Douglas PARTNERS

GROUNDED EXPERTISE

Specialist Advice

Report on Preliminary Geotechnical Investigation

Proposed Residential Development

5-7 Church Street & 42 Donald Street, Nelson Bay NSW

Prepared for Fortezza Group Pty Ltd

Project 227295.00

29 August 2024

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

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Author		29 August 2024
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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

Report on Preliminary Geotechnical Investigation
Proposed Residential Development
5-7 Church Street & 42 Donald Street, Nelson Bay NSW

1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a preliminary geotechnical investigation undertaken for a proposed residential development at 5-7 Church Street & 42 Donald Street, Nelson Bay NSW (the site). The investigation was commissioned by email instructing to proceed dated 3 July 2024 from Roberto Giammaria of Fortezza Group Pty Ltd and was undertaken with reference to Douglas' proposal 227295.00.P.001.Rev2 dated 26 June 2024.

It is understood that the proposed residential development, named "The Belvedere", will comprise of the construction of a ten-storey residential apartment building with up to 8 m of excavation anticipated in the western two thirds of the site for a two-level basement car park. The site is shown on Drawing 1, Appendix E.

The aim of the investigation was to assess the subsurface soil and groundwater conditions at the field test locations in order to provide:

- Likelihood of acid sulfate soils based on regional mapping;
- Characterisation of subsurface conditions and depth to groundwater (if encountered);
- General earthworks and site preparation measures (including excavatability, fill material properties, fill layer thickness, compaction requirements and suitability of onsite materials for re-use), based on the conditions encountered at the test locations and only to the depths investigated;
- Preliminary retaining wall design parameters (bulk density, drained cohesion, friction angle K_a, K_p and K_0) and recommended temporary batter slopes;
- Site classification in accordance with AS2870 (2011);
- Earthquake site soil sub class to AS1170.4 (2007);
- Suitability of shallow footing options, founding depths, preliminary geotechnical design parameters and settlement estimates based on the conditions encountered at the test locations;
- Suitable pile types, preliminary geotechnical design parameters, estimated founding depths and settlement estimates based on the conditions encountered at the test locations;
- Aggressivity of soil conditions to buried steel and concrete as per AS2159; and
- Recommendations for further work (once access is available).

The investigation included five cone penetration tests (CPT), the drilling of five boreholes and laboratory testing of selected samples. The details of the field and laboratory work are presented in this report, together with comments and recommendations on the items listed above.

This investigation was undertaken concurrently with a preliminary site investigation (contamination) (PSI) and preliminary waste classification testing investigation, with contamination and waste classification components reported separately in the PSI and preliminary waste classification report (Douglas, 2024).

This report must be read in conjunction with all appendices including the notes provided in Appendix A and the PSI and preliminary waste classification report (Douglas, 2024).

2. Site Description

The site is located at 5-7 Church Street & 42 Donald Street, Nelson Bay NSW and is identified as Lot A and B DP 417172 and Lot 15 DP 5616. It consists of a rectangular shaped area of approximately 2200 m^2. The general site layout is shown in Figure 1 and Drawing 1, in Appendix E. The site is bordered by Church Street to the west, Donald Street to the south, residential dwellings to the north and commercial developments (restaurant, shops, carparking) to the east.

Figure 1: Site location, approximate site boundary shown in red.

The site is occupied by a single storey residential dwelling in the north-western corner with a separate garage on the northern site boundary (refer Figure 2), a small building (likely former outhouse toilet) in the central portion of the site (refer Figure 3), and a two-storey brick commercial building and concrete driveway / slab in the south-eastern corner of the site (refer Figure 4).

The remainder of the site was predominantly grassed, mounded/hummocky in places and some bushes and trees in the south-western corner.

The site slopes down to the south-east, with surface levels at the field test locations ranging from RL 21.2 AHD to 25.0 AHD.

Figure 2 to Figure 6 show areas of the site at the time of the investigation.

Figure 2: Looking south-east across Lot 15 (5 Church Street).

Figure 3: Looking south-west from CPT 2.

Figure 4: Looking approximately west along Donald Street from the south-east corner of the site.

Figure 5: Looking west across the south-western corner of the site (Lot A, 7 Church Street).

Figure 6: Looking approximately south along the eastern site boundary. Note existing timber retaining wall, estimated to be up to 3 m in height for adjacent commercial property.

3. Published Data

3.1 Geology

Reference to NSW Seamless Geology mapping indicates the site is underlain by Pleistocene to quaternary aged coastal deposits. The unit is described as indurated marine-deposited and aeolian-reworked fine to coarse-grained quartz-lithic sand with abundant carbonate and sporadic humic debris in stabilised dunes.

Reference to the NSW NCCA Quaternary Geology mapping indicates the site is underlain by Pleistocene aged bedrock-mantling dune comprising marine sand and indurated sand which is indicated to have low pyrite, organic and carbonate content and low to moderate heavy mineral content, and no shell content.

3.2 Hydrogeology

The regional groundwater regime is generally expected to flow to the north / north-east towards Port Stephens which is approximately 250 m from the site. Ports Stephens is considered to be the nearest sensitive receptor.

Groundwater is expected to flow similarly to surface topology ie flowing under the site to the east / north-east. Due to the sand deposits, groundwater levels are expected to be unconfined and fluctuate with rainfall.

Search of NSW registered groundwater bores indicates the following nearby registered groundwater bores within 500 m of the site (information sourced from groundwater work summary for each bore):

- GW200584 – 275 m north-east – installed in 2007 – no purpose listed on the work summary;
- GW080159 – 325 m north-east – 10 m deep well installed in 2001 – monitoring purposes – standing water level of 0.48 m in sands; and
- GW200402 – 375 m east – 24 m deep well installed in 2001 – monitoring purposes – standing water level of 6.40 m in sands.

It should be noted that groundwater levels are affected by factors such as climatic conditions and soil permeability and therefore vary with time.

3.3 Soil Landscape

Reference to NSW Soil Landscapes of Central NSW index indicates the site is underlain by soils typical of the Fingal Head soil landscape which typically comprises gently undulating rises to rolling low hills comprised of high-level dunes and sand sheets mantling bedrock. Typical limitations of this soil landscape include localised shallow soils, widespread poor moisture availability, widespread non-cohesive soils, localised steep slopes, localised mass movement hazard, localised foundation hazard, widespread recharge zone, widespread wind erosion hazard.

