and Recommendations

8.1. Foundations

It is understood that the foundations for the proposed development include both shallow and deep foundations.

It is expected that pad or pile footings into moderately weathered or better sandstone will be required for the foundations of the new buildings. Table 6 below presents the Limit State geotechnical design parameters that may be used for design of pad footings and bored piles into the different classes of rock encountered onsite. While parameters have been included for Unit 2b, the low to very low strength shale band, we recommend all foundations be founded on sandstone of the same rock class. Founding on similar strata helps to limit the effects of differential settlement.

Table 6 Geotechnical Foundation Design Parameters for Shale and Sandstone

Material	Ultimate End Bearing Value (MPa)	Ultimate Shaft Adhesion (kPa)	Vertical Elastic Modulus Ev (MPa)
Class V Shale	0.7	50	50
Class IV Shale	1	150	100
Class V Sandstone	0.8	150	80
Class IV Sandstone	1	400	400
Class III Sandstone	3.5	1000	750
Class II Sandstone	6	1500	1000
Class I Sandstone	12	3000	2000

Notes:

a) Assumes a minimum embedment depth of at least 0.5 m into the relevant bearing stratum or one pile dimeter, whichever is deeper.

b) Shaft adhesion assumes a rough socket (at least grooves of depth 1 mm to 4 mm and width greater than 5 mm at spacing of 50 mm to 200 mm)

c) Foundation unit extends to a depth of at least 5 times of pile diameter below pile toe.

For the use of geotechnical design parameters for Class III or better sandstone, geotechnical proving of foundation conditions for individual footings will be required. Such proving would require geotechnical inspections during construction to check rock mass quality.

For pad footings, either a working stress or limit state design method could be adopted. For piles a limit state design method should be used if the design is to comply with AS2159-2009 “Piling – Design and installation”.

Footings designed using the serviceability end bearing pressures given above should result in settlements of less than 1% of the least footing dimension. Coffey can provide detailed analysis and refinement of the foundation system to support detailed design if required.

In accordance with AS2159-2009, the geotechnical strength reduction factor, Φg, is dependent on assignment of an Average Risk Rating (ARR) which considers various geotechnical uncertainties, redundancy of the foundation system, construction supervision, and the quantity and type of pile testing. The assessment of Φg therefore depends on the structural design of the foundation system as well as the design and construction method, and testing (if any) to be employed by the designer and piling contractor.

To assist with preliminary design, we recommend Φg of 0.5 be adopted for pile/footings on sandstone. The final selection of Φg should be reviewed by the design geotechnical engineer for the project.

8.1.1. Aggressivity

Based on the summary of analytical results presented in Table 4, it was found the sandy fill encountered within the boreholes is non-aggressive towards buried concrete and steel elements.

8.2. Excavatability

Bulk excavations for the basements are interpreted from the concept design drawings to extend to elevations of 32.30 m AHD at Building A, 30.80 m AHD at Building B and 29.30 m AHD at Building C, with the excavation floor generally within Units 2c and 2d.

A summary of the excavatability of the encountered soil and rock is contained in Table 7 and is suggested as a guide only. Excavation contractors should inspect the rock core, engineering logs and core photographs to make their own judgement as to likely productivity and specific plant.

Table 7 Excavatability Requirements

Material	Strength	Likely Minimum Plant Requirements
Units 1, 2a and 2b	Generally soil strength and very low rock strength	Bulldozer blade, excavator bucket. Localised hard zones may require ripping and rock breaking.
Unit 2c	Low to high strength rock	Bulldozer with ripper, excavator bucket. Higher strength zones may require a rock breaker.
Unit 2d	High strength rock	Cat D10 or equivalent. Rotary rock grinder or rock saw attachments may be required to avoid over break and excessive vibrations below shoring and near adjected vibration sensitive structures. Higher strength bands may require a rock breaker.

The use of hydraulic impact hammers for bulk excavation, trimming the sides of excavations, and detailed excavation, will cause vibrations that could affect vibration sensitive structures and services. Assessment of the potential impacts of excavation induced vibrations should be considered as part of detailed design and excavation planning. Additional discussion of the vibration monitoring requirements is contained in Section 8.3.3.

8.3. Excavation Support Requirements

8.3.1. Unsupported Excavations

Batter slopes or bench excavation should be possible where excavations can be set back sufficiently from adjacent structures. The batter slopes or benches should be scaled following excavation to

remove all loose material which could slide or topple from the face during construction and hence pose a risk to construction personnel.

Table 8 below provides a summary of the recommended batter slopes for each geotechnical unit likely expected within the depth of excavation of up to 3 m in height and above the groundwater table. It should be noted that the proposed batters in rock are subject to assessment by a geotechnical engineer during construction. If adverse joints or other defects are present, flatter batters or slope stabilisation may be required. Temporary batters should not be in place for longer than three months, as a general guide.

Table 8 Maximum Allowable Batter Slopes

Geotechnical Unit	Temporary Batter	Permanent Batter
Unit 1 - Fill	2H:1V	3H:1V
Class V Sandstone / Shale	1H:1V	1.5H:1V
Class IV Sandstone / Shale	0.5H:1V	1H:1V
Class III Sandstone or better	Near Vertical	0.5H:1V

Notes:
a) Protection against erosion may be required/
b) Localised or pattern rock bolting may be required to stabilise rock wedges or blocks formed by unfavourably oriented defects. Significantly weaker bands in the shale may require shotcrete protection against degradation.

These recommended maximum batters are based on there being no structures or surcharge located at or near the crest of the cuts. Steeper slopes in the soil and weathered rock materials would require engineer designed retaining structures. Case-specific advice is required for unsupported cuts greater than 3 m in height. The above batter slopes assume that no groundwater seepage occurs along the battered face. Where seepage occurs or where adverse weather conditions extend for a period of time, advice should be obtained from a geotechnical consultant and slopes inspected. It is recommended to install diversion drains above the crests of all batters to direct runoff from the batter face to limit erosion.

8.3.2. Design Parameters for Retaining Wall Design

Where the recommended batter slopes are impractical to construct, steeper batters or vertical cuts can be achieved by employing a (temporary or permanent) shoring system installed during construction.

For vertical excavation sidewalls, sheet pile walls are considered impractical at this site due to the shallow depth of rock level. Whilst soldier pile shoring walls can often be used in this geology, the development site is in the vicinity of a heritage structure and roads. A stiffer shoring wall system, such as secant piles, diaphragm walls or contiguous piles, may be required to limit excavation-induced ground movements. Where it is important to minimise adjacent ground movements due to the presence of sensitive structures or services, internal bracing and/or tie-back anchors may also be required during construction.

Based on our experience, a slope batter for soils steeper than 1V:1H during excavation is not recommended. As is recommended in Table 8 above, class V rock can be formed in a 1H:1V slope batter during construction. However, if adverse joints or other defects are present, flatter batters or slope stabilisation (such as shotcrete) may be required. Subject to the assessment of actual site conditions by an experienced geotechnical engineer or geologist during excavation, a near vertical cut in class IV rock can be achieved if additional geotechnical stabilisation measures are implemented.

Table 9 presents recommended design parameters for the design of temporary retaining walls where there is a level retained ground surface. The Ko values in Table 9 assume that some wall movement and relaxation of horizontal stress will occur due to the excavation. Actual in-situ Ko values may be higher, particularly in the rock units. Retaining wall analyses will need to consider surcharges, footing loads from adjacent structures and hydrostatic pressure.

Table 9 Recommended Parameters for Temporary Retaining Wall Design

Material	Bulk Density γ (kN/m3)	Effective Cohesion c' (kPa)	Effective Friction Angle Φ' (°)	Coefficient of Active Earth pressure, Ka	Coefficient of Earth pressure at rest, Ko	Coefficient of Passive Earth pressure, Kp	Elastic modulus E_H (MPa)
Fill	19	0	28	0.4	0.50	2.5	10
Class V Sandstone	22	10	30	0.3	0.50	3.5	40
Class IV Sandstone	23	50	35	0.27	0.50	3.7	100
Class III Sandstone	24	250	40	0.27	0.50	3.7	350

Notes:
a) K_0 of 0.5 assumes a small amount of wall movement (0.1 to 0.3% of wall height). In-situ K_0 may be significantly higher (approximately 2 to 3), particularly in soils derived from weathered rock and weathered, low strength rock units.

Ground anchor design should be based on allowing effective anchorage to be developed by locating the bond length behind an 'active zone', determined by drawing a line at 45° from the base of the wall to intersect the ground surface behind the excavated face. The following ultimate bond stresses presented in Table 10 below can be adopted for ground anchor design with the provision that bond lengths are between 3 m to 5 m and anchors are to be proof loaded to at least 1.5 times their design working load.

Table 10 Recommended Bond Stresses for Ground Anchor Design

Material Description	Ultimate Bond Stress (kPa)
Class V Sandstone	200
Class IV Sandstone	500
Class III Sandstone	800
Class II Sandstone	1500
Class I Sandstone	2000

8.3.3. Excavation Induced Ground Movements

Excavation will cause some ground movements adjacent to the excavation site. The magnitude of the movements that will be experienced by a retaining wall will depend on various factors including the earth pressures that exist, groundwater conditions and construction sequence. Documented data has shown that for well-designed and constructed shoring, vertical and lateral movements can be about 0.1% to 0.3% of the retained height at the excavation face. Lateral ground movements can occur at distances up to twice the basement depth from the edge of excavations.

It shall be noted that the assessment of excavation-induced ground movements involves detailed soil structure interaction analysis. The accuracy of the assessment results plays an important role in determining the impact of the excavation on the adjacent structures and roads as well as evaluating the effectiveness of the proposed retaining wall. If this assessment is required, Coffey can provide the assessment (by numerical analyses) during the detailed design when more design information becomes available.

It is recommended that dilapidation surveys be carried out prior to the commencement of the excavation to assess the condition of the buildings within the zone of influence of the excavation. Potential risk of damage to buildings from ground movements during excavation should be considered

during the development of the excavation methodology. Ground movements of the buildings should be monitored during excavation to reduce the risk of damage from excessive ground movements.

8.3.4. Protection of Adjacent Structures

For the protection of adjoining structures, the type of structure, location, layout, and depth should be determined at the commencement of excavation design works. This information could then be used in conjunction with available information on site ground conditions and the results of any subsequent investigations for geotechnical assessments to determine whether the excavations may affect existing structures. Depending on the complexity of the geotechnical problem, analytical methods would range from a simple empirical assessment, through to 3-dimensional finite element analyses and consultation with the project structural engineers will be required to assess possible load influences, resulting ground movements/stresses, and additional support requirements.

The use of excavation plant such as impact hammers will generate vibrations that may affect any surrounding sensitive structures and buried services. Measures to mitigate the risks associated with vibration such as the use of rock saws or rock grinders should be considered. The vibration limits in Table 11 below are commonly recommended to reduce the risk of vibration damage to sensitive receptors.

Table 11 Ground Vibration Limits for Various Types of Structures

Type of Structure	Peak Particle Velocity (mm/s)
Historic buildings or monuments	3
Residential or low-rise buildings in good condition	10
Reinforced concrete commercial and industrial buildings in good condition	25

It is recommended that a vibration limit is selected considering the structure of concern. It should be noted that limits set by the relevant authorities may override these recommendations.

Dilapidation surveys should be carried out on neighbouring structures or sensitive services prior to commencing excavation as a baseline record of their condition. Excavation trials with vibration monitoring should also be carried out to assess appropriate distances for various excavation plant to be used to limit generated vibrations and need for ongoing vibration monitoring during site works to confirm that the limits are not exceeded.

Where excavations may impact on existing foundations of nearby structures, underpinning may be required, depending on the founding level of the building foundations, lateral support provided and rock conditions. This should be determined prior to basement excavation and carried out on a design and construct basis.

8.4. Earthworks

8.4.1. Use of Excavated Material as Fill

Topsoil, asphalt, vegetation, and other potentially deleterious material should be stripped and should only be re-used as landscaping material only.

The existing sandy fill identified in this investigation can be re-used as general fill, provided it is properly compacted.

A Waste Classification of any materials to be disposed of offsite will be required before doing so.

8.4.2. Compaction Requirements and Procedures

For bulk earthworks using modern purpose-built earthmoving plant, fill material should be placed in layers not exceeding 300mm loose thickness and moisture conditioned to Standard Optimum Moisture Content (SOMC) ± 2%.

All engineered fill should be compacted to achieve a minimum dry density ratio of 98% SMDD (Standard Maximum Dry Density) and moisture conditioned to SOMC ± 2% at the time of compaction.

Earthworks construction should be constructed under Level 1 geotechnical inspection and testing as defined in AS3798-2007.

8.5. Groundwater Considerations

At the time of Coffey's groundwater monitoring on 14 April 2020, groundwater was measured between 30.86 to 32.91 m AHD. The supplied design plans indicate the lowest level of basement will be at an elevation of 29.30 m AHD, below the measured water table depth.

Seepage will typically be encountered at the soil/rock interface and in fractures within the bedrock. Seepage in the bedrock may be assumed as typically flowing downwards towards local drainage line or regional water table. Based on measured groundwater levels and general site topography, groundwater inflow may potentially be running towards the south-east, towards an unnamed water channel which flows northward into Dee Why Lagoon.

Groundwater inflows may be captured by strip drains installed behind any shoring system or retaining walls and diverted into the stormwater system. Where additional inflows are encountered, pump-and-sump methods could be adopted to dewater the excavation for the inflow. The groundwater should be directed and stored in sedimentation tank/basins, analysed and potentially treated prior to release into the Council stormwater or sewerage system, depending on consultation with Council. Water quality testing should be undertaken in accordance with Council requirements prior to discharge.

8.6. Earthquake Loadings

The Australian Standard for Earthquake loads (AS 1170.4) provides guidance on the design of structures for earthquake loads. For Sydney, AS 1170.4 quotes an acceleration coefficient of a = 0.08. Based on the subsurface profile encountered during the investigations and with reference to Table 4.1 of AS1170.4, the site classification is considered Class B_e – Rock.

9. Limitations of this Report

Subsurface conditions can be complex and may vary over relatively short distances – and over time. The inferred geotechnical model and recommendations in this report are based on limited subsurface investigations at discrete locations. The engineering logs describe subsurface conditions only at the investigation locations. Further investigations may be required to support detailed design if there are scope limitations or changes to the nature of the project. We can assist with detailed design and/or to review designs and verify that the conditions exposed are consistent with design assumptions during construction.

The attached document entitled "Important information about your Coffey report" forms an integral part of this report and presents additional information about its uses and limitations.

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

Appendix A – Design Plans

1 Site Plan
1 : 250

Verify all dimensions on site prior to commencement of work.
Refer all discrepancies to the Architect for determination.
Use figured dimensions in preference to scaling.