3.4 Acid Sulfate Soils (ASS)

Reference to NSW Acid Sulfate Soil risk mapping indicates the site is outside of the mapped area of acid sulfate risk. The nearest mapped area is approximately 110 m to the east which is mapped as low probability of occurrence (greater than 3 m below ground surface).

Typically, acid sulfate soils occur at elevations of 5 AHD and lower, but typically at elevations less than 1 AHD in coastal environments. The surface levels on the site are generally higher than 20 AHD and therefore ASS are not expected in the upper soil profile at the site.

3.5 Salinity

Reference to soil profiles and salinity observations from the NSW Central Resource for Sharing and Enabling Environmental Data (SEED) information system eSPADE (https://www.environment.nsw.gov.au/eSpade2Webapp) indicates no salting evident at three observed locations in a similar geological environments located within 2 km east and west of the site.

3.6 Mine Subsidence

With reference to the NSW Planning Portal (www.planningportal.nsw.gov.au), there are no known occurrence of mine workings below the site and the site is not located within a mine subsidence district.

4. Field Work

4.1 Subsurface Investigation

4.1.1 General

The field work was undertaken on 9 and 16 July 2024 and comprised the following at the locations indicated on Drawing 1, in Appendix E:

- Five CPTs (designated CPTs 1 to 5) to depths between 14.26 m and 20.0 m. CPT 4 was terminated at 14.26 m due to excessive rod bending; and
- Drilling of five bores (designated Bores 6 to 10) to 6.0 m depth.

The test locations were set out by an environmental engineer taking into consideration the existing services on site and within accessible areas. The environmental engineer also logged the subsurface profiles in the bores and collected representative samples for identification and laboratory testing purposes.

The tested / drilled locations were recorded using a differential GPS, which is typically accurate to ±0.1 m, depending on satellite coverage and site condition. The approximate location (GDA2020 Zone 56) and elevation (AHD) of the tests are shown on the attached CPT plots and borehole logs. It is important to note that Douglas is not a registered surveyor, hence the locations and elevations are approximate only.

4.1.2 CPTs

The CPTs were conducted using a purpose-built truck mounted CPT rig which required track mats to access part of the site. A 35 mm diameter instrumented cone and friction sleeve assembly was hydraulically thrust into the soil at a rate of 2 cm / sec. Cone tip resistance, depth and sleeve friction were recorded by a computer data acquisition system for subsequent plotting and analysis. The remnant CPT holes were dipped to measure the depth to groundwater or hole collapse.

4.1.3 Boreholes

The bores were drilled using a specialised site investigation rig employing continuous push-tube methods. 'Disturbed' samples were collected for laboratory testing purposes.

The bores were reinstated with drilled spoil at the completion of drilling and sampling, which was compacted in layers using hand tools within about 1 m of the surface.

4.2 Results

The subsurface conditions inferred in the CPTs and encountered in the bores are detailed in the attached CPT plots and borehole logs in Appendix B. These should be read in conjunction with the notes on Appendix A, which explain the descriptive terms and classification methods.

The CPT plot includes an interpreted soil profile (soil behaviour type) based on published correlations between measured cone parameters and soil type. In this regard, it is difficult to distinguish between natural and fill, particularly if the fill is a similar material to the underlying natural ground. In the CPT descriptions, the depth of possible fill is shown but should be considered as approximate.

No visual or olfactory evidence (eg staining, odours, free phase product) was observed during the investigation to suggest the presence of significant contamination within the soils at the test locations.

The PID screening recorded values of less than 1 ppm suggesting the absence, or very low concentrations, of VOC in the samples tested.

The subsurface conditions encountered in bores and CPTs have been broadly divided into geotechnical units summarised as follows:

Unit 1 – Fill / Possible Fill

- Unit 1.1 – Fill (no building demolition waste): generally comprising brown silty sand with rootlets;
- Unit 1.2 – Fill (with building demolition waste): generally comprising brown silty sand with brick, tile, glass and rootlets; and
- Unit 1.3 –Fill / Possible Fill: generally comprising sand / gravelly sand, inferred as loose or medium dense, variably to poorly compacted.

Unit 2 –Aeolian and Alluvial Sand

- Unit 2.1 – Sand and Silty Sand: generally loose or loose to medium dense. Some bands of indurated sand noted in Bores 6, 7, 9 and 10;
- Unit 2.2 – Sand and Silty Sand: generally medium dense or denser, locally very dense. Some loose or loose to medium dense bands inferred in CPTs 1, 4 and 5.

Table 1 below summarises the subsurface conditions encountered at the site.

Table 1: Subsurface Summary

Soil Unit	Description	Base of Unit (m)									
		1	2	3	4	5	6	7	8	9	10
1.1	Fill / Silty Sand (no demolition waste)	- [1]	- [1]	- [1]	- [1]	- [1]	0.1	NE	0.1	NE	NE
1.2	Fill / Silty Sand (with demolition waste)	- [1]	- [1]	- [1]	- [1]	- [1]	NE	**0.1**	NE	**0.6**	**0.1**
1.3	Fill / Possibly Fill: Sand / Gravelly Sand	0.4 [1]	0.55 [1]	0.55 [1]	0.15 [1]	0.25 [1]	-	-	-	-	-
2.1	Sand / Silty Sand: Loose or Loose to Medium Dense	NE	NE	NE	1.9	1.7	6.0* ^	6.0* ^	6.0*	6.0* ^	6.0 #* ^
2.2	Sand / Silty Sand: Medium Dense or Denser	20.0 [2]	20.0	20.0	14.26 [3]	20.0	-	-	-	-	-
Groundwater (m)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Limit of Investigation (m)		20.0	20.0	20.0	14.26	20.0	6.0	6.0	6.0	6.0	6.0

Notes to Table 1:
1 - Unable to detect demolition waste with investigation methodology (CPTs)
2 - Loose to medium dense silty sand inferred in CPT 1 from 12.8 m to 13.6 m depth
3 - Loose silty sand inferred in CPT 4 from 6.15 m to 7.35 m and 11.0 m to 12.15 m depth; and loose to medium dense silty sand inferred from 9.1 m to 11.0 m depth
NE – Not encountered
* No strength data obtained below 1.2 m depth in Bores 6 to 10
^ Indurated sand noted on the bore log, inferred from drilling resistance
# very loose to loose from 0.3m to 1.2 m depth
Bold cells indicate subsurface units with potential contaminant observations (presence of building materials which are indicative of the presence of hazardous building materials)

No free groundwater was observed in the upper 10 m of the CPT voids following removal of rods (limit of measurement). No free groundwater was observed during drilling of boreholes. It should be noted that groundwater depths and ground moisture conditions are affected by factors such as climatic conditions and soil permeability and will therefore vary with time.