DATUM : AHD

Setout

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			
C	REFER SCHEDULE	24.April.19			

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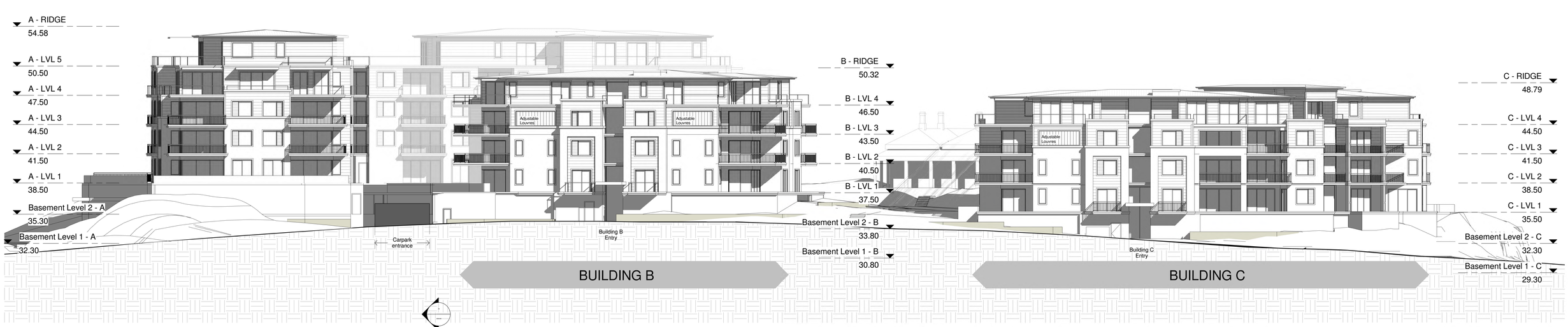
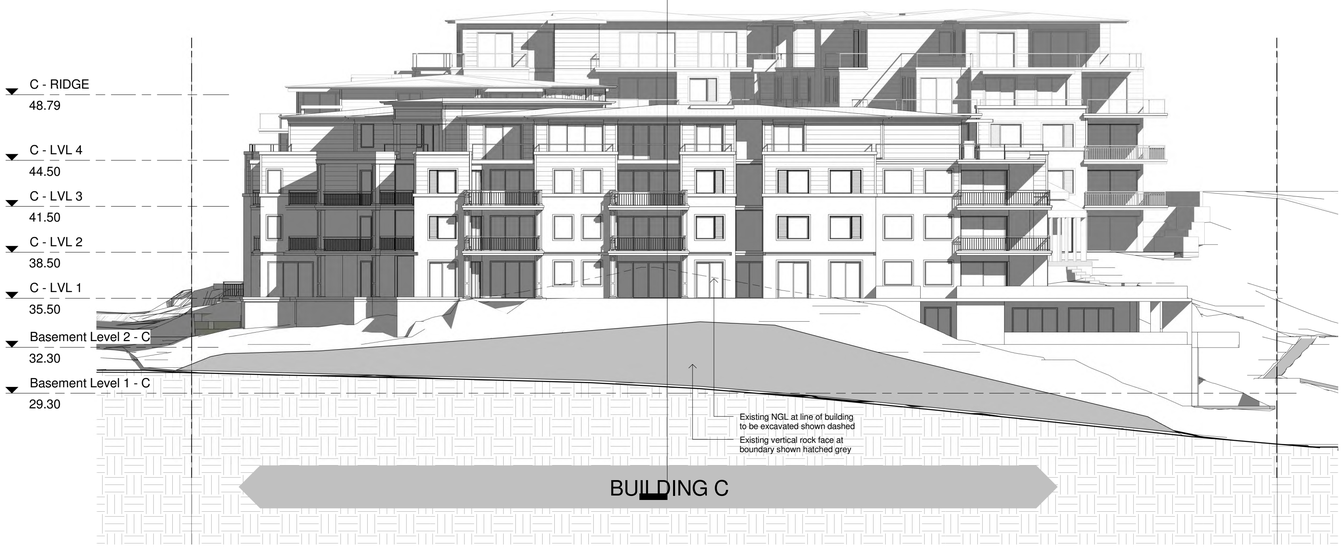
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **SITE PLAN**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:250 Date: APRIL 2019	Project No: 1607	Drawing No: **A 1.01**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**



1 West Elevation (No trees)
1 : 200



2 South Elevation (No trees)
1 : 200

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Use figured dimensions in preference to scaling.

DATUM : AHD

Setout

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
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C	REFER SCHEDULE	24.April.19			

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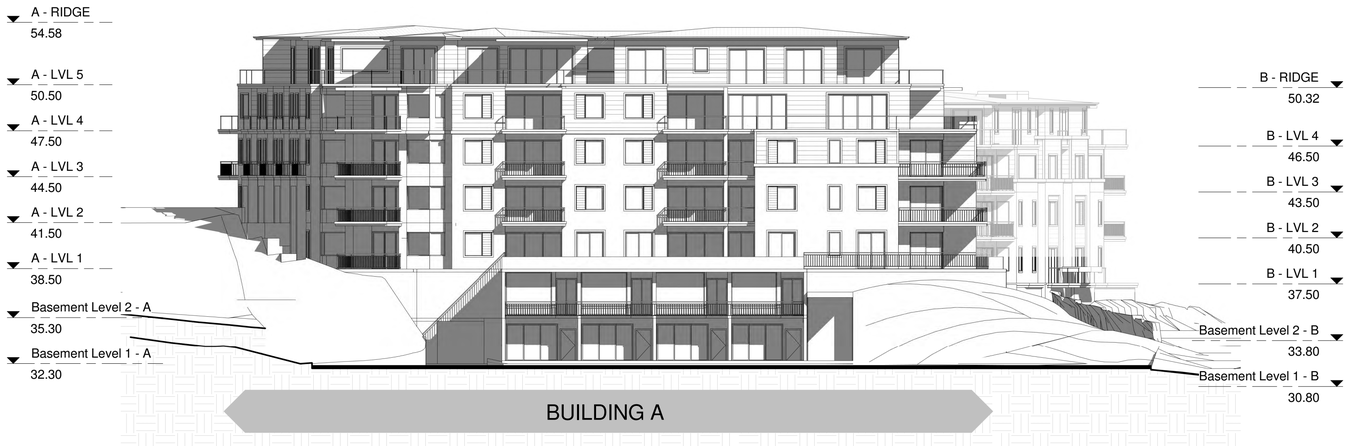
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **WEST ELEVATION & SOUTH ELEVATION (no trees)**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 3.02**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**

1 East Elevation (No trees)
1 : 200



2 North Elevation (No trees)
1 : 200

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Verify all dimensions on site prior to commencement of work.
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DATUM : AHD

Setout

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			
C	REFER SCHEDULE	24.April.19			

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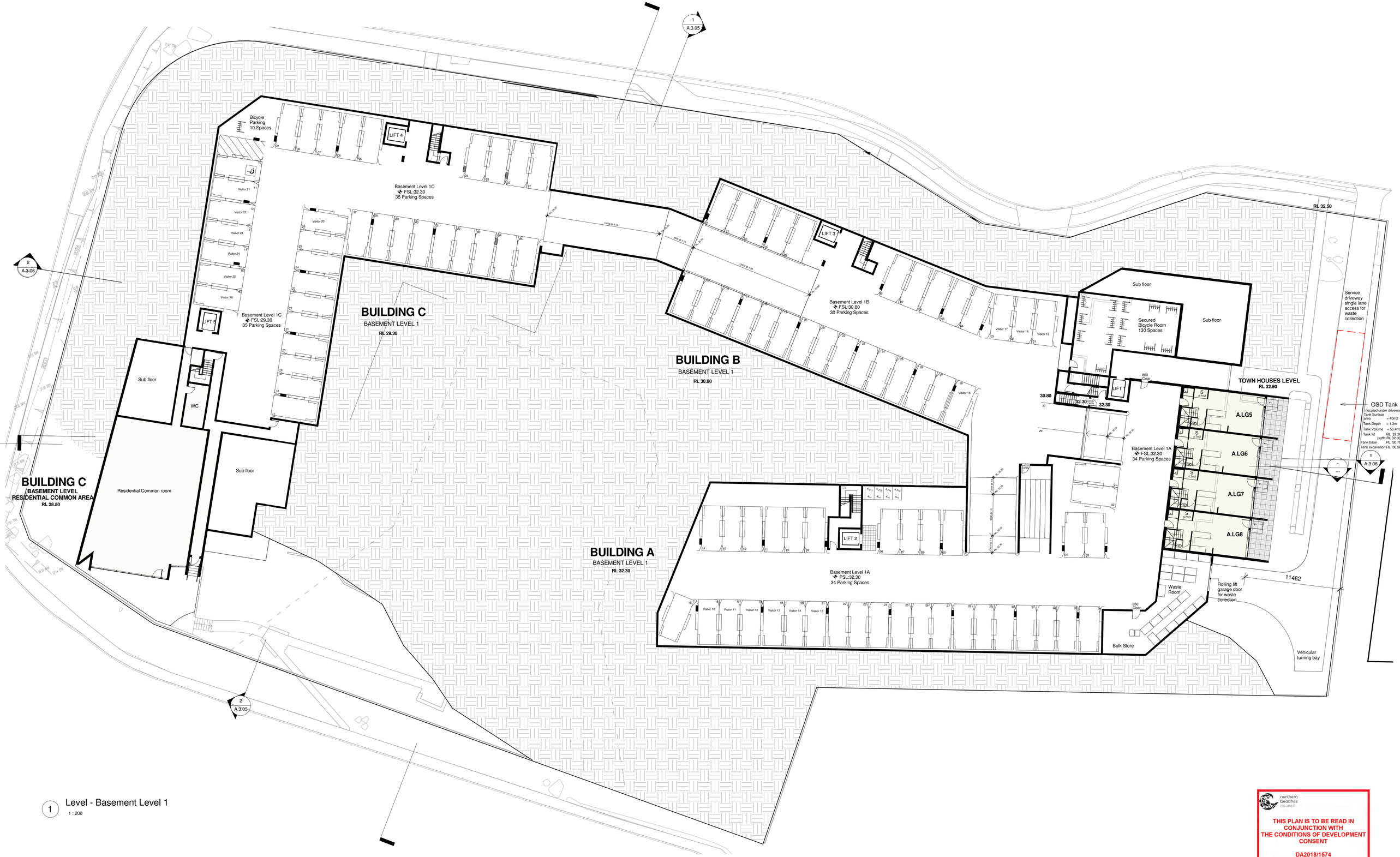
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **EAST ELEVATION & NORTH ELEVATION (no trees)**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 3.04**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**



1 Level - Basement Level 1
1 : 200

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			
C	REFER SCHEDULE	24.April.19			

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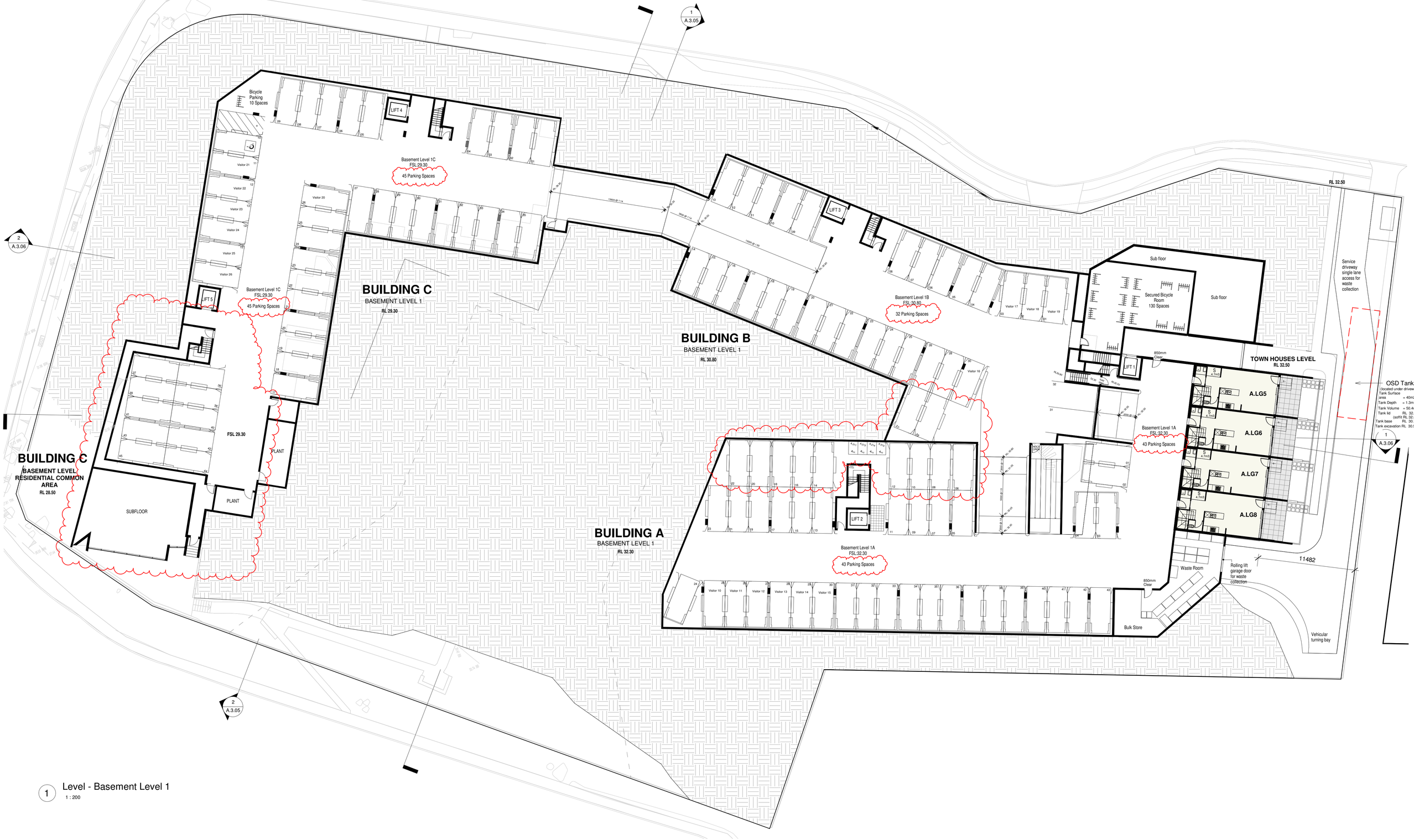
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **BASEMENT PARKING PLAN 1**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 2.01**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**



1 Level - Basement Level 1
1 : 200

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			
C	REFER SCHEDULE	24.April.19			
D	SECTION 4.55 APPLICATION	06.Feb.19			

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Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **BASEMENT PARKING PLAN 1**		Status: DEVELOPMENT APPLICATION
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200	Date: APRIL 2019	Project No: 1607 / Drawing No: **A 2.01**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD	Reviewed: Checked: AO	Revision: **D**

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			
C	REFER SCHEDULE	24.April.19			