5. Laboratory Testing

Geotechnical laboratory testing comprised three soil aggressivity tests and six pH and EC tests. The results of the laboratory testing are presented in Appendix C and are summarised in Table 2 below.

Table 2: Summary of Soil Aggressiveness Testing

Bore	Depth (m)	Description	pH	EC (µS/cm)	Chlorides (mg/kg)	Sulfates (mg/kg)
6	0 – 0.1	Fill / Silty Sand	5.8	15	NT	NT
6	3.0	Sand	6.3	3	<10	<10
7	0 – 0.1	Fill / Silty Sand	5.4	11	NT	NT
8	0 – 0.1	Fill / Silty Sand	5.6	50	NT	NT
8	6.0	Sand	5.9	2	<10	<10
9	0 – 0.1	Fill / Silty Sand	6.3	42	NT	NT
9	0.5	Sand	7.1	20	NT	NT
10	0 – 0.1	Fill / Silty Sand	6.1	52	NT	NT
10	6.0	Silty Sand (indurated)	5.3	14	<10	10

Notes to Table 2:

NT – not tested

EC – electrical conductivity

6. Proposed Development

With reference to available architectural drawings (Hayes Anderson Lynch Architects Pty Ltd (HAL) Drawings SD101 to SD312 Revision Q dated 05/06/2024), it is understood that the proposed residential development, will comprise of the construction of a nine-storey residential apartment building with a two-level basement car park.

Based on supplied information, it is anticipated that cuts of up to 8 m would be required to facilitate the construction of the below ground car parking area. Based on Section A, provided on HAL Drawing SD312 Issue Q, the finished floor level of Basement 02 is proposed to be 17.5 AHD and locally deeper at the proposed lift pit in the centre of the building. The anticipated excavation elevation for the lift pit is not indicated on the provided drawing, however, has been assumed to be less than 1 m for this assessment.

Section A from HAL Drawing No. SD312 Issue Q is provided in Figure 7. The plans are also included in Appendix E.

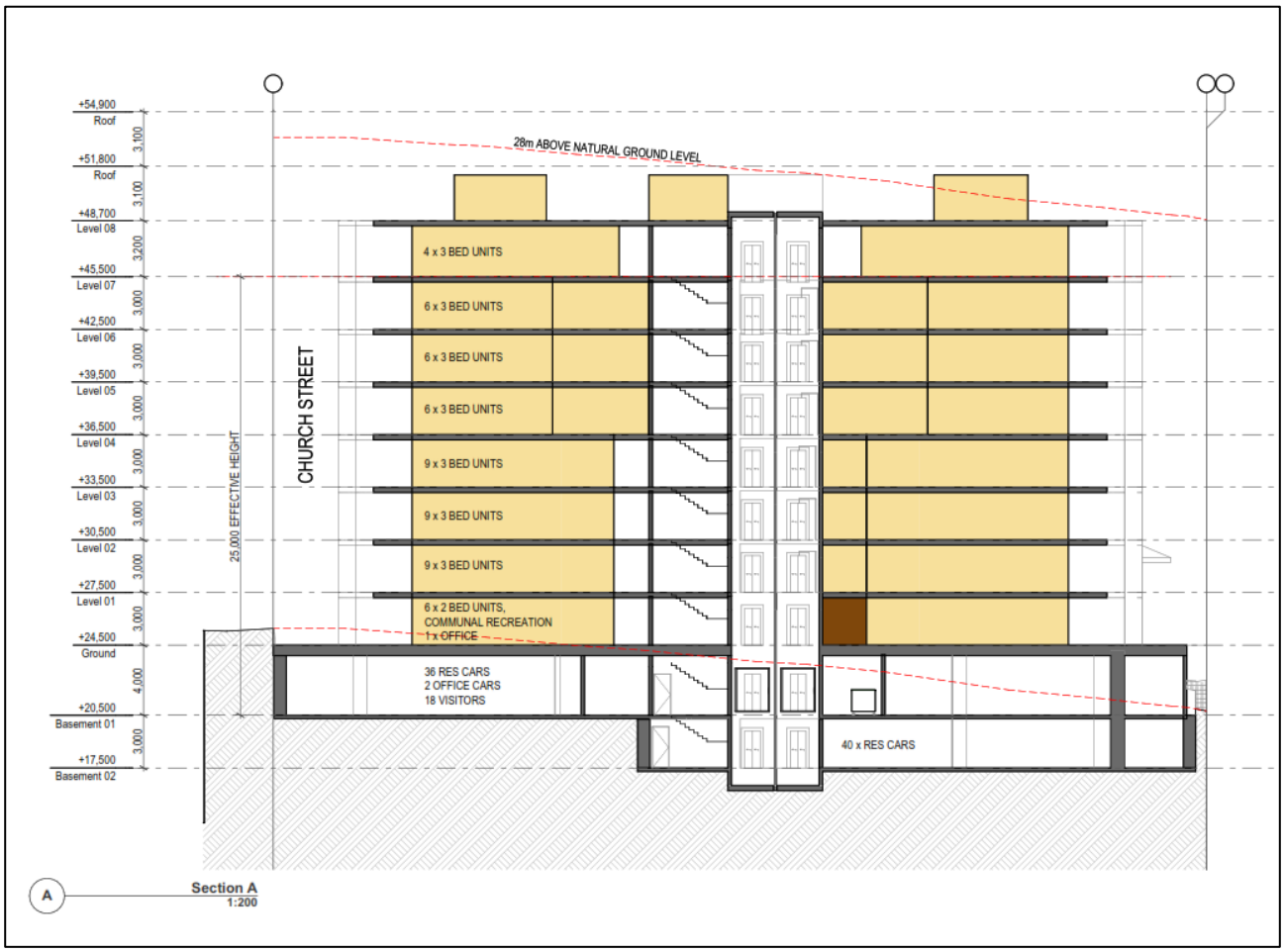

Figure 7: Section of the proposed development (figure adapted from HAL Drawing No. SD312 Issue Q dated 05/06/2024)

Based on the proposed finished floor levels for Basement Levels 01 and 02 of 20.5 AHD and 17.5 AHD, respectively, an allowance for slab thickness and working platform (if required) and underdrainage features, the base level of bulk excavation is anticipated to be 20 AHD and 17 AHD for Basement Levels 01 and 02, respectively.

Based on the existing site surface levels, the following cut and fill depths have been estimated in connection with the proposed development (refer Drawing 2 in Appendix E):

- Up to 8.5 m of cut for Basement Level 02 (refer blue shaded area);
- Up to 6.5 m of cut for Basement Level 01 in the western portion of the site (refer green shaded area);
- Up to 2.5 m of cut for Basement Level 01 in the southern portion of the site (refer green shaded area);
- Up to 1.7 m of fill for the ground floor in the southern portion of the site;
- Up to 2.5 m of fill in the north-eastern corner of the site;

- Localised excavation for the lift well (Basement 02 level); and
- Localised excavations for buried services and footings (Basement 01 and 02 and Ground Floor).

Based on finished floor levels and existing surface levels, the following is noted for the proposed retaining walls:

- The retaining wall on the eastern building extent would range from approximately 0 m (in the southern extent) to 4.5 m in height (at the northern extent). This wall is proposed within 5 m of an adjacent commercial building and existing retaining wall that was estimated to be up to 3 m high;
- The retaining wall proposed on the northern building extent would range between approximately 5 m (at the eastern extent) to 8 m (at the western extent of Basement Level 02) high. This wall is proposed within less than 5 m of existing residential dwellings;
- The retaining wall proposed on the western building extent would range from 4.5 m (at the southern extent) to 6 m (at the northern extent) in height. This wall is proposed approximately 5 m from Church Street and existing buried infrastructure within the road corridor;
- The retaining wall proposed on the southern building extent would range between 0 m (at the eastern extent) and 6 m (at the western extent of the Basement Level 02) in height. This wall is proposed within 10 m of Donald Street and existing buried infrastructure within the road corridor; and
- The internal wall at the western extent of the Basement Level 02 would be 3 m in height.

Given the proximity of existing buildings and infrastructure to the proposed retaining walls and the proposed depth of excavation, excavation support would be required prior to bulk excavation (as discussed further in Section 7.1.3).

7. Comments

7.1 Excavations

7.1.1 Excavatability

Excavations up to 8 m depth within the basement footprint would probably encounter granular fill, overlying initially loose, then medium dense sand and silty sand. Some bands of weakly indurated (cemented) silty sands may be encountered.

Excavation of this material may be readily conducted using conventional earthmoving equipment, such as a hydraulic excavator.

Groundwater was not encountered in any of the bores, or within the upper 10 m of the CPT voids following withdrawal of the rods and is therefore not expected to be encountered during proposed excavations.

7.1.2 Temporary Batter Slopes

Temporary unretained excavations up to a maximum 2.0 m deep and provided there are no loads, services, structures or traffic located within the slope height behind the batter crest, should be battered at no steeper than 1.5H:1V in the sands where space permits. Where batters are unlikely to be suitable, excavation support prior to excavation will be required. If elevated groundwater is encountered at the time of excavation, such that it seeps from the batter face, additional geotechnical advice should be sought.

Excavations greater than 2.0 m deep within the sand at the site should be appropriately supported (refer Section 7.1.3).

The adoption of such temporary batter slopes will also be dependent upon all surcharge, such as from spoil heaps, equipment and traffic, being kept well back (or at least the vertical excavation depth) from the slope crest.

Any cuts steeper than suggested above should be fully shored.

The duration of construction personnel working within trench excavations should be minimised as far as practicable (eg use of laser guided buckets for bedding sand placement/trimming after compaction, remote control/excavator mounted compaction equipment etc). It is also suggested that trench boxes/shields be installed at pipe joints, to provide further protection for construction personnel.

7.1.3 Excavation Support

There are existing buildings located in close proximity to the eastern and northern site boundaries and there is insufficient data to confirm whether these buildings have been piled. Therefore careful consideration will be required in the design and construction of the basement in order to minimise the risk of ground movements which may damage the existing buildings, adjacent buried services and roadways. It should be noted that no retaining system can guarantee that structures at the crest of an excavation will not be affected, however the risks can be reduced by adopting suitable techniques.

It is recommended that excavations adjacent to the existing buildings be fully braced in order to minimise lateral deflections. Cantilever type walls are not recommended for such situations as deflections typically associated with such walls can lead to damage of adjacent structures. Suitable retaining systems may include cutter soil mix (CSM), secant, or possibly sheet pile walls which are fully supported laterally using either soil nails/anchors extending below the adjacent properties or props which are internal to the excavation. For sheet pile walls there is a risk of some settlement and vibration damage of adjacent structures occurring due to both installation and extraction and are least preferred for this development site.

Where battering is not feasible for trench or footing excavations (due to space, the presence of groundwater or surface infrastructure such as roads, other services and structures), temporary sheet piling is suggested to support excavations. Sheet piling (or similar) could be suitable for temporary and permanent excavation support for the internal retaining walls where retained soil height is limited to around 3 m.

It is recommended that a dilapidation assessment is undertaken on adjacent properties prior to construction.

Recommended design parameters for estimating long-term earth pressures for the support of lateral pile loads are shown in Table 3. These values are for a level backfill and are unfactored hence a suitable factor of safety should be used in design.

Table 3: Design Parameters for Retaining Structures

Unit	γ_b (kN/m^3)	ϕ' (deg)	K_a	K_o	K_p
Unit 1: - Fill / Possibly Fill: Sand / Gravelly Sand	20	30	0.33	0.50	3.00
Unit 2.1: - Sand / Silty Sand: Loose or Loose to Medium Dense	20	32	0.31	0.47	3.25
Unit 2.2: - Sand / Silty Sand: Medium dense or denser	20	36	0.26	0.41	3.85

Notes to table:

γ_b - bulk density

K_o - coefficient of 'at-rest' earth pressure

K_p - coefficient of passive earth pressure

ϕ' friction angle

K_a - coefficient of active earth pressure

In the context of retaining wall design, the use of active pressure coefficients (K_a) requires that there will be sufficient deflection of the retaining system during construction to reach active conditions. If lateral deflections are to be restrained by the structure, at-rest coefficients (K_o) should be used. For the support of lateral pile loads, the passive earth pressure coefficient should be used in conjunction with a factor of safety of at least 2.0 or an appropriate material reduction factor.