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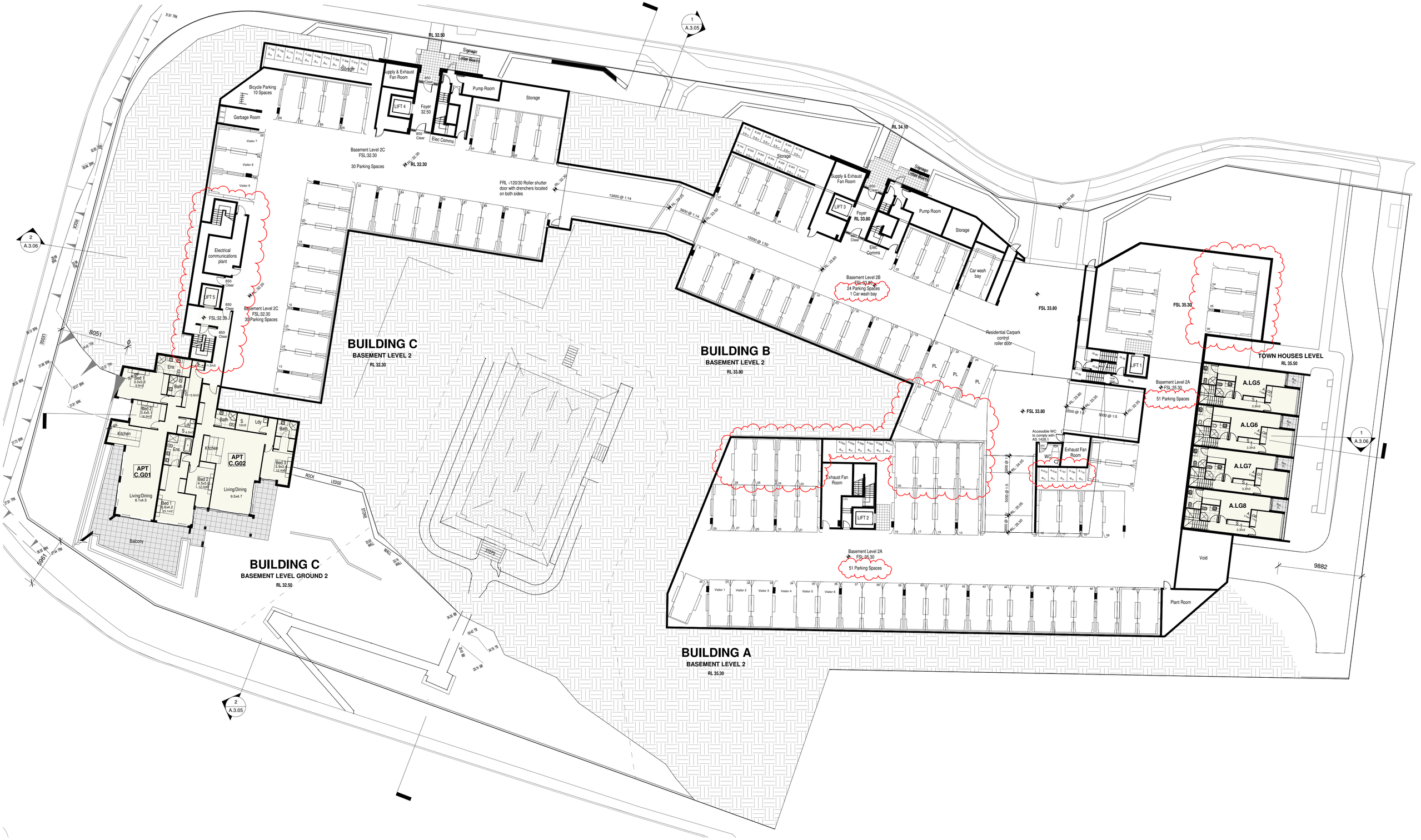
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **BASEMENT PARKING PLAN 2**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 2.02**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**



DATUM : AHD

Setout

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03 Sept.18			
B	REFER SCHEDULE	20 Feb.19			
C	REFER SCHEDULE	24 April.19			
D	SECTION 4.55 APPLICATION	06 Feb. 20			

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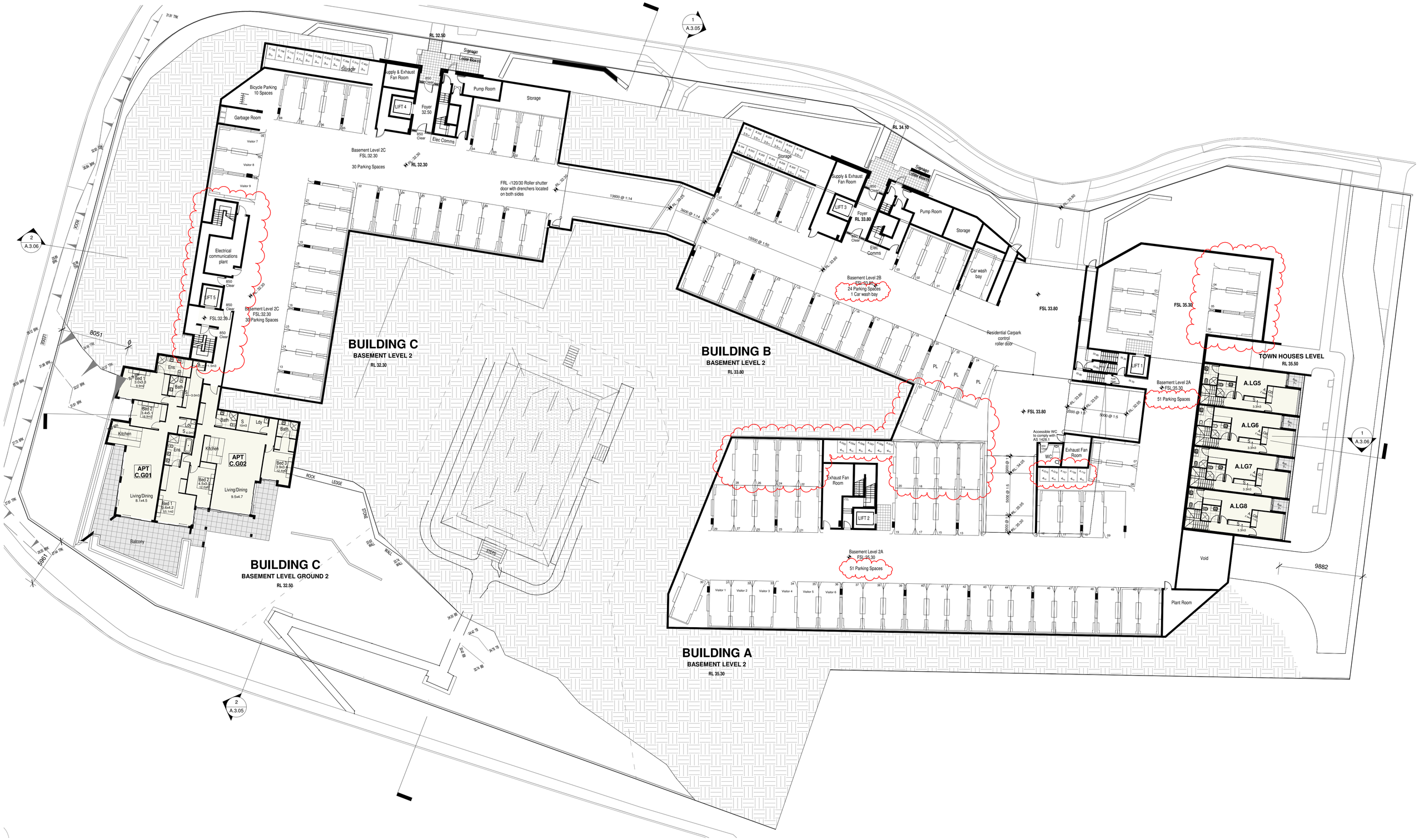
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **BASEMENT PARKING PLAN 2**		Status: DEVELOPMENT APPLICATION
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200	Date: APRIL 2019	Project No: 1607 / Drawing No: **A 2.02**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD / Reviewed: / Checked: AO		Revision: **D**


BUILDING C
BASEMENT LEVEL 2
RL 32.30
BUILDING C
BASEMENT LEVEL GROUND 2
RL 32.50
BUILDING B
BASEMENT LEVEL 2
RL 33.80
BUILDING A
BASEMENT LEVEL 2
RL 35.30
Basement Level 2C
FSL:32.30
30 Parking Spaces
Basement Level 2B
FSL:33.80
24 Parking Spaces
1 Car wash bay
Basement Level 2A
FSL:35.30
51 Parking Spaces
Bicycle Parking
10 Spaces
Garbage Room
Storage
Supply & Exhaust
Fan Room
Pump Room
Foyer
32.50
Elec Comms
LIFT 4
LIFT 5
LIFT 3
LIFT 1
LIFT 2
Electrical
communications
plant
FRL -/120/30 Roller shutter
door with drenchers located
on both sides
13600 @ 1:14
3600 @ 1:14
16000 @ 1:50
Car wash
bay
Foyer
RL 33.80
Residential Carpark
control
roller door
FSL 33.80
Exhaust Fan
Room
Accessible WC
to comply with
AS 1428.1
WC
5000 @ 1:5
5000 @ 1:5
5000 @ 1:5
Void
Plant Room
TOWN HOUSES LEVEL
RL 35.50
A.LG5
A.LG6
A.LG7
A.LG8
APT
C.G01
APT
C.G02
Kitchen
Living/Dining
8.1x4.5
Living/Dining
9.5x4.7
Bed 1
3.6x4.2
15.1m2
Bed 2
3.4x5.3
18.9m2
Bed 2
4.5x3.0
12.0m2
Bed 3
3.9x3.2
12.4m2
Balcony
Visitor 1
Visitor 2
Visitor 3
Visitor 4
Visitor 5
Visitor 6
Visitor 7
Visitor 8
Visitor 9
ROCK LEDGE
STONE WALL
STEPS
8051
5961
9882
RL 32.50
RL 32.30
RL 34.10
RL 33.80
RL 35.30
RL 35.55
RL 35.30
FSL:32.39
FSL 35.30
1
A.3.05
2
A.3.06
2
A.3.05
1
A.3.06

1 Level 1 plan
1 : 200

Verify all dimensions on site prior to commencement of work.
Refer all discrepancies to the Architect for determination.
Use figured dimensions in preference to scaling.

DATUM : AHD

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			
C	REFER SCHEDULE	24.April.19			

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Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **LEVEL 1 PLAN**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200	Date: APRIL 2019	Project No: 1607 / Drawing No: **A 2.03**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD	Reviewed:	Checked: AO / Revision: **C**

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1 Level 2 Plan
1 : 200

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			
C	REFER SCHEDULE	24.April.19			

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Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **LEVEL 2 PLAN**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 2.04**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**

1 Level 3 plan
1 : 200

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DATUM : AHD

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Issue	Description	Date	Issue	Description	Date
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Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **LEVEL 3 PLAN**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 2.05**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**

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1 Level 4 plan
1 : 200

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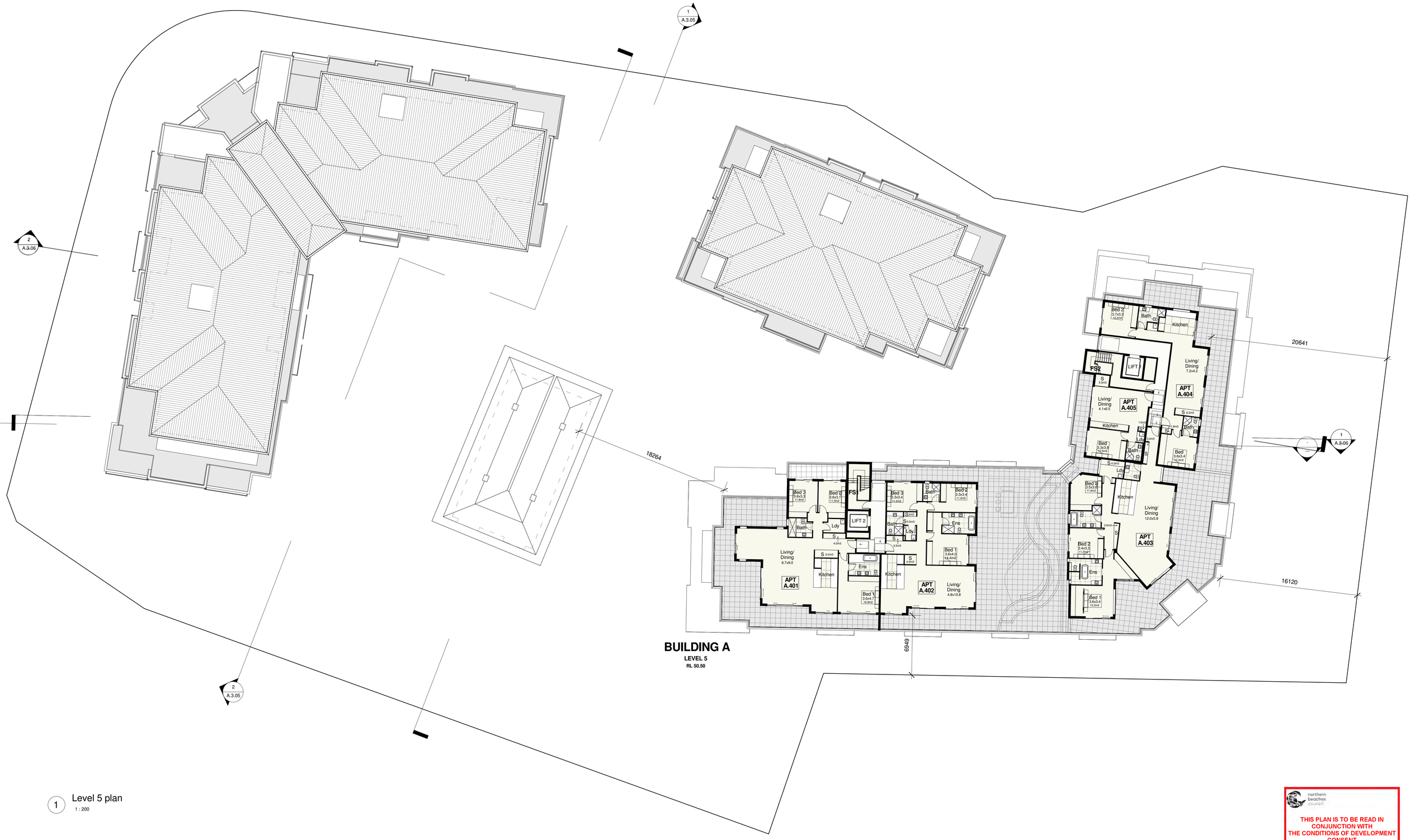
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **LEVEL 4 PLAN**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 2.06**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**



1 Level 5 plan
1 : 200

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Issue	Description	Date	Issue	Description	Date
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Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **LEVEL 5 PLAN**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **A 2.07**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**