The design values given in Table 3 do not include any surcharge loads that may be imposed near any proposed excavations, e.g. vehicle loads, neighbouring buildings, construction surcharge. This would include surcharge loads applied by adjacent buildings supported on shallow footing systems and / or piled footings founded above the proposed excavation depth, which would require further assessment and / or investigation.

Drainage is to be provided in the backfill behind all of the permanent retaining walls alternatively, the wall should be designed for hydrostatic pressures. Where drainage is provided, it should include 100 mm diameter slotted pipe at the toe, with single sized (either 10 mm or 20 mm) aggregate extending over the full height of the wall. In Douglas' experience, sand is not suitable to be used as a drainage layer behind walls, particularly where indurated sand is present because this can cause temporary perched water in the sand profile resulting in hydrostatic pressures being applied to the wall. The backfill should include a 100 mm slotted pipe at its base and at 2 m height intervals. All pipes should discharge to a formal drainage system or downslope of the site and the backfill should be encapsulated in a suitable geotextile fabric. Crest drains for surface water behind crest of retaining walls should also be included.

It is recommended that a risk assessment be undertaken prior to construction to assess safety, constructability and potential impacts on existing services and structures.

Notwithstanding the above comments, the contractor should comply with all statutory requirements for excavation support.

7.2 Earthworks and Site Preparation

Prior to any earthworks at the site, any deleterious materials and vegetation should be stripped from within the building envelope and either removed from site or stockpiled for possible re-use, if applicable and with reference to Douglas, 2024. The fill should be segregated from the underlying natural sands. Reuse of existing site fill may be suitable, subject to further investigation as discussed in Douglas (2024).

The naturally occurring silty sand and sand excavated from the development area could be suitable for re-use as structural fill for the support of infill slabs, provided that it is free from deleterious materials such as topsoil, vegetation and particles greater than 150 mm in size. It is noted that silty sand will require careful moisture conditioning as it can become difficult to compact if it is too wet.

Imported fill (if required) should preferably comprise free draining cohesionless sand with less than 5% by weight of particles passing a 0.075 mm sieve or other granular material such as fine crushed rock. The material should be free from organic matter and large particles. A fine crushed rock is preferred at the surface to provide a trafficable layer for construction plant.

The following site preparation and earthworks measures are recommended for the support of buildings and pavements at the site:

- Remove / segregate the fill;
- Excavate to design bulk level and stockpile for reuse (as appropriate);
- Test roll the exposed subgrade to ensure uniform base conditions. It is suggested that test rolling involve at least six passes of a minimum 12 tonne deadweight roller. Vibration should generally not be used (or used with extreme caution) as it may cause settlement and distress to adjacent structures;
- Remove any soft spots as revealed by excessive heaving/settlement under the roller to a depth of at least 0.3 m (subject to geotechnical inspection) and replace with a compacted, granular material. The area should then be subject to additional test rolling; and
- Fill to the underside of the slab, if required, should be placed in layers of not more than 200 mm thickness and compacted to at least 80% density index (for cohesionless sands) or 100% standard dry density ratio (for non-sand materials).

If fill is to be used for the support of structural loads, earthworks testing and inspections should be carried out under controlled 'Level 1' inspection and testing, as defined in Section 8 of AS 3798 (2007). Again, vibratory rolling is not recommended due to the proximity of adjacent structures. Density testing of sand layers would probably require placement of a second layer to allow confinement, with the testing undertaken through the upper layer into the underlying layer.

If the basement slabs are to be fully suspended on piles, only nominal rolling would be required as the sand subgrade would merely act as temporary formwork support for casting of the slab.

During construction, some loosening of the surface sands in foundation excavations is expected. Therefore, the base of any excavation should be re-compacted using a light vibratory plate compactor prior to constructing any footings.

Owing to the sand subgrade at the site, a granular bridging / capping layer will likely be required to act as a working platform if any tyred vehicles (construction or otherwise) are required to traffic the compacted sand surface prior to construction. Based on previous experience, the granular layer will need to be at least 200 mm to 250 mm thick, however the actual thickness will depend on the material used and traffic load applied to the layer. Any damage to the working platform caused by vehicular traffic should be promptly repaired by placement and compaction of additional granular material.

7.3 Site Classification

The site is classified Class P with reference to the residential footing standard (AS 2870, 2011) due to the presence of fill across the site. Accordingly, footings should be designed in accordance with engineering principles. It may be possible to reclassify the site following earthworks where controlled fill is placed and compacted below the building in accordance with Level 1 methods and with reference to Section 7.2. If sand is used for the controlled fill, it may be possible to classify the building areas Class A but this should be confirmed after earthworks.

It should be noted that site classifications are only applicable for residential type development and not applicable for the proposed development.

The soils encountered at the site were predominately sandy in nature which do not tend to shrink or swell with changes in soil-moisture content.

7.4 Earthquake Subsoil Class

The investigation included CPTs to 20 m and bores to 6 m depth. The overlying soil profile contains loose to medium dense sand underlain by medium dense to very dense sand. Previous investigations by Douglas east of the site have encountered rock within 30 m of the surface.

Based on the procedures presented in the earthquake standard (AS 1170.4, 2007), the site subsoil classification is Class Ce Shallow site soil.

7.5 Footing Systems

7.5.1 Shallow Footings

An assessment of 'shallow' footings has been made, considering pad footings, strip footings and raft slabs, or a combination of these.

Shallow footings would be founded on the Unit 2.2 medium dense or denser sand / silty sand. The results of CPTs 1 and 3 indicate the cone resistance (q_c) at about 19.5 AHD (1 m below Basement Level 01) was in the range of 15 MPa to 20 MPa. The results of CPTs 1, 2, 4 and 5 indicate q_c was in the range of 30 MPa to 40 MPa at about 16.5 AHD (1 m below Basement Level 02), with the exception of CPT 4 which had a q_c of 5 Pa at this depth. The subsurface profile below Basement Level 02 included bands of loose or loose to medium dense sand.

The allowable bearing capacity for pad footings at least 1 m wide and up to 2.5 m square, and strip footings at least 1 m wide, founded 1 m below proposed basement levels in medium dense or better sand are assessed to be 350 kPa for Basement Level 01 and 300 kPa for Basement Level 02. These values are primarily governed by settlement considerations and the loose sand inferred in CPT 4 from 6.15 m to 7.35 m depth.

Pad footings could be considered for columns where the applied pressure is less than those presented above. The estimated settlements would be around 15 mm if designed for the pressures provided above. However, the potential differential settlements between columns supported on pads of different load combinations would require careful assessment.

7.5.2 Piles

7.5.2.1 General

Piles should preferably be founded in the medium dense or denser sand layers in Unit 2.2.

Owing to the granular subsoil overlying the suitable founding strata, conventional bores piles will not be suitable for the proposed development. Driven piles are likely to refuse on dense to very dense sand layers within Unit 2.2 but consideration should be given to the effect on nearby vibration sensitive structures. Steel screw piles can be difficult to install through cemented sand and medium dense or stronger sand and may approach refusal where the cone tip resistance (q_c) of the CPT approaches about 20 MPa.

Continuous flight auger (CFA) piles are likely to be the most suitable pile type for support of the proposed development. The methods for installation of CFA or grout injected piles are essentially vibration-free.

If CFA piles are proposed, more CPTs would be required to confirm the founding levels (for building loads and the retaining walls) as CFA piles do not have the benefit of assessing the pile capacity as they are installed.

If a secant wall is adopted for the retaining walls, the secant piles should be installed by experienced contractors using guide walls to reduce loss of verticality ('wander'). Nevertheless some gaps between piles may eventuate which would increase leakage through the wall and potential for surface settlement and damage to adjacent structures.

7.5.2.2 Geotechnical Strength Reduction Factor

Estimates of pile capacities in compression have been undertaken with reference to the piling standard AS 2159 (2009). The pile capacities are expressed in limit state terms whereby the Design Geotechnical Strength ($R_{d,g}$) is defined in AS 2159 (2009) as:

$R_{d,g} = \phi_g R_{ug}$, which must exceed the Design Action Effect E_d

R_{ug} is the ultimate geotechnical strength, which is calculated using static theory, and therefore represents an estimate only. The geotechnical strength reduction factor ϕ_g depends on a number of factors including the extent of site investigation, type of analysis and pile testing regime during construction. For the preliminary estimates presented below, a value of ϕ_g = 0.45 was adopted due to the variable depth to a founding material across the site. Higher values of ϕ_g may be justifiable if additional CPTs are undertaken, sufficient load testing is conducted, as per AS 2159 (2009) and construction supervision / testing is undertaken but this will depend on the pile type and should be assessed by the piling contractor. The traditional "allowable" capacity is related to "working" load and is generally lower than $R_{d,g}$, depending on the structural factors applied to determine E_d.

It is noted that integrity testing of cast-in-place piles does not improve the geotechnical strength reduction factor. However, Table 8.2.4(B) of (AS 2159, 2009) requires that 5% to 15% of piles are subject to integrity testing if the adopted ϕ_g exceeds 0.4 and the ARR is greater than 2.5. Furthermore, if at least 5% of piles are integrity tested, the maximum concrete placement factor (k) may be adopted in accordance with Table 5.3.2 of (AS 2159, 2009).

7.5.2.3 Geotechnical Capacity of Single Piles

Estimates of geotechnical pile capacities have been determined using the CPT results and in-house program ConePile Version 5.9.1. The plots of estimated pile capacity against depth are included in Appendix D.

The ultimate parameters provided in Table 4 are suggested for the preliminary static design of CFA piles subject to vertical compressive loads, with at least three pile diameters embedment into the founding strata and a consistent founding stratum extending to at least four pile diameters below the toe of the pile.

It is recommended that the contribution of skin friction in the upper 1.5 m of soil and any shaft length that has been disturbed be ignored in any pile capacity calculations.

Table 4: Estimated Pile Capacities for CFA Piles (Grout-injected Piles)

CPT	Surface Elevation (AHD)	Basement FFL (AHD)	Estimated Depth of Excavation (m)	Target Depth (m)	Estimated Design Geotechnical Strength in Compression ($R_{d,g}$) [1,3] (kN), ϕ_g = 0.45 0.6 m diameter
1	24.9	17.5	7.9	14.0	1,200
2	22.9	17.5	5.9	11.0	1,500
3	25.0	20.5	5.0	14.0	1,600
4	21.6	17.5	4.6	11.5	1000
5	22.8	17.5	5.8	13.0	1,300

Pile groups may be considered where anticipated structural loads exceed single pile capacities. However, it should be noted that group capacities are not necessarily a straight multiple of individual capacities due to interaction effects. It is recommended that piles should not be spaced closer than three pile diameters (centre to centre).

Total settlement of about 1% to 2% of the pile diameter is expected for piles installed at the depths shown in Table 4 and proportioned as above, under working loads.

All pile types should be suitably protected against decay / corrosion taking account of the subsurface conditions, water table fluctuations and design life.

7.5.1 Raft or Piled Raft

Consideration could also be given to stiffened raft slabs founding on the medium dense to dense sand. A raft or piled raft could potentially combine the benefits of the medium dense sand layer, low net overburden pressure and reduced pile lengths to form a suitable foundation system. It would entail the use of a considerably thicker and stiffer raft slab to distribute the loads over strategically located piles (if required). The layout and depth of piles, as well as slab thickness and stiffness, can be adjusted to minimise differential settlements between columns.

The design of the raft or piled raft requires integrated geotechnical and structural analysis. It is best undertaken using finite element software (e.g. Plaxis). It is recommended that a piled raft analysis be carried out to assess the feasibility of this foundation option and enable a cost-benefit assessment.

7.6 Soil Aggressiveness

The results of laboratory testing of soil samples collected during field work have been compared to the exposure classifications for steel and concrete as outlined in AS 2159 (2009). The following table summarises the exposure classifications for each of the samples tested.