Setout

1 Roof Plan
1 : 200

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Issue	Description	Date	Issue	Description	Date
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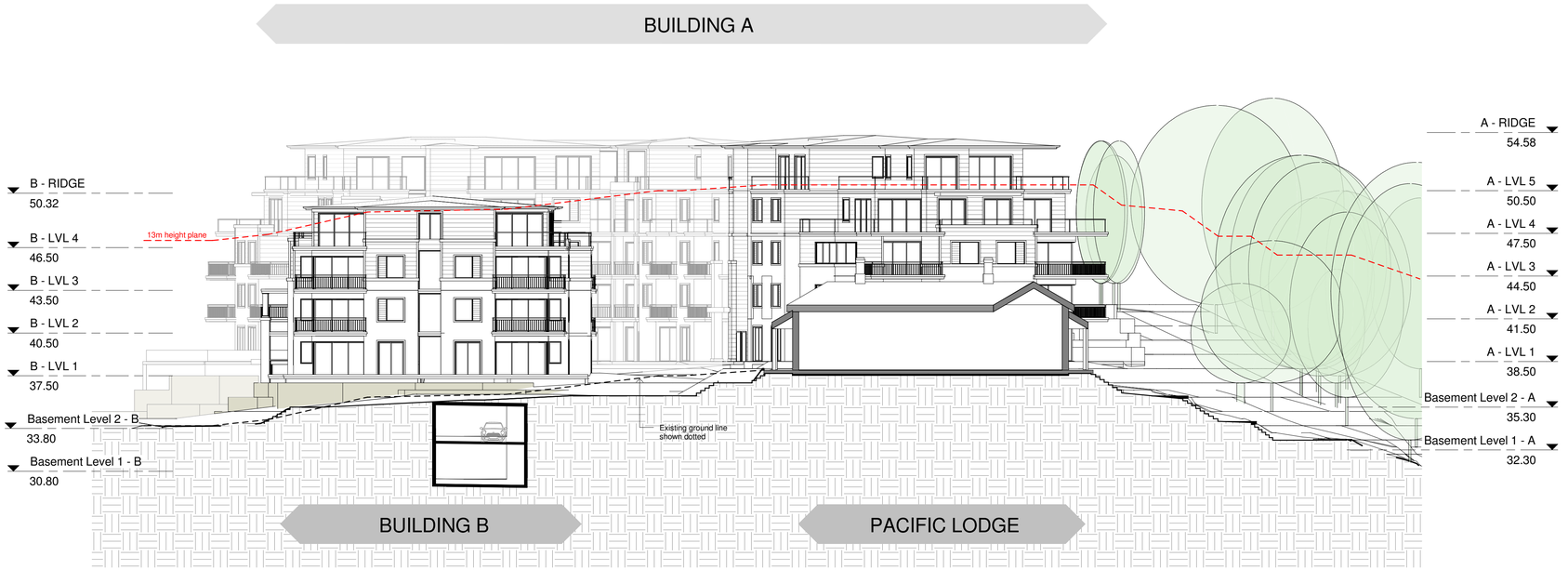
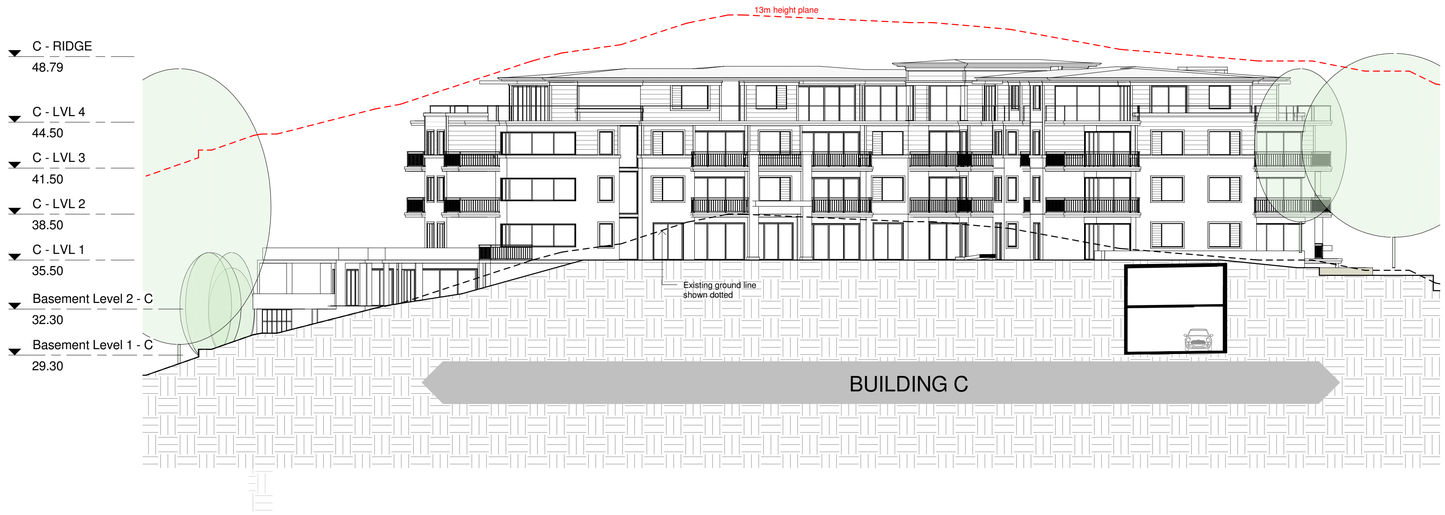
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **ROOF PLAN**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: APRIL 2019	Project No: 1607	Drawing No: **DA.2.08**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **C**



1 Section A-A
1 : 200



2 Section B-B
1 : 200

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DATUM : AHD

Setout

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			

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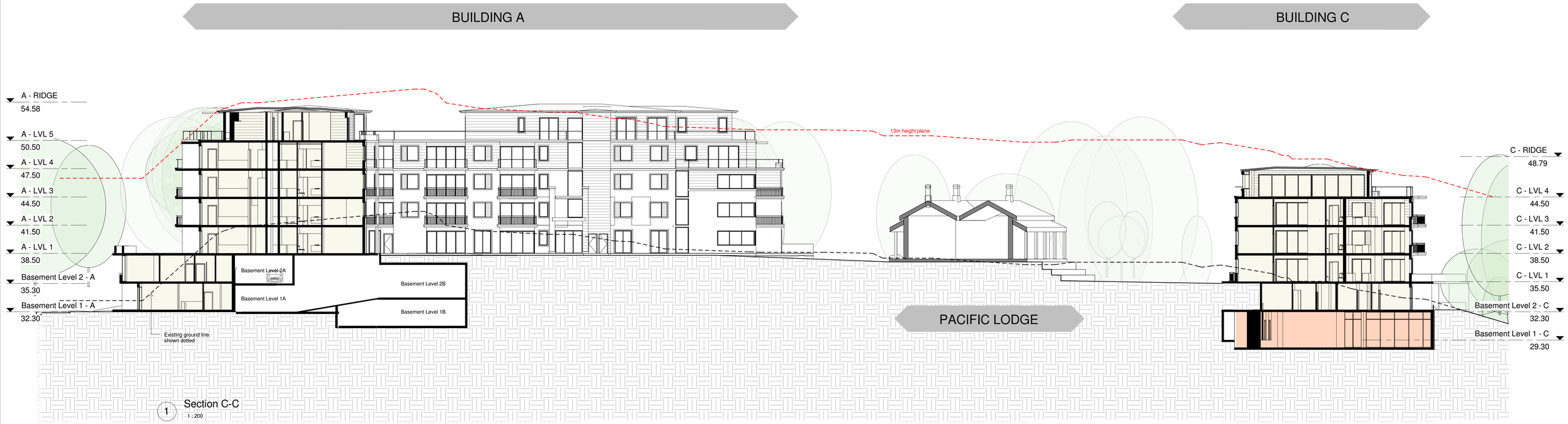
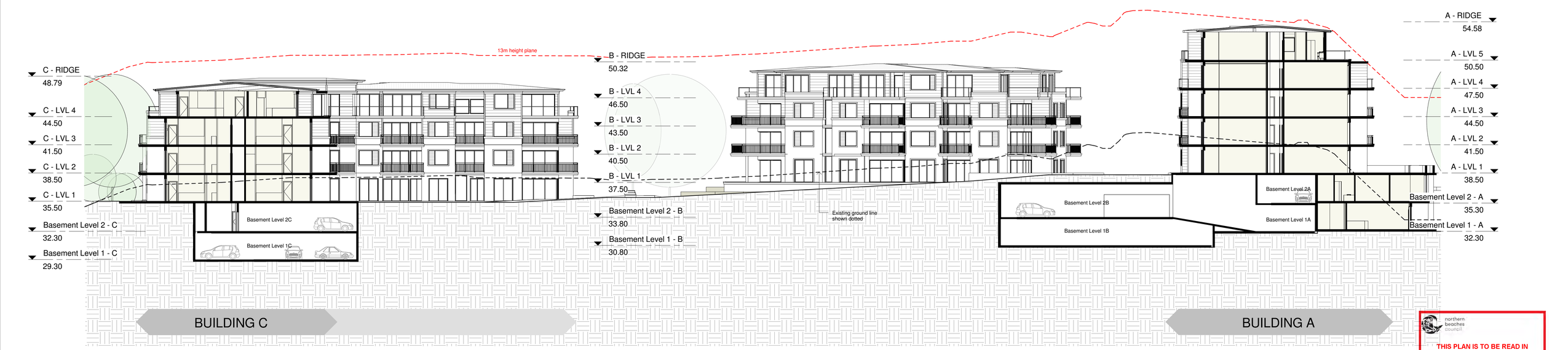
Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **SECTION A-A & B-B**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: Feb 2019	Project No: 1607	Drawing No: **A 3.05**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **B**



1 Section C-C
1 : 200



2 Section D-D
1 : 200

northern beaches council

THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE CONDITIONS OF DEVELOPMENT CONSENT

DA2018/1574

Verify all dimensions on site prior to commencement of work.
Refer all discrepancies to the Architect for determination.
Use figured dimensions in preference to scaling.

DATUM : AHD

Set out

Issue	Description	Date	Issue	Description	Date
A	DEVELOPMENT APPLICATION	03.Sept.18			
B	REFER SCHEDULE	20.Feb.19			

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www.rosegroup.com.au

ROSE Creating a quality way of living

Project: PROPOSED MIXED USE DEVELOPMENT	Drawing title: **SECTION C-C & D-D**	Status: DEVELOPMENT APPLICATION	
Address: 23 Fisher Road, Dee Why LOT 11 D.P.577062	Scale: 1:200 Date: Feb 2019	Project No: 1607	Drawing No: **A 3.06**
Client: Hamptons By Rose Pty Ltd	Drawn: RAD Reviewed: Checked: AO		Revision: **B**

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Appendix B – Figures

- FIGURE 1 – SITE LOCATION PLAN
- FIGURE 2 – SECTION A-A’
- FIGURE 3 – SECTION B-B’

LOCALITY PLAN
NOT OT SCALE

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	AW	AM	17/04/2020

LEGEND

- BOREHOLE LOCATION
- GROUNDWATER MONITORING WELL LOCATION
- SECTION LINE

MAP PROJECTION: GDA2020 MGA ZONE 56

5 0 5 15 25

Scale (metres) 1:500

drawn	AM / AW
approved	AM
date	17/04/2020
scale	AS SHOWN
original size	A3

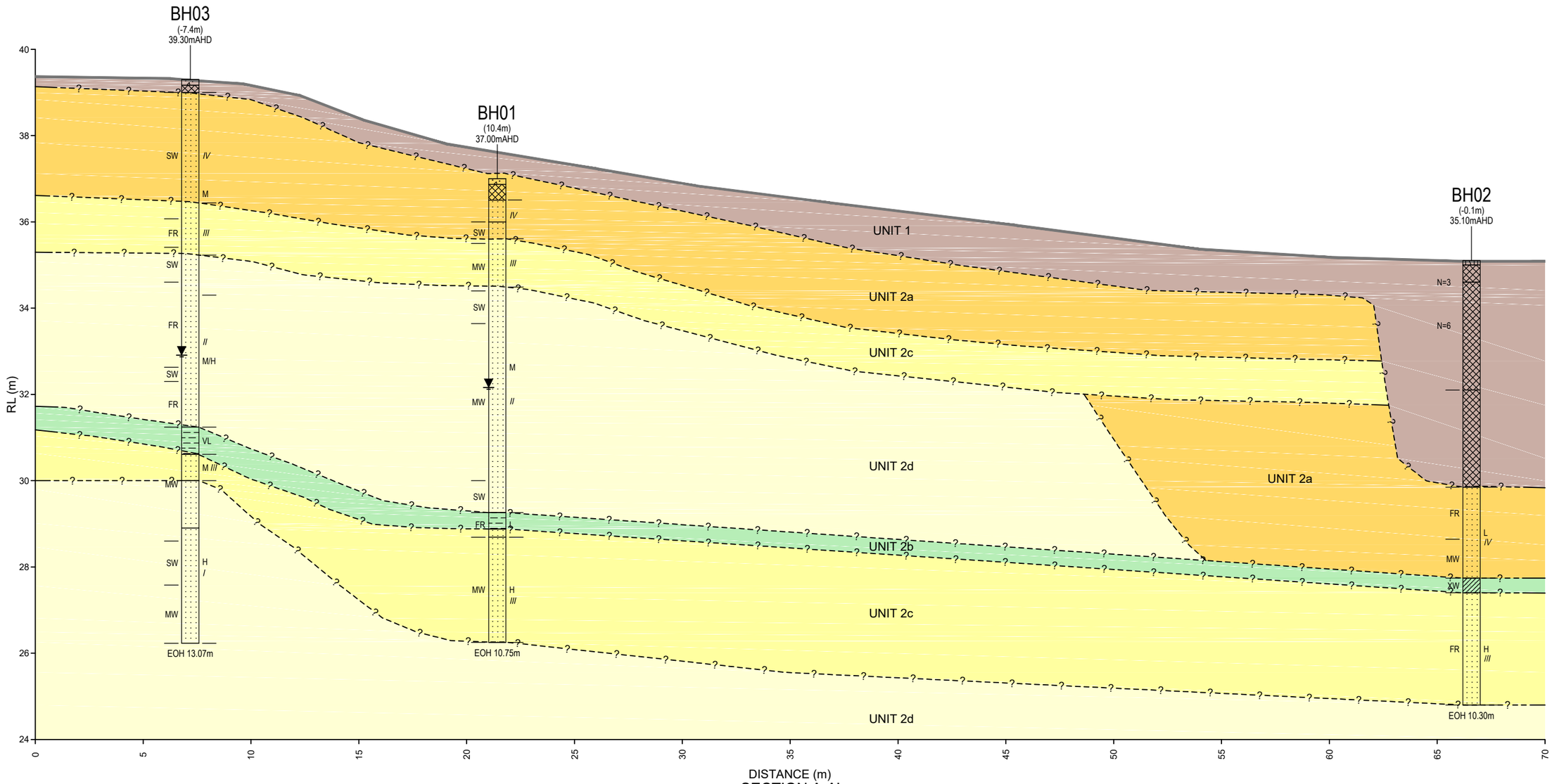
coffey
A TETRA TECH COMPANY

client:	HAMPTONS BY ROSE PTY LTD ATF NORTHERN BEACHES TRUST
project:	GEOTECHNICAL INVESTIGATION REPORT 15-23 FISHER ROAD, DEE WHY, NSW
title:	SITE LOCATION PLAN
project no:	754-SYDGE271604AA
figure no:	FIGURE 1
rev:	A

PLOT DATE: 17/04/2020 11:54:36 AM DWG FILE: F:\1. PROJECTS\4. SYD-GEOTECHNICS\2020\SYDGE271604 FISHER RD DEE WHY - ROSE\12. CAD\754-SYDGE271604AA.DWG

NORTH-EAST

SOUTH-WEST



SECTION A-A'

LEGEND

- CONCRETE
- FILL
- SANDSTONE
- SHALE
- TOPSOIL
- SANDY CLAY
- PEBBLY SANDSTONE
- EXISTING GROUND SURFACE
- INFERRED GEOLOGICAL BOUNDARY
- IV — ROCK CLASSIFICATION (PELLS ET AL, 2019)
- MW — WEATHERING
- H — ROCK STRENGTH
- WATER LEVEL (m)

UNIT LEGEND

- UNIT 1 - FILL/TOPSOIL
- UNIT 2a - CLASS V/IV SANDSTONE
- UNIT 2b - CLASS IV/V AND EXTREMELY WEATHERED SHALE
- UNIT 2c - CLASS III SANDSTONE
- UNIT 2d - CLASS II/I SANDSTONE

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	AW	AM	17/04/2020

Horizontal Scale (metres) 1:200

Vertical Scale (metres) 1:100

drawn	AM / AW
approved	AM
date	17/04/2020
scale	AS SHOWN
original size	A3

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A TETRA TECH COMPANY

client: HAMPTONS BY ROSE PTY LTD
ATF NORTHERN BEACHES TRUST

project: GEOTECHNICAL INVESTIGATION REPORT
15-23 FISHER ROAD, DEE WHY, NSW

title: SECTION A-A'

project no: 754-SYDGE271604AA | figure no: FIGURE 2 | rev: A

PLOT DATE: 17/04/2020 2:15:57 PM DWG FILE: F:\1. PROJECTS\4. SYD-GEOTECHNICS\2020\SYDGE271604 FISHER RD DEE WHY - ROSE\12. CAD\754-SYDGE271604AA.DWG

NORTH

SOUTH

BH03
(0.0m)
39.30mAHD

BH04
(0.0m)
37.60mAHD

UNIT 1

UNIT 2a

UNIT 2c

UNIT 2d

UNIT 2d

UNIT 2b

UNIT 2c

UNIT 2d

IV
SW
M
III
FR
SW
II
FR
M/H
SW
FR
VL
M III
MW
SW
H
I
MW

EOH 13.07m

III
M
II
FR
M-H
I
VL-L
VL-M
H III

EOH 10.97m

RL (m)

40
38
36
34
32
30
28
26
24

0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75

DISTANCE (m)

SECTION B-B'

LEGEND

- CONCRETE
- FILL
- SANDSTONE
- SHALE
- TOPSOIL
- SANDY CLAY
- PEBBLY SANDSTONE
- EXISTING GROUND SURFACE
- INFERRED GEOLOGICAL BOUNDARY
- IV — ROCK CLASSIFICATION (PELLS ET AL, 2019)
- MW — WEATHERING
- H — ROCK STRENGTH
- WATER LEVEL (m)

UNIT LEGEND

- UNIT 1 - FILL/TOPSOIL
- UNIT 2a - CLASS V/IV SANDSTONE
- UNIT 2b - CLASS IV/V AND EXTREMELY WEATHERED SHALE
- UNIT 2c - CLASS III SANDSTONE
- UNIT 2d - CLASS II/I SANDSTONE

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	AW	AM	17/04/2020

2.5 0 2.5 5 7.5 10
Horizontal Scale (metres) 1:200

1 0 1 3 5
Vertical Scale (metres) 1:100

drawn	AM / AW
approved	AM
date	17/04/2020
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client: HAMPTONS BY ROSE PTY LTD
ATF NORTHERN BEACHES TRUST

project: GEOTECHNICAL INVESTIGATION REPORT
15-23 FISHER ROAD, DEE WHY, NSW

title: SECTION B-B'

project no: 754-SYDGE271604AA | figure no: FIGURE 3 | rev: A

PLOT DATE: 17/04/2020 2:12:12 PM DWG FILE: F:\1. PROJECTS\4. SYD-GEOTECHNICS\2020\SYDGE271604 FISHER RD DEE WHY - ROSE\12. CAD\754-SYDGE271604AA.DWG

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Appendix C – Borehole Logs, Core Photographs and Well Construction Details

Soil Description Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disaggregated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with AS 1726:2017 as shown in the table on Sheet 2.

PARTICLE SIZE DEFINITIONS

Components	Subdivision	Size (mm)
Boulders Cobbles		>200 63 - 200
Gravel	Coarse Medium Fine	19 - 63 6.7 - 19 2.36 - 6.7
Sand	Coarse Medium Fine	0.6 - 2.36 0.210 - 0.6 0.075 - 0.21
Silt Clay		0.002 – 0.075 < 0.002

MOISTURE CONDITION

Coarse Grained Soil

Dry (D)	Non-cohesive and free-running
Moist (M)	Soil feels cool, darked in colour. Soil tends to stick together.
Wet (W)	As for moist, with free water forming when handled.

Fine Grained Soil

Moist, dry of plastic limit ($w<W_P$)	Hard and friable or powdery
Moist, near plastic limit ($w\approx W_P$)	Can be moulded at a moisture content approximately equal to the plastic limit.
Moist, wet of plastic limit ($w>W_P$)	Soils usually weakened and free water forms on hands when handling.
Wet, near liquid limit ($w\approx W_L$)	Near liquid limit.
Wet, wet of liquid limit ($w>W_L$)	Wet of liquid limit.

CONSISTENCY OF COHESIVE SOILS

Term (Abbreviation)	Indicative undrained shear strength s_u (kPa)	Field guide
Very Soft (VS)	<12	Soil exudes between fingers when squeezed in hand.
Soft (S)	12 – 25	Soil can be moulded by light finger pressure.
Firm (F)	25 – 50	Soil can be moulded by strong finger pressure.
Stiff (St)	50 – 100	Soil cannot be moulded by fingers.
Very Stiff (VSt)	100 – 200	Soil can be indented by thumb nail.
Hard (H)	>200	Soil can be indented with difficulty by thumb nail.
Friable (Fb)	–	Soil can be easily crumbled or broken into small pieces by hand.

RELATIVE DENSITY OF NON-COHESIVE SOILS

Term (Abbreviation)	Density index (%)
Very Loose (VL)	Less than 15
Loose (L)	15 – 35
Medium Dense (MD)	35 – 65
Dense (D)	65 – 85
Very Dense (VD)	Greater than 85

MINOR COMPONENTS

Term	Assessment Guide	Proportion of minor component in:
Trace	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: Fines - <5%, Accessory coarse fraction - <15% Fine grained soils: sand/gravel <15%
With	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: Fines - 5 to 12%, Accessory coarse fraction – 15 to 30% Fine grained soils: sand/gravel 15 to 30%

SOIL STRUCTURE AND CEMENTATION

Zoning		Cementation	
Layer	Zone is continuous across exposure or sample.	Weakly cemented	Easily disaggregated by hand in air or water.
Lense	Discontinuous layer of different material, with lenticular shape.	Moderately cemented	Effort is required to disaggregate the soil by hand in air or water.
Pocket	Irregular inclusion of different material.		

GEOLOGICAL ORIGIN

Residual soil	Structure and fabric of parent rock not visible.
Extremely weathered material	Structure and/or fabric of parent rock is visible.
Alluvial soil	Deposited by streams and rivers.
Estuarine soil	Deposited in coastal estuaries, including sediments carried by inflowing rivers and streams, or tidal currents.
Marine soil	Deposited in a marine environment
Lacustrine soil	Deposited in freshwater lakes
Aeolian soil	Carried and deposited by wind
Colluvial soil	Deposited on slopes (transported downslope by gravity, with or without assistance of water).
Topsoil	Mantle of surface or near surface material, often defined by high levels of organic material.
Fill	Any material which has been placed by anthropogenic processes. Fill may be significantly more variable between tested locations than naturally occurring soils.

Soil Description Explanation Sheet (2 of 2)

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)						GROUP SYMBOL	SOIL NAME
COARSE GRAINED SOIL More than 65% of materials less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	**GRAVEL** More than half of coarse fraction is larger than 2.36 mm	CLEAN GRAVEL (Fines less than 5%)	Wide range in grain size and substantial amounts of all intermediate particle sizes, not enough fines to bind coarse grains, no dry strength.		GW	GRAVEL
				Predominantly one size or a range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength.		GP	GRAVEL
			GRAVEL with FINES (Fines greater than 12%)	'Dirty' materials with excess of non-plastic fines (for identification procedures see ML below).		GM	Silty GRAVEL
				'Dirty' materials with excess of plastic fines (for identification procedures see CL below).		GC	Clayey GRAVEL
		SAND More than half of coarse fraction is smaller than 2.36 mm	CLEAN SAND (Fines less than 5%)	Wide range in grain sizes and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength.		SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength.		SP	SAND
			SAND with FINES (Fines greater than 12%f)	'Dirty' materials with excess of non-plastic fines (for identification procedures see ML below).		SM	Silty SAND
				'Dirty' materials with excess of plastic fines (for identification procedures see CL below).		SC	Clayey SAND
FINE GRAINED SOIL More than 35% of material less than 63 mm is smaller than 0.075 mm			**IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm**				
		SILT & CLAY Liquid limit less than 50%	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**		
			None to low	Slow to rapid	Low	ML	SILT
			Medium to high	None to slow	Medium	CL, CI	CLAY
			Low to medium	Slow	Low	OL	Organic SILT
		SILT & CLAY Liquid limit greater than 50%	Low to medium	None to slow	Low to medium	MH	SILT
			High to very high	None	High	CH	CLAY
			Medium to high	None to very slow	Low to medium	OH	Organic CLAY
HIGHLY ORGANIC SOILS			Readily identified by colour, odour, spongy feel and frequently by fibrous texture.			PT	Peat

● Low plasticity – Liquid Limit W_L less than 35%. ● Medium plasticity –W_L between 35% and 50%. ● High plasticity – W_L greater than 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
Parting	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (e g. bedding). May be open or closed.	
Fissure	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. May include desiccation cracks.	
Sheared Seam	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
Sheared Surface	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect	

TERM	DEFINITION	DIAGRAM
Softened Zone	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere	
Tube	Tubular cavity. May occur singly or as one of a large number of separate or interconnected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter. Origins include root holes, animal burrows, tunnel erosion.	
Tube cast	An infilled tube. The infill may be uncemented or weakly cemented soil or have rock properties.	
Infilled Seam	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open defects.	

Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726:2017.

DEFINITIONS: Rock material, defect, structure and rock mass are defined as follows:

Rock material	In engineering terms rock material is any naturally occurring aggregate of minerals and/or organic materials that cannot be disaggregated by hand in air or water without prior soaking. Rock material is intact rock that is bounded by defects. Material which can be disaggregated or remoulded should be described as a soil.
Defect	Discontinuity, fracture, break or void in the material or materials across which there is little or no tensile strength.
Structure	Nature and configuration of the different defects within the rock mass and their relationship with each other.
Rock mass	It is the entirety of the system formed by all of the rock material and all of the defects. That is, it is a body of material which is not effectively homogeneous.

MATERIAL DESCRIPTIVE TERMS:

Rock name	Simple rock names are used rather than precise geological classification.
Particle size	Grain size terms for sandstone are:
Coarse grained	Mainly 0.6mm to 2mm
Medium grained	Mainly 0.2mm to 0.6mm
Fine grained	Mainly 0.06mm (just visible) to 0.2mm
Fabric	When grains show an alignment, a preferred orientation or a layering (e.g. bedding or lamination for sedimentary rocks, and foliation or cleavage for metamorphic rocks) the terms used are:
Massive	No layering or penetrative fabric.
Indistinct	Layering or fabric just visible. Little effect on strength properties.
Distinct	Layering or fabric is easily visible. Rock may break more easily parallel to the fabric.

CLASSIFICATION OF MATERIAL WEATHERING

Term	Abbreviation	Definition
Residual Soil	**RS**	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. Soil has not been significantly transported.
Extremely Weathered	**XW**	Material is weathered to such an extent that it has soil properties, i.e. it either disaggregates or can be remoulded in water. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered[1]	**HW**	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 the deposition of weathering products in pores.
Moderately Weathered[1]	**MW**	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 no longer recognisable. Little or no change of strength from fresh rock.
Slightly Weathered	**SW**	Rock is partially discoloured with staining or bleaching adjacent to defects, but shows little or no change of strength from fresh rock.
Fresh	**FR**	Rock shows no sign of decomposition of individual minerals or colour changes.

Notes on Weathering:

1. The term 'Distinctly Weathered' (DW) may be used where it is not practicable (or it is judged that there is no advantage in making such a distinction) to distinguish between 'Highly Weathered' and 'Moderately Weathered'. 'Distinctly Weathered' is defined as follows: '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 weathering products in pores'.
2. Where physical and chemical changes of the rock material are caused by hot gases or liquids at depth (process called alteration) the term 'altered' may be substituted for 'weathering' to give the abbreviations XA, HA, MA, SA and DA.

ROCK MATERIAL STRENGTH TERMS

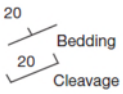
Term (Abbreviation)	Guide to Strength: Point Load Strength Index, $I_{s(50)}$ (MPa)	Guide to Strength: Field Assessment
Very Low (VL)	0.03 - 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; too hard to cut a triaxial sample by hand; pieces up to 30mm thick can be broken by finger pressure.
Low (L)	0.1 - 0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium (M)	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High (H)	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High (VH)	3 to 10	Hand specimen breaks after more than one blow; rock rings under hammer.
Extremely High (EH)	More than 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Notes on Rock Material Strength:

1. Material with strength less than 'Very Low' should be described using soil characteristics.
2. The method of measuring the $I_{S(50)}$ should be in accordance with AS 4133.4.2.
3. The rock strength should be determined perpendicular to any anisotropy in the rock. High strength anisotropic rocks may readily break parallel to the planar anisotropy.
4. Although AS1726:2017 provides a basis for rock strength terms based on Unconfined Compressive Strength (UCS), the ratio between UCS and $I_{S(50)}$ may vary from less than 10 to over 30 depending on the rock type and overall strength. The UCS/$I_{S(50)}$ strength ratio should be determined for each rock material.
5. The rock strength classification using $I_{S(50)}$ above should be considered indicative only. The rock strength classified in accordance with AS1726:2017 may be higher or lower if UCS results are available.

Rock Description Explanation Sheet (2 of 2)

COMMON ROCK DEFECT TYPES

Term	Definition	Diagram	Map Symbol	Graphic Log (Note 1)
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (e.g. cleavage). May be open or closed.			
Joint	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or sub-parallel to layering or to planar anisotropy in the rock material. May be open or closed.			
Sheared Zone/Seam (Note 3)	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.			
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.			
Crushed Seam (Note 3)	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.			
Infilled Seam	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams up to 1mm thick may be described as veneer or coating on a joint surface.			
Extremely Weathered Seam	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.			

Notes on Defects:

1. Usually borehole logs show the true dip of defects, and face sketches and sections show the apparent dip.
2. Partings and joints are not usually shown on the graphic log unless considered significant.
3. Sheared zones/seams, sheared surfaces and crushed seams are generally faults in geological terms.

DEFECT SHAPE TERMS

Planar	The defect does not vary in orientation
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps
Irregular	The defect has many sharp changes of orientation

Note: The assessment of defect shape is partly influenced by the scale of the observation.

DEFECT ROUGHNESS TERMS

Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.
Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
Smooth	Smooth to touch. Few or no surface irregularities.
Polished	Shiny smooth surface.
Slickensided	Grooved or striated surface, usually polished.

DEFECT COATING TERMS

Clean	No visible coating.
Stained	No visible coating but surfaces are discoloured.
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy.
Coating	A visible coating up to 1mm thick. Thicker soil material should be described using appropriate defect terms (e g. infilled seam). Thicker rock strength material should be described as a vein.

DIMENSION OF DEFECTS

Spacing, length, openness and thickness

The spacing, length, aperture (openness), and seam thickness should generally be described directly in millimetres or metres.

Block Shape

Where it is considered significant, block shape (e.g. tabular, prismatic, columnar) should be described using the terms in Table 23 of AS 1726:2017.

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Engineering Log - Borehole

Borehole ID.	**BH01**
sheet:	1 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**16 Mar 2020**
principal:	
date completed:	**17 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,203.08; N: 6,264,091.39 (MGA94) | surface elevation: 37.00 m (AHD) | angle from horizontal: 90°

drill model: Geoprobe 205, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
DT / AD / CASING			D	37				**CONCRETE**.	M			**CONCRETE**
								FILL: SAND: fine to coarse grained, orange-red-brown, dark grey.				**FILL**
			D					**SANDSTONE**: recovered as Sandy CLAY, orange-brown, sand is fine to coarse grained.				**WEATHERED SANDSTONE** SPT no recovery
				36	1.0			Borehole BH01 continued as cored hole				
				35	2.0							
				34	3.0							
				33	4.0							
				32	5.0							
				31	6.0							
				30	7.0							

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: NON CORED 754-SYDGE271604.GPJ <<DrawingFile>> 27/04/2020 16:23

method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- DT diatube

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remoulded (kPa)
- R refusal
- HB hammer bouncing

soil group symbol & soil description
based on AS 1726:2017

moisture condition
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Cored Borehole

Borehole ID.	**BH01**
sheet:	2 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**16 Mar 2020**
principal:	
date completed:	**17 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,203.08; N: 6,264,091.39 (MGA94) | surface elevation: 37.00 m (AHD) | angle from horizontal: 90°

drill model: Geoprobe 205, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
		37									
					started coring at 1.00m						
NMLC	14/04/20	36	1.0		**SANDSTONE**: fine to coarse grained, orange, pale grey, red-brown, distinctly bedded at 0°-30°.	SW					**SANDSTONE**
						MW		a=0.95 d=0.39			
		35	2.0						100%		
						SW		a=0.83 d=0.65			
		34	3.0								
						MW		a=0.98 d=0.86			
		33	4.0					a=0.80 d=0.76	100%		
		32	5.0					a=0.85 d=0.84			
		31	6.0					a=0.89 d=0.92	98%		
		30	7.0			SW					SM, Clay, 10 mm
						FR		a=0.86 d=0.67 a=0.24 d=0.13	98%		**SHALE**

Defects are: PT, 0 - 30°, PL, RO, CN, unless otherwise described

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method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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Engineering Log - Cored Borehole

Borehole ID.	**BH01**
sheet:	3 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**16 Mar 2020**
principal:	
date completed:	**17 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,203.08; N: 6,264,091.39 (MGA94) | surface elevation: 37.00 m (AHD) | angle from horizontal: 90°

drill model: Geoprobe 205, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information				material substance						rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC		29			**SHALE**: dark grey, distinctly laminated at 0°-20°. *(continued)*	FR					
					SANDSTONE: fine to medium grained, grey, distinctly bedded at 0°-20°.	MW					
					SANDSTONE: fine to medium grained, orange, pale grey, red-brown, distinctly bedded at 0°-30°.			a=1.78 d=1.80			**SANDSTONE**
		28	9.0						98%		
								a=1.39 d=1.12			
		27	10.0								
								a=2.79 d=1.47			
		26	11.0		Borehole BH01 terminated at 10.75 m Target depth						
		25	12.0								
		24	13.0								
		23	14.0								
		22	15.0								

method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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Piezometer Installation Log

Hole ID.	**BH01**
sheet:	1 of 1
project no.	**754-SYDGE271604**
date started:	**16 Mar 2020**
date completed:	**17 Mar 2020**
logged by:	**RN**
checked by:	**RR**

client: ***Hamptons by Rose Pty Ltd ATF Northern Beaches Trust***

principal:

project: ***15-23 Fisher Road, Dee Why - Geotechnical Investigation Report***

location: ***Fisher Road, Dee Why, NSW***

position: E: 341,203.08; N: 6,264,091.39 (MGA94) | surface elevation: 37.00 m (AHD) | angle from horizontal: 90°

equipment type: Geoprobe 205, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **piezometer construction details**

method & support	water	RL (m)	depth (m)	graphic log	material name
AD/T CASING		36	1		**CONCRETE**
					FILL
					WEATHERED SANDSTONE
					SANDSTONE
	14/04/20	34	3		
		32	5		
NMLC		30	7		
		28	9		
		26	11		**SHALE**
					SANDSTONE

bore construction license:
drilling company:
driller:
driller's permit no.:

BH01

Concrete

1.20 m

Bentonite

1.50 m

1.75 m

Sand

10.75 m

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method & support
see engineering log for details

water
- 10-Oct-12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
- core recovered (graphic symbols indicate material)
- no core recovered

ID	type	installation date	stickup (m)	tip depth (m)	water level (m)	Relative Levels (AHD) stickup	tip	water level
BH01	standpipe piezo.			10.75 m			26.25	

BH01 1.00 - 6.00 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH01

project no: 754-SYDGE271604 | fig no: **FIGURE 1** | rev:

BH01 6.00 - 10.75 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH01

project no: 754-SYDGE271604 | fig no: **FIGURE 2** | rev:

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Engineering Log - Borehole

Borehole ID.	**BH02**
sheet:	1 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**16 Mar 2020**
principal:	
date completed:	**16 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,190.39; N: 6,264,046.77 (MGA94) | surface elevation: 35.10 m (AHD) | angle from horizontal: 90°

drill model: Geoprobe 205, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/T CASING		Not Observable	D	35				**TOPSOIL: SILTY SAND**.	M			**TOPSOIL**
			SPT 1, 1, 2 N*=3					**FILL: SAND**: fine to coarse grained, brown.				**FILL**
				34	1.0			**FILL: SAND**: fine to medium grained, non plastic, dark brown, with rootlets.				
			SPT 3, 3, 3 N*=6									
				33	2.0							
								2.8 m: sandstone cobbles				**WEATHERED BEDROCK**
				32	3.0			Borehole BH02 continued as cored hole				
				31	4.0							
				30	5.0							
				29	6.0							
				28	7.0							

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- DT diatube

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remoulded (kPa)
- R refusal
- HB hammer bouncing

soil group symbol & soil description
based on AS 1726:2017

moisture condition
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Cored Borehole

Borehole ID.	**BH02**
sheet:	2 of 3
project no.	**754-SYDGE271604**
client:	***Hamptons by Rose Pty Ltd ATF Northern Beaches Trust***
date started:	***16 Mar 2020***
principal:	
date completed:	***16 Mar 2020***
project:	***15-23 Fisher Road, Dee Why - Geotechnical Investigation Report***
logged by:	***RN***
location:	***Fisher Road, Dee Why, NSW***
checked by:	***RR***

position: E: 341,190.39; N: 6,264,046.77 (MGA94) | surface elevation: 35.10 m (AHD) | angle from horizontal: 90°

drill model: Geoprobe 205, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC	Not Observable	35	0.0		started coring at 3.00m						
		34	1.0								
		33	2.0								
		32	3.0		**FILL: SAND**: fine to coarse grained, orange-brown.				0%		
		31	4.0								
		30	5.0		**SANDSTONE**: fine to coarse grained, white, grey, indistinctly bedded at 0°-20°.	FR	O X	a=0.23 d=0.08	52%		
		29	6.0			MW	O X	a=0.31 d=0.15	71%		
		28	7.0		7.22 m: healed iron joints						
					Sandy CLAY (CI): medium plasticity, dark grey, with medium grained sand, derived from extremely weathered shale.	XW					
						FR	X O	a=1.45 d=1.12	92%		Defects are: PT, 0 - 30°, PL, RO, CN, unless otherwise described

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method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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Engineering Log - Cored Borehole

Borehole ID.	**BH02**
sheet:	3 of 3
project no.	**754-SYDGE271604**
client:	***Hamptons by Rose Pty Ltd ATF Northern Beaches Trust***
date started:	**16 Mar 2020**
principal:	
date completed:	**16 Mar 2020**
project:	***15-23 Fisher Road, Dee Why - Geotechnical Investigation Report***
logged by:	**RN**
location:	***Fisher Road, Dee Why, NSW***
checked by:	**RR**

position: E: 341,190.39; N: 6,264,046.77 (MGA94) | surface elevation: 35.10 m (AHD) | angle from horizontal: 90°

drill model: Geoprobe 205, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information				material substance						rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC	Not Observable	27			**SANDSTONE**: fine to medium grained, grey, distinctly bedded at 0°-30°. *(continued)*	FR		a=1.42 d=1.28	92%		
		26	9.0								
		25	10.0					a=1.36 d=1.07			
					Borehole BH02 terminated at 10.30 m Target depth						
		24	11.0								
		23	12.0								
		22	13.0								
		21	14.0								
		20	15.0								

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method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

BH02 5.25 - 10.00 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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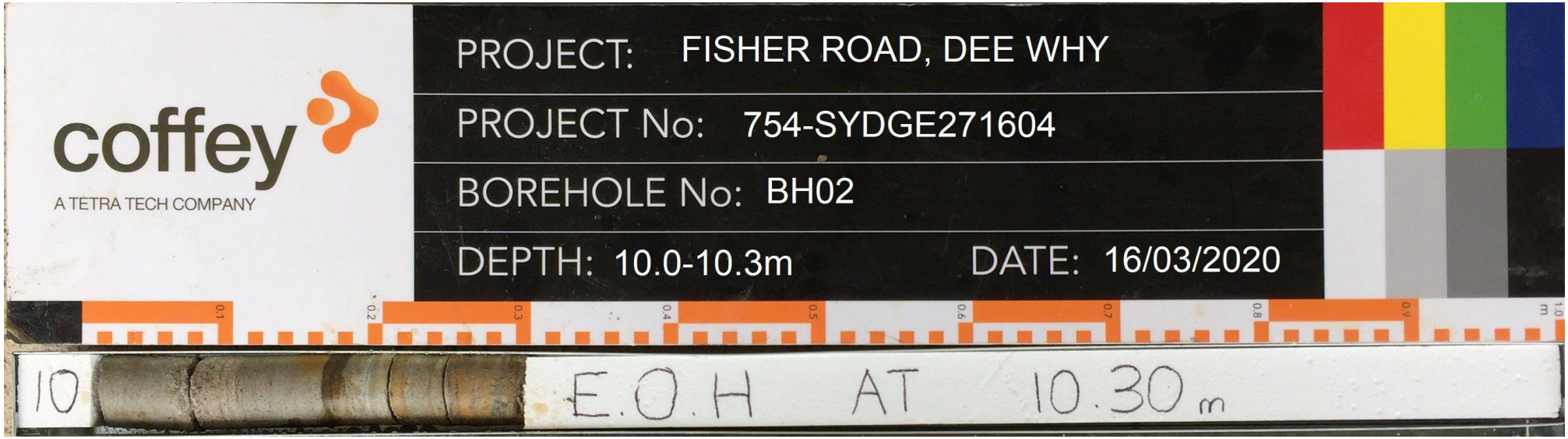
client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH02

project no: 754-SYDGE271604 | fig no: **FIGURE 3** | rev:



BH02 10.00 - 10.30 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH02

project no: 754-SYDGE271604 | fig no: **FIGURE 4** | rev:

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Engineering Log - Borehole

Borehole ID.	**BH03**
sheet:	1 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**27 Mar 2020**
principal:	
date completed:	**27 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,225.54; N: 6,264,095.21 (MGA94) | surface elevation: 39.30 m (AHD) | angle from horizontal: 90°

drill model: XC Rig, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/T CASING			D	39				**CONCRETE**: 130mm thick.				**CONCRETE**
								FILL: SAND: fine to coarse grained, brown.	M			**FILL**
								Borehole BH03 continued as cored hole				
				38	1.0							
				37	2.0							
				36	3.0							
				35	4.0							
				34	5.0							
				33	6.0							
				32	7.0							

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- DT diatube

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remoulded (kPa)
- R refusal
- HB hammer bouncing

soil group symbol & soil description
based on AS 1726:2017

moisture condition
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Cored Borehole

Borehole ID.	**BH03**
sheet:	2 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**27 Mar 2020**
principal:	
date completed:	**27 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,225.54; N: 6,264,095.21 (MGA94) surface elevation: 39.30 m (AHD) angle from horizontal: 90°

drill model: XC Rig, Track mounted drilling fluid: water hole diameter : 125 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
					started coring at 0.30m						
NMLC		39			**SANDSTONE**: medium to coarse grained, yellow-brown, indistinctly bedded at 0°-20°.	SW		a=0.31 d=0.30	92%		**SANDSTONE**
		38	1.0					a=0.52 d=0.47			
		37	2.0					a=0.75 d=0.53	64%		SM, Sandy clay, 100 mm
		36	3.0			FR		a=1.26 d=1.16	100%		
		35	4.0			SW		a=0.71 d=0.55			
		34	5.0		5.50 m: minor carbonaceous flecks	FR		a=0.73 d=0.87	100%		
		33	6.0					a=1.16 d=1.04			
	14/04/20	32	7.0			SW FR		a=0.99 d=0.86	100% 93%		Defects are: PT, 0 - 20°, PL, RO, CN, unless otherwise described

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: CORED 754-SYDGE271604.GPJ <<DrawingFile>> 27/04/2020 15:22

method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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Engineering Log - Cored Borehole

Borehole ID.	**BH03**
sheet:	3 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**27 Mar 2020**
principal:	
date completed:	**27 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,225.54; N: 6,264,095.21 (MGA94) | surface elevation: 39.30 m (AHD) | angle from horizontal: 90°

drill model: XC Rig, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC		31			**SHALE**: dark grey, distinctly laminated at 0°-10°.	MW		a=0.93 d=0.61 a=0.09 d=0.06	93%		**SHALE**
			9.0		**SANDSTONE**: fine to medium grained, pale grey, red, brown, indistinctly bedded at 0°-20°.			a=0.44 d=0.38			**SANDSTONE**
		30			9.20 to 9.36 m: UCS Sample: 41.8 MPa **SANDSTONE**: coarse grained, red-brown, massive, with few pebble inclusions.				100%		
			10.0					a=1.46 d=1.84			
		29			**SANDSTONE**: fine to medium grained, pale grey, red-brown, indistinctly to distinctly bedded at 0°-20°.	SW					
			11.0					a=1.35 d=1.89	100%		
		28				MW					
			12.0					a=1.85 d=2.20			
		27							100%		
			13.0					a=1.67 d=1.05			
		26			Borehole BH03 terminated at 13.07 m Target depth						
			14.0								
		25									
			15.0								
		24									

Defects are: PT, 0 - 20°, PL, RO, CN, unless otherwise described

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: CORED 754-SYDGE271604.GPJ <<DrawingFile>> 27/04/2020 15:22

method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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Piezometer Installation Log

Hole ID.	**BH03**
sheet:	1 of 1
project no.	**754-SYDGE271604**
client:	***Hamptons by Rose Pty Ltd ATF Northern Beaches Trust***
principal:	
project:	***15-23 Fisher Road, Dee Why - Geotechnical Investigation Report***
location:	***Fisher Road, Dee Why, NSW***
date started:	**27 Mar 2020**
date completed:	**27 Mar 2020**
logged by:	**RN**
checked by:	**RR**

position: E: 341,225.54; N: 6,264,095.21 (MGA94) | surface elevation: 39.30 m (AHD) | angle from horizontal: 90°

equipment type: XC Rig, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **piezometer construction details**

method & support	water	RL (m)	depth (m)	graphic log	material name
HDT CASING NMLC	14/04/20 ▼	38	1		**CONCRETE**
					FILL
					SANDSTONE
		36	3		
		34	5		
		32	7		
			8		**SHALE**
		30	9		**SANDSTONE**
		28	11		
		26	13		
		24	15		

bore construction license:
drilling company:
driller:
driller's permit no.:

BH03

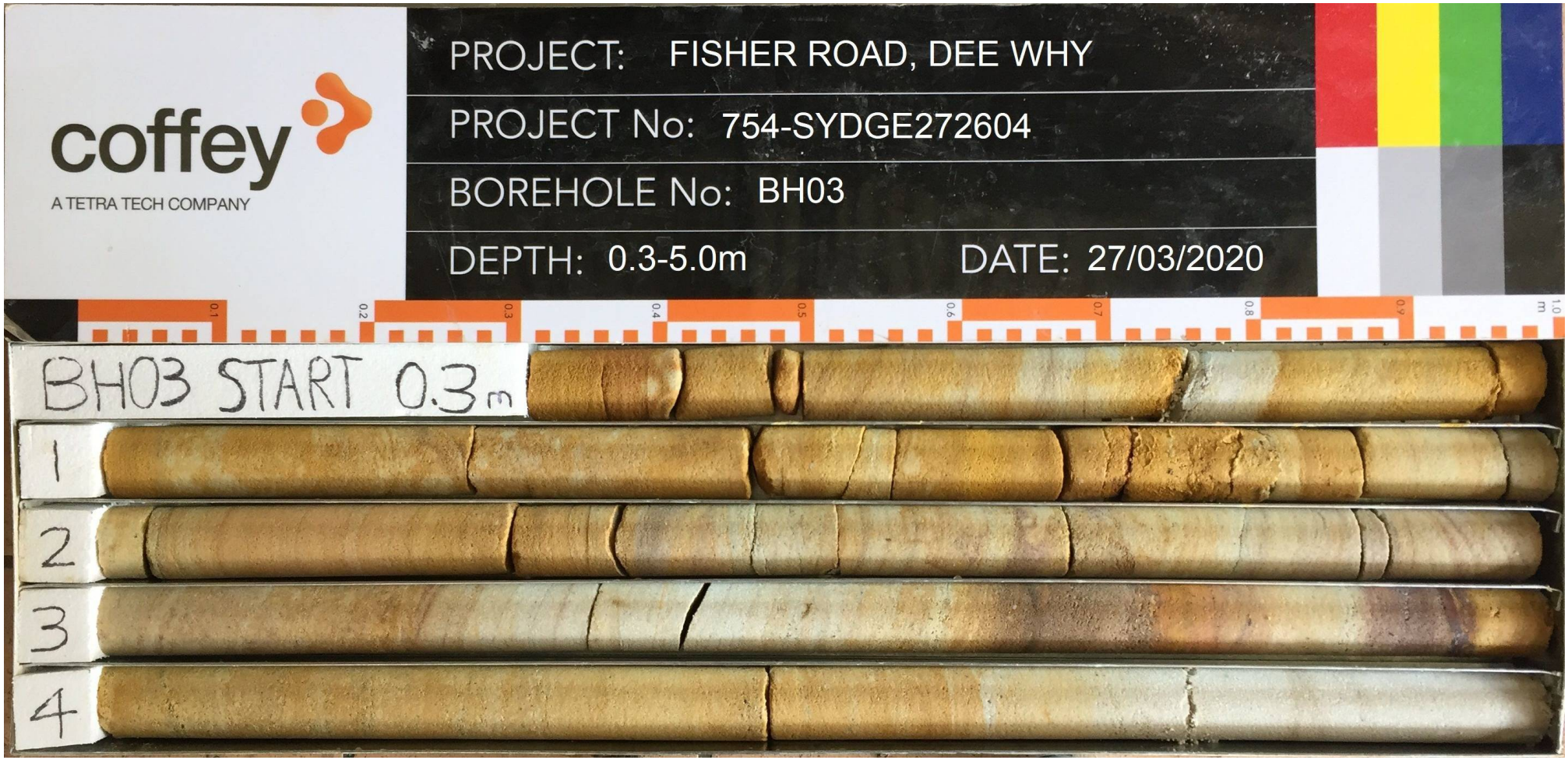
0.50 m — Concrete
0.80 m — Bentonite
1.30 m — Sand
13.07 m

method & support
see engineering log for details

water
- 10-Oct-12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25 — water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
- core recovered (graphic symbols indicate material)
- no core recovered

ID	type	installation date	stickup (m)	tip depth (m)	water level (m)	Relative Levels (AHD) stickup	tip	water level
BH03	standpipe piezo.			13.07 m			26.23	



BH03 0.30 - 5.00 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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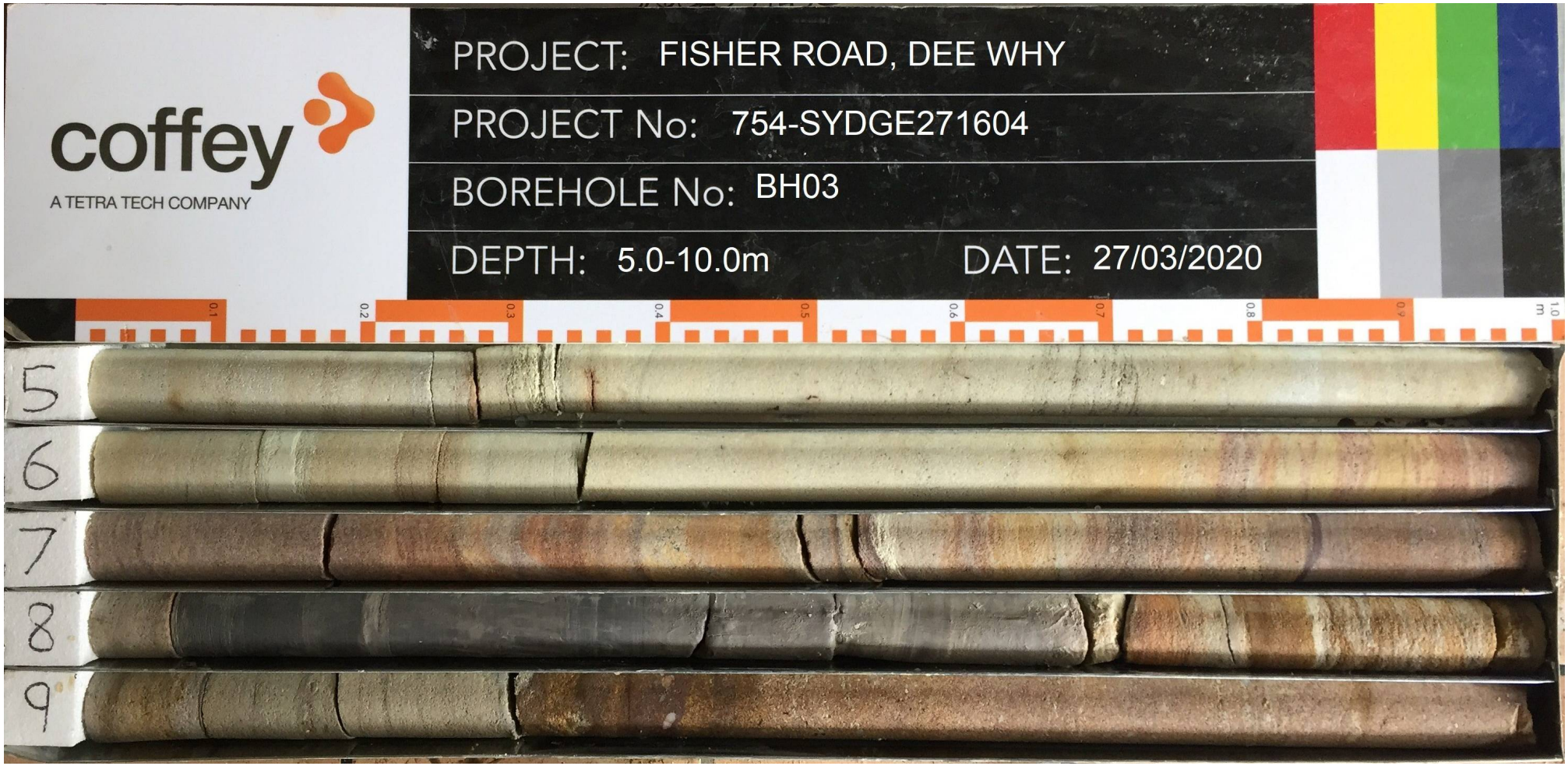
client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH03

project no: 754-SYDGE271604 | fig no: **FIGURE 5** | rev:



BH03 5.00 - 10.00 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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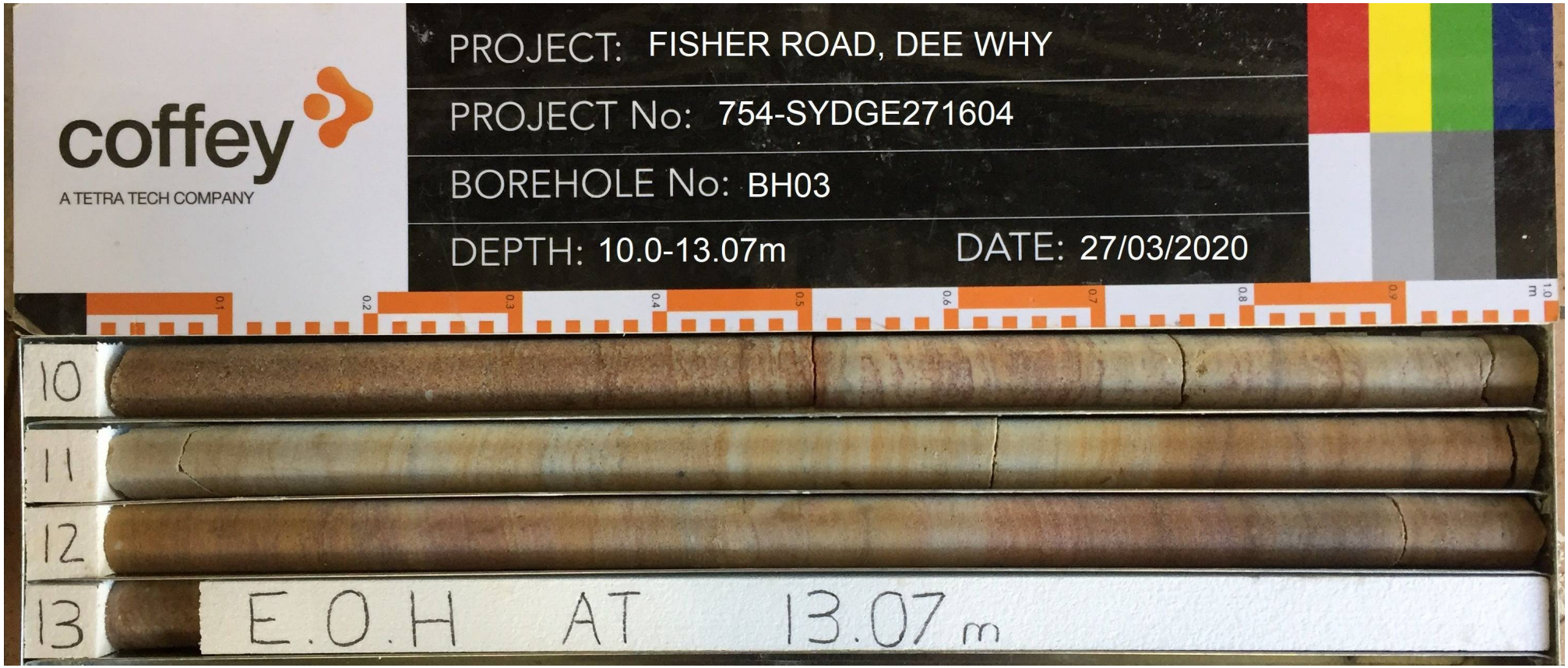
client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH03

project no: 754-SYDGE271604 | fig no: **FIGURE 6** | rev:



BH03 10.00 - 13.07 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH03

project no: 754-SYDGE271604 | fig no: **FIGURE 7** | rev:

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Engineering Log - Borehole

Borehole ID.	**BH04**
sheet:	1 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**30 Mar 2020**
principal:	
date completed:	**30 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,217.64; N: 6,264,029.64 (MGA94) | surface elevation: 37.60 m (AHD) | angle from horizontal: 90°

drill model: XC Rig, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	soil group symbol	material description (SOIL NAME: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/T DT CASING			D					**CONCRETE**.				**CONCRETE**
								FILL: SAND: fine to coarse grained, brown.	M			**FILL**
								SANDSTONE: recovered as Sandy CLAY, pale grey, sand is fine to coarse grained.				**WEATHERED SANDSTONE**
				37	1.0			Borehole BH04 continued as cored hole				
				36	2.0							
				35	3.0							
				34	4.0							
				33	5.0							
				32	6.0							
				31	7.0							
				30								

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method
- AD auger drilling*
- AS auger screwing*
- HA hand auger
- W washbore
- DT diatube

* bit shown by suffix
e.g. AD/T
- B blank bit
- T TC bit
- V V bit

support
- M mud
- C casing
- N nil

penetration
1 2 3 — no resistance ranging to refusal

water
- 10-Oct-12 water level on date shown
- water inflow
- water outflow

samples & field tests
- B bulk disturbed sample
- D disturbed sample
- E environmental sample
- SS split spoon sample
- U## undisturbed sample ##mm diameter
- HP hand penetrometer (kPa)
- N standard penetration test (SPT)
- N* SPT - sample recovered
- Nc SPT with solid cone
- VS vane shear; peak/remoulded (kPa)
- R refusal
- HB hammer bouncing

soil group symbol & soil description
based on AS 1726:2017

moisture condition
- D dry
- M moist
- W wet
- Wp plastic limit
- Wl liquid limit

consistency / relative density
- VS very soft
- S soft
- F firm
- St stiff
- VSt very stiff
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense

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Engineering Log - Cored Borehole

Borehole ID.	**BH04**
sheet:	2 of 3
project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**
date started:	**30 Mar 2020**
principal:	
date completed:	**30 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**
logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**
checked by:	**RR**

position: E: 341,217.64; N: 6,264,029.64 (MGA94) | surface elevation: 37.60 m (AHD) | angle from horizontal: 90°

drill model: XC Rig, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
					started coring at 0.40m						
NMLC		37	1.0		**SANDSTONE**: fine to coarse grained, pale grey, massive, with carbonaceous flecks.	FR		a=0.52 d=0.40 a=0.31 d=0.37	88%		**SANDSTONE**
		36			**LITHIC SANDSTONE**: medium to coarse grained, orange-brown, massive. 1.18 m: becoming orange, brown, pale grey						
			2.0		**SANDSTONE**: fine to medium grained, pale yellow-brown, massive. 2.00 to 2.61 m: rootlets of tree within rock core, recovered the core, the rest of the roots washed away 2.50 m: becoming fine to medium grained				77%		JT, 75°, PL, RO, Fe SN, root jacking
		35						a=0.70 d=0.74			
			3.0		**SANDSTONE**: medium to coarse grained, red-brown, massive to indistinctly bedded at 0°-20°.			a=0.98 d=1.18	100%		
		34									
			4.0		4.00 m: becoming red-brown			a=0.91 d=0.98			
		33							100%		
			5.0					a=1.37 d=1.18			
		32									
			6.0		**SANDSTONE**: fine to medium grained, red-brown to pale grey, distinctly bedded at 0°-20°.			a=0.73 d=0.94	100%		
	14/04/20	31									
			7.0					a=0.85 d=0.65	100%		
		30									

Defects are: PT, 0 - 20°, PL, RO, CN, unless otherwise described

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: CORED 754-SYDGE271604.GPJ <<DrawingFile>> 27/04/2020 15:22

method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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Engineering Log - Cored Borehole

Borehole ID.	**BH04**
sheet:	3 of 3
project no.	**754-SYDGE271604**
client:	***Hamptons by Rose Pty Ltd ATF Northern Beaches Trust***
date started:	**30 Mar 2020**
principal:	
date completed:	**30 Mar 2020**
project:	***15-23 Fisher Road, Dee Why - Geotechnical Investigation Report***
logged by:	**RN**
location:	***Fisher Road, Dee Why, NSW***
checked by:	**RR**

position: E: 341,217.64; N: 6,264,029.64 (MGA94) | surface elevation: 37.60 m (AHD) | angle from horizontal: 90°

drill model: XC Rig, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC		29	9.0		**SANDSTONE**: fine to medium grained, red-brown to pale grey, distinctly bedded at 0°-20°. *(continued)*	FR		a=1.02 d=1.23 a=1.11 d=1.15	100% 95%		**SANDSTONE**
		28			**SHALE**: dark grey, distinctly laminated at 0°-5°.			a=0.09 d=0.18			**SHALE**
			10.0		**SANDSTONE**: medium grained, grey, with distinct carbonaceous laminae at 0°-20°.			a=1.12 d=0.34			**SANDSTONE**
		27			**SANDSTONE**: fine to medium grained, red-brown to pale grey, distinctly bedded at 0°-20°, with lithic rich bands. 10.43 to 10.63 m: UCS Sample: 26.5 MPa			a=0.08 d=0.05 a=0.31 d=0.22	100%		
			11.0		Borehole BH04 terminated at 10.97 m Target depth			a=1.45 d=1.36			
		26	12.0								
		25	13.0								
		24	14.0								
		23	15.0								
		22									

CDF_0_9_07_LIBRARY.GLB rev:AU Log COF BOREHOLE: CORED 754-SYDGE271604.GPJ <<DrawingFile>> 27/04/2020 15:22

method & support
AS auger screwing
AD auger drilling
CB claw or blade bit
W washbore
RR rock roller
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
DT diatube

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS shear surface
SZ shear zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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Piezometer Installation Log

		Hole ID.	**BH04**
		sheet:	1 of 1
		project no.	**754-SYDGE271604**
client:	**Hamptons by Rose Pty Ltd ATF Northern Beaches Trust**	date started:	**30 Mar 2020**
principal:		date completed:	**30 Mar 2020**
project:	**15-23 Fisher Road, Dee Why - Geotechnical Investigation Report**	logged by:	**RN**
location:	**Fisher Road, Dee Why, NSW**	checked by:	**RR**

position: E: 341,217.64; N: 6,264,029.64 (MGA94) | surface elevation: 37.60 m (AHD) | angle from horizontal: 90°

equipment type: XC Rig, Track mounted | drilling fluid: water | hole diameter : 125 mm

drilling information | **material substance** | **piezometer construction details**

method & support	water	RL (m)	depth (m)	graphic log	material name
HD/DT CASING					**CONCRETE**
					FILL
					WEATHERED SANDSTONE
					SANDSTONE
NMLC	14/04/20	36	1		
		34	2		
		32	3		
		30	4		
		28	5		
		26	6		
			7		
			8		
			9		
			10		**SHALE**
			11		**SANDSTONE**

bore construction license:
drilling company:
driller:
driller's permit no.:

BH04

Concrete

0.60 m

Bentonite

0.90 m

1.40 m

Sand

10.97 m

method & support
see engineering log for details

water
- 10-Oct-12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
- core recovered (graphic symbols indicate material)
- no core recovered

ID	type	installation date	stickup (m)	tip depth (m)	water level (m)	Relative Levels (AHD) stickup	tip	water level
BH04	standpipe piezo.			10.97 m			26.63	

BH04 0.40 - 5.00 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH04

project no: 754-SYDGE271604 | fig no: **FIGURE 8** | rev:

BH04 5.00 - 10.00 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

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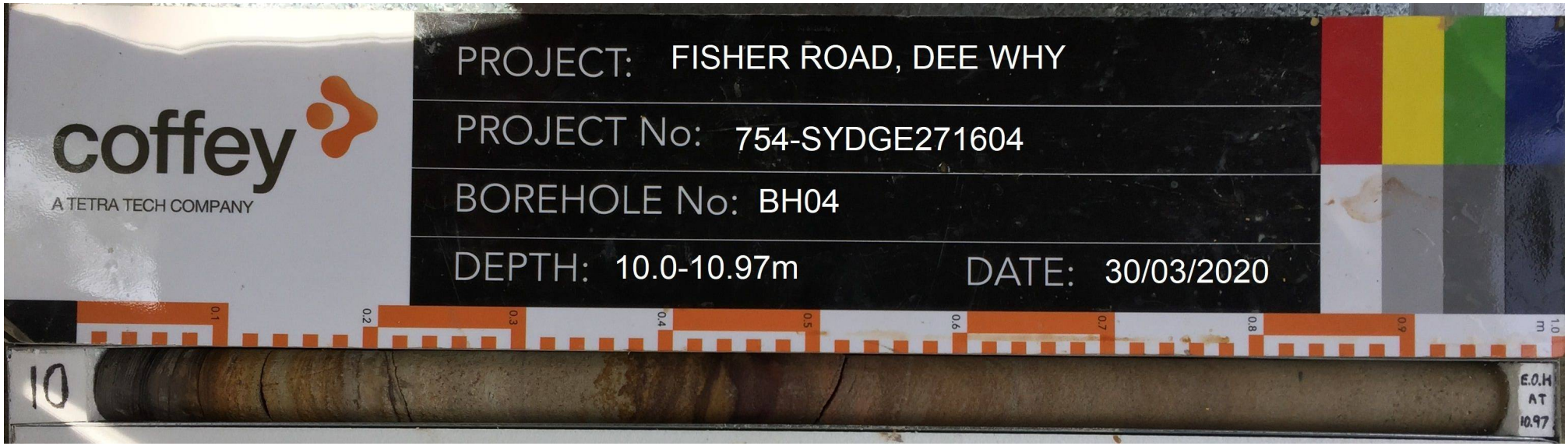
client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH04

project no: 754-SYDGE271604 | fig no: **FIGURE 9** | rev:



BH04 10.00 - 10.97 m

drawn	**A.W.**
approved	**A.M.**
date	**27/04/2020**
scale	**N.T.S.**
original size	**A4**

coffey
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client: Hamptons by Rose Pty Ltd ATF Northern Beaches Trust

project: 15-23 Fisher Road, Dee Why - Geotechnical Investigation Report
Fisher Road, Dee Why, NSW

title: **CORE PHOTOGRAPH**
BH04

project no: 754-SYDGE271604 | fig no: **FIGURE 10** | rev:

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Appendix D – Laboratory Test Results

Sydney Laboratory
Unit 5/43 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD2000901
Issue No: 1
This report replaces all previous issues of report no 'SYD2000901'.

Client:
Coffey Services Pty Ltd
799 Pacific Hwy
Chatswood NSW 2067

Project: 12517521

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 15/04/2020

Sample Details

GHD Sample No	SYD20-0152-03
Date Sampled	16/03/2020
Sampled By	Supplied by Client
Location	Fisher Road, Dee Why
BH / TP No.	BH01
Depth (m)	0.2 to 0.3
Soil Description	SAND with silt mottled yellow & red brown

Other Test Results

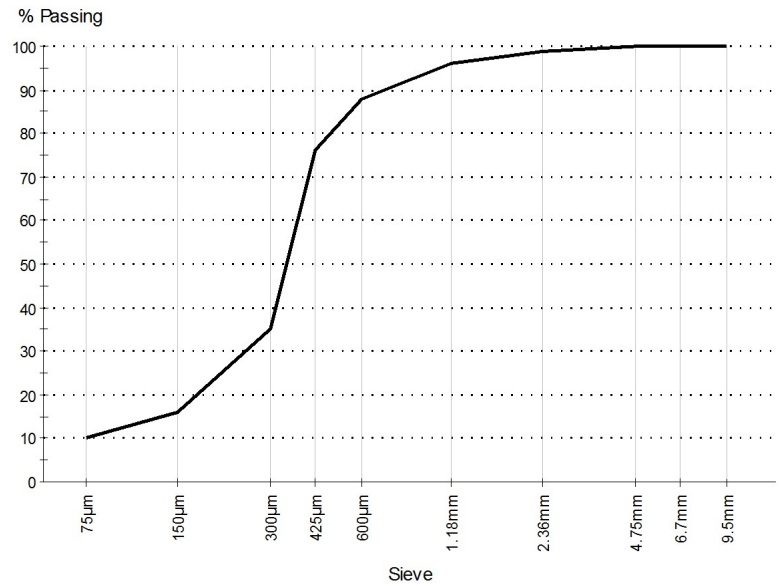
Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	10.0	
Curvature Coefficient	AS 1289.3.6.1	2.25	
Uniformity Coefficient		4.95	

Particle Size Distribution

AS 1289.3.6.1

Drying by: Oven
Date Tested:

Note: Sample Washed



Sieve Size	% Passing	Limits
9.5mm	100	
6.7mm	100	
4.75mm	100	
2.36mm	99	
1.18mm	96	
600µm	88	
425µm	76	
300µm	35	
150µm	16	
75µm	10	

Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD2000900
Issue No: 1
This report replaces all previous issues of report no 'SYD2000900'.

Client:
Coffey Services Pty Ltd
799 Pacific Hwy
Chatswood NSW 2067

Project: 12517521

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Date of Issue: 15/04/2020

Sample Details

GHD Sample No	SYD20-0152-02
Date Sampled	16/03/2020
Sampled By	Supplied by Client
Location	Fisher Road, Dee Why
BH / TP No.	BH02
Depth (m)	0.50 to 0.95
Soil Description	Silty SAND with gravel yellow - red brown

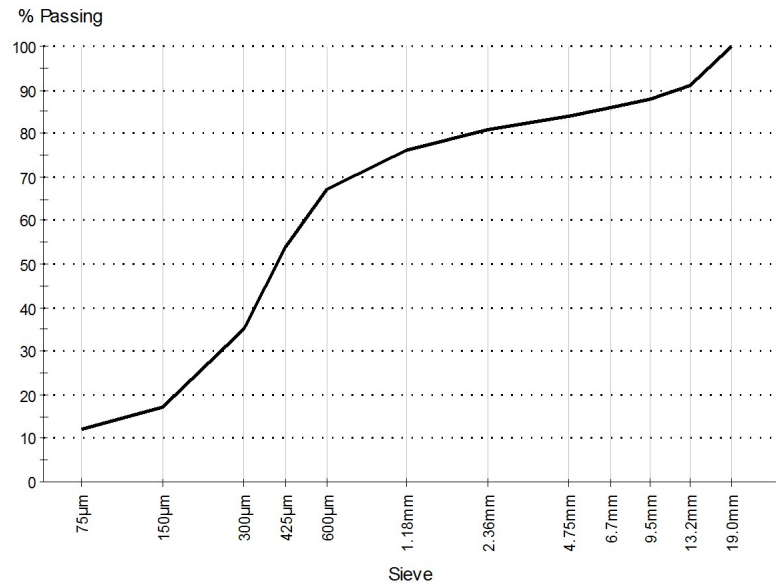
Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	14.8	

Particle Size Distribution

AS 1289.3.6.1

Drying by: Oven
Date Tested:



Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	91	
9.5mm	88	
6.7mm	86	
4.75mm	84	
2.36mm	81	
1.18mm	76	
600µm	67	
425µm	54	
300µm	35	
150µm	17	
75µm	12	

Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD2000899
Issue No: 1
This report replaces all previous issues of report no 'SYD2000899'.

Client:
Coffey Services Pty Ltd
799 Pacific Hwy
Chatswood NSW 2067

Project: 12517521

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 15/04/2020

Sample Details

GHD Sample No	SYD20-0152-01
Date Sampled	16/03/2020
Sampled By	Supplied by Client
Location	Fisher Road, Dee Why
BH / TP No.	BH02
Depth (m)	1.50 to 1.95
Soil Description	SAND with silt trace gravel yellow brown

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.7	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	N/A	
Mould Length (mm)		0	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	N/A	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	NP	
Plasticity Index (%)	AS 1289.3.3.1	NP	

Particle Size Distribution

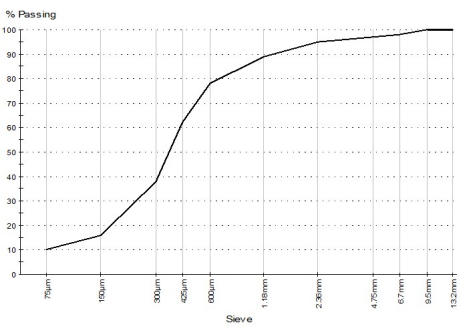
Method: AS 1289.3.6.1

Date Tested:

Note: Sample Washed

Sieve Size	% Passing	Limits
13.2mm	100	
9.5mm	100	
6.7mm	98	
4.75mm	97	
2.36mm	95	
1.18mm	89	
600µm	78	
425µm	62	
300µm	38	
150µm	16	
75µm	10	

Chart



Comments

NP = Non Plastic

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GHD GEOTECHNICS

Uniaxial Compressive Strength - Report

Report No: SYD2001004
Issue No: 1

Client:	Coffey Services Australia Pty Ltd.
Project:	Fisher Road
Location:	Dee Why
Job No.:	12519071

Accredited for compliance with ISO / IEC 17025 - Testing Laboratory Accreditation No. 679

Authorised signatory: D. Brooke

Date of Issue: 15/04/2020

Sample Details

Test Method: AS4133.4.2.2 - UCS less than 50 Mpa
Storage History: Tested as received

Sample ID:	SYD20-0152-07	SYD20-0152-08			
Client Sample ID:	-	-			
Borehole No.:	BH03	BH04			
Depth (m):	9.20 to 9.36	7.00 to 7.16			
Date Sampled:	27/03/2020	30/03/2020			
Date Tested:	6/04/2020	6/04/2020			
Sample Description:	Sandstone	Sandstone			

Test Results

Sample Height (mm):	150.7	151.2			
Sample Diameter (mm):	51.6	51.7			
Sample Height/Diameter Ratio:	2.9	2.9			
Sample Dry Density (t/m3):	2.351	2.175			
Moisture Content (%):	4.1	8.1			
Time of Failure (min):	7.5	7.4			
Uniaxial compressive strength (MPa):	**41.8**	**26.5**			
Mode of Failure:	Double Shear	Double Shear			
Specimen Comments:					
Where rock strength is likely to exceed 50 Mpa, ends are ground flat to 0.02mm					

Comments (if applicable):

Note 1	The length to diameter ratio falls outside the test method limits of 2.5:1 to 3:1.
Note 2	Specimen sides not straight to within 0.3mm
Note 3	Specimen ends not parallel or at right angles
Note 4	(T229) The length to diameter ratio falls outside the test method limits of 2.0:1 to 2.5:1.
Note 5	Maximum load falls below the limit of performance of compression machine

Testing machine Wykeham Farrance - 2000 kN

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GHD GEOTECHNICS

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Fax: (02) 9462 4710

Uniaxial Compressive Strength - Report

Report No: SYD2001004
Issue No: 1

Client:	Coffey Services Australia Pty Ltd.
Project:	Fisher Road
Location:	Dee Why
Job No.:	12519071

Accredited for compliance with ISO / IEC 17025
Laboratory Accreditation No. 679

Photographs

BH03
9.20 to 9.36

BH04
7.00 to 7.16

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CERTIFICATE OF ANALYSIS 240767

Client Details

Client	GHD Pty Ltd
Attention	David Brooke
Address	57-63 Herbert Street, Artarmon, NSW, 2064

Sample Details

Your Reference	**12519071**
Number of Samples	4 soil
Date samples received	14/04/2020
Date completed instructions received	14/04/2020

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.

Report Details

Date results requested by	15/04/2020
Date of Issue	15/04/2020

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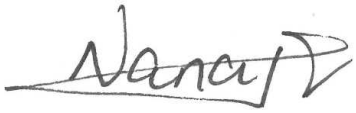
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity					
Our Reference		240767-1	240767-2	240767-3	240767-4
Your Reference	UNITS	BH02	BH01	BH03	BH04
Depth		1.5-1.95	0.8-0.9	0.2-0.3	0.2-0.3
Type of sample		soil	soil	soil	soil
pH 1:5 soil:water	pH Units	7.8	7.2	8.8	8.7
Electrical Conductivity 1:5 soil:water	µS/cm	20	28	76	17
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	10	23	<10

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

QUALITY CONTROL: Soil Aggressivity						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	7.8	7.9	1	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	20	20	0	99	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	<10	0	95	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	<10	0	98	[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.

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.

END OF REPORT