Table 5: Soil Aggressiveness Exposure Classification with reference to AS 2159 (2009)

Bore	Depth (m)	Description	Soil Condition	pH (concrete)	pH (steel)	Resistivity(1) (Ω.cm) (steel)	SO_3 (ppm) (concrete)	Cl (ppm) (steel)
6	0 – 0.1	Fill / Silty Sand	B	5.8	5.8	66667	NT	NT
6	3	Sand	B	6.3	6.3	333333	<10	<10
7	0 – 0.1	Fill / Silty Sand	B	5.4	5.4	90909	NT	NT
8	0 – 0.1	Fill / Silty Sand	B	5.6	5.6	20000	NT	NT
8	6	Sand	B	5.9	5.9	500000	<10	<10
9	0 – 0.1	Fill / Silty Sand	B	6.3	6.3	23810	NT	NT
9	0.5	Sand	B	7.1	7.1	50000	NT	NT
10	0 – 0.1	Fill / Silty Sand	B	6.1	6.1	19231	NT	NT
10	6	Silty Sand (indurated)	B	5.3	5.3	71429	10	<10

Notes to Table

	Non-aggressive
	Mildly aggressive
	Moderately aggressive
	Severely Aggressive
	Very Severe

1 - Resistivity calculated based on inverse of conductivity in aqueous solution results

Scale of aggressivity based on threshold values given in AS 2159 – 2009: Piling – Design and Installation.

The results of the laboratory testing suggest mildly aggressive conditions towards buried concrete structures and non-aggressive conditions towards buried steel structures.

7.7 **Additional Investigation**

Further to the recommendations in Douglas (2024), additional geotechnical investigation is recommended as follows:

- Additional CPTs to fill in data gaps (ie within existing building and pavement footprints) and along the site boundaries. The additional CPTs would refine pile founding levels and retaining wall design;
- Additional CPTs in the vicinity of CPT 4 to better understand the comparatively low pile capacity;
- Piled raft analysis using finite element software (e.g. Plaxis) and structural analysis to assess the feasibility of this foundation option and enable a cost-benefit assessment;
- A risk assessment prior to construction to assess safety, constructability and potential impacts on existing services and structures from the proposed excavation depths and retaining wall design. In this regard, a dilapidation assessment would be beneficial;
- Deep borehole investigation to collect soil samples below 6 m depth for soil aggressiveness assessment; and
- Installation of a groundwater monitoring well at depth to confirm groundwater depth.

8. References

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VC. (2018). *Site Classification Investigation, 90 Magnus Street, Nelson Bay, Ref: P915-18_125-R-001-Rev0*. Valley Civilab Pty Ltd, Ref: P915-18_125-R-001-Rev0 dated 19 October 2018.

9. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 5-7 Church Street & 42 Donald Street, Nelson Bay NSW with reference to Douglas' proposal 227295.00.P.001.Rev2 dated 26 June 2024 and acceptance received from Roberto Giammaria of Fortezza Group Pty Ltd dated 3 July 2024. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Fortezza Group Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

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

Asbestos has been detected by observation or by laboratory analysis, either on the surface of the site, or in fill materials at the test locations sampled and analysed. Additionally, building demolition materials, such as concrete, brick, tile was located in previous below-ground fill and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

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

Appendix A

About this Report

Terminology, Symbols and Abbreviations

Soil Descriptions

Sampling, Testing and Excavation Methodology

Cone Penetration Tests

About this Report

November 2023

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

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

Reports

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

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

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

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

continued next page

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

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Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

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

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

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

Abbreviation Codes

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

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

Data Integrity Codes

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

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

Graphic Symbols

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

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Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

Introduction

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

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

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

Particle size designation and Behaviour Model

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

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

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

[1] – refer grain size subdivision descriptions below

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

Component proportions

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

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

[1] As defined in AS1726-2017 6.1.4.4

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

Composite Materials

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

Soil Descriptions

Classification

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

Soil Name

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

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

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

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

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

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

Identification of minor components

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

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

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

Soil Composition

Plasticity

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

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

Grain Size

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

Grading

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

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

Soil Condition

Moisture

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

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

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

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

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

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

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

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

Consistency (fine grained soils)

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

Relative Density (coarse grained soils)

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

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

Compaction (anthropogenically modified soil)

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

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

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

Soil Origin

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

Cobbles and Boulders

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

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

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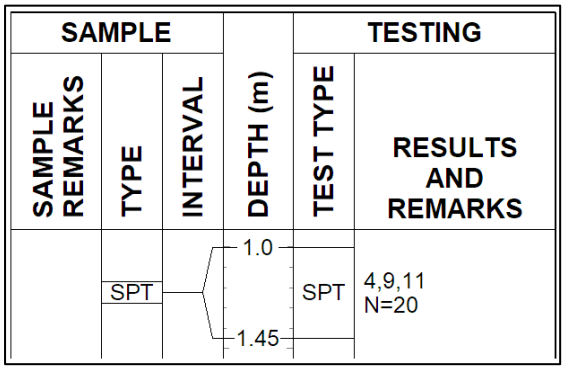
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

March 2024

Sampling and Testing

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



Sampling

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

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

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

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

Field and Laboratory Testing

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

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

Field and laboratory testing (continued)

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

Groundwater Observations

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

Drilling or Excavation Methods/Tools

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

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

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

Douglas PARTNERS

Cone Penetration Testing

November 2023

Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

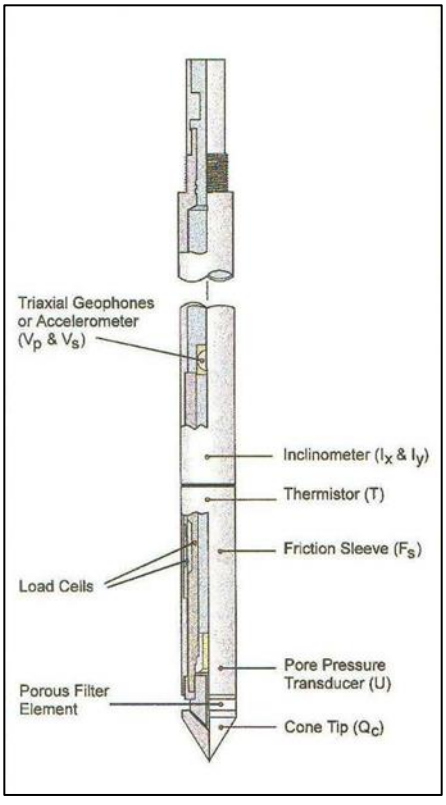


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.

Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (qc, fs, i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (□) plus basic parameters
Seismic	Shear wave velocity (Vs), compression wave velocity (Vp), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Qt) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration testing

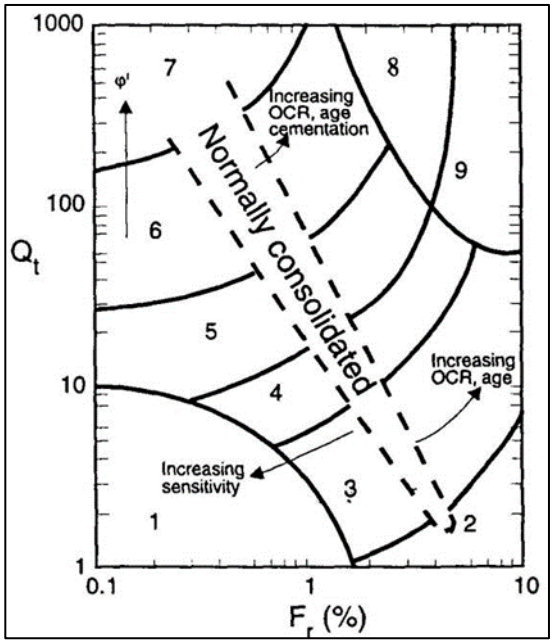


Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation.

The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G0. Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

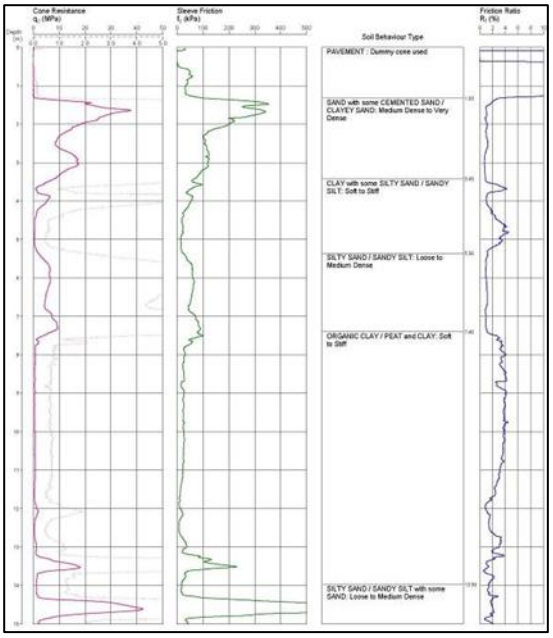


Figure 4: Sample Cone Plot

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Appendix B

Cone Penetration Test Plots (CPTs 1 to 5)

Borehole Logs (Bores 6 to 10)

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

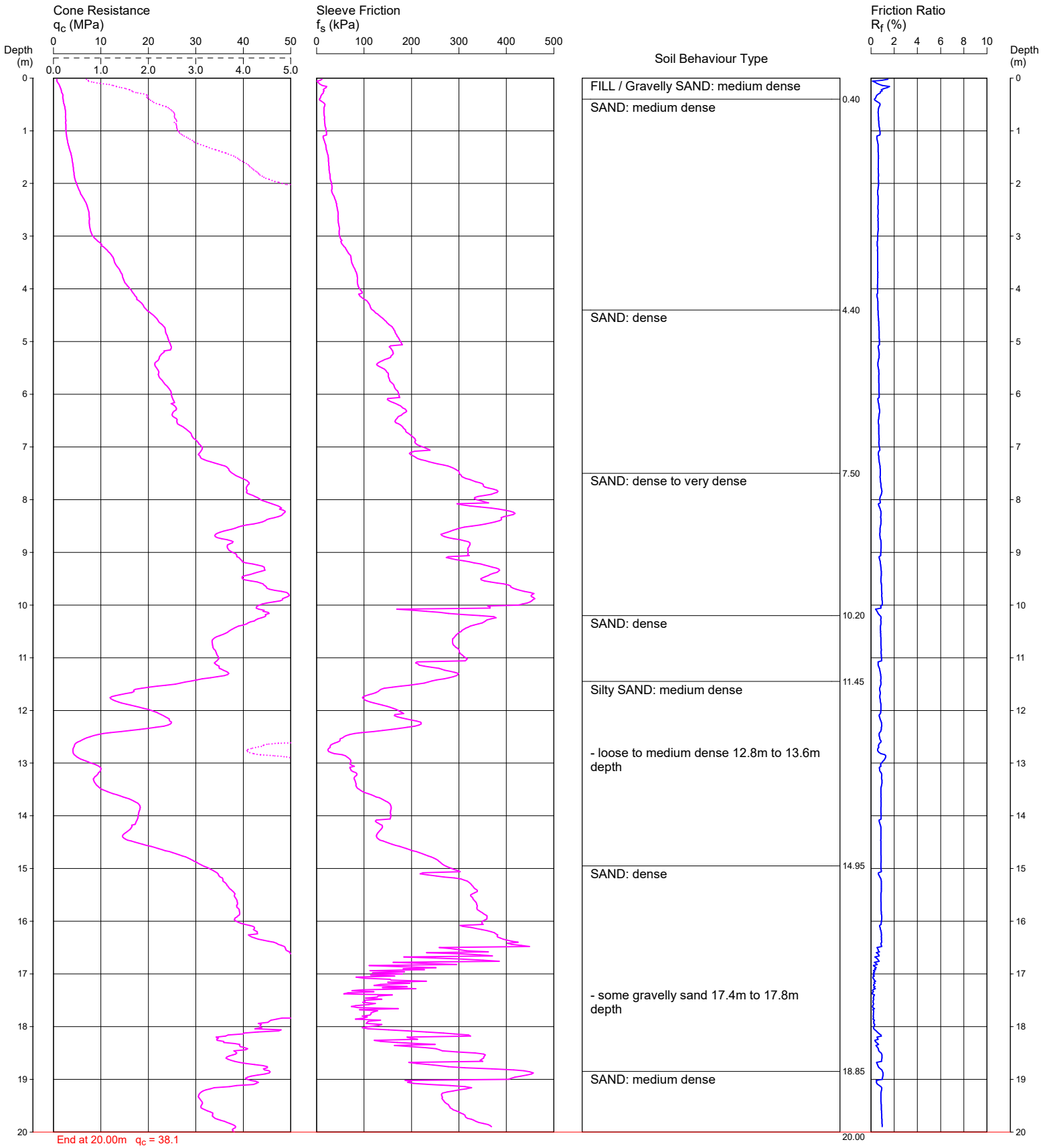
REDUCED LEVEL: 24.9 AHD

COORDINATES: 419557.4E 6379291.2N GDA20 Zone 56

CPT1

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT1.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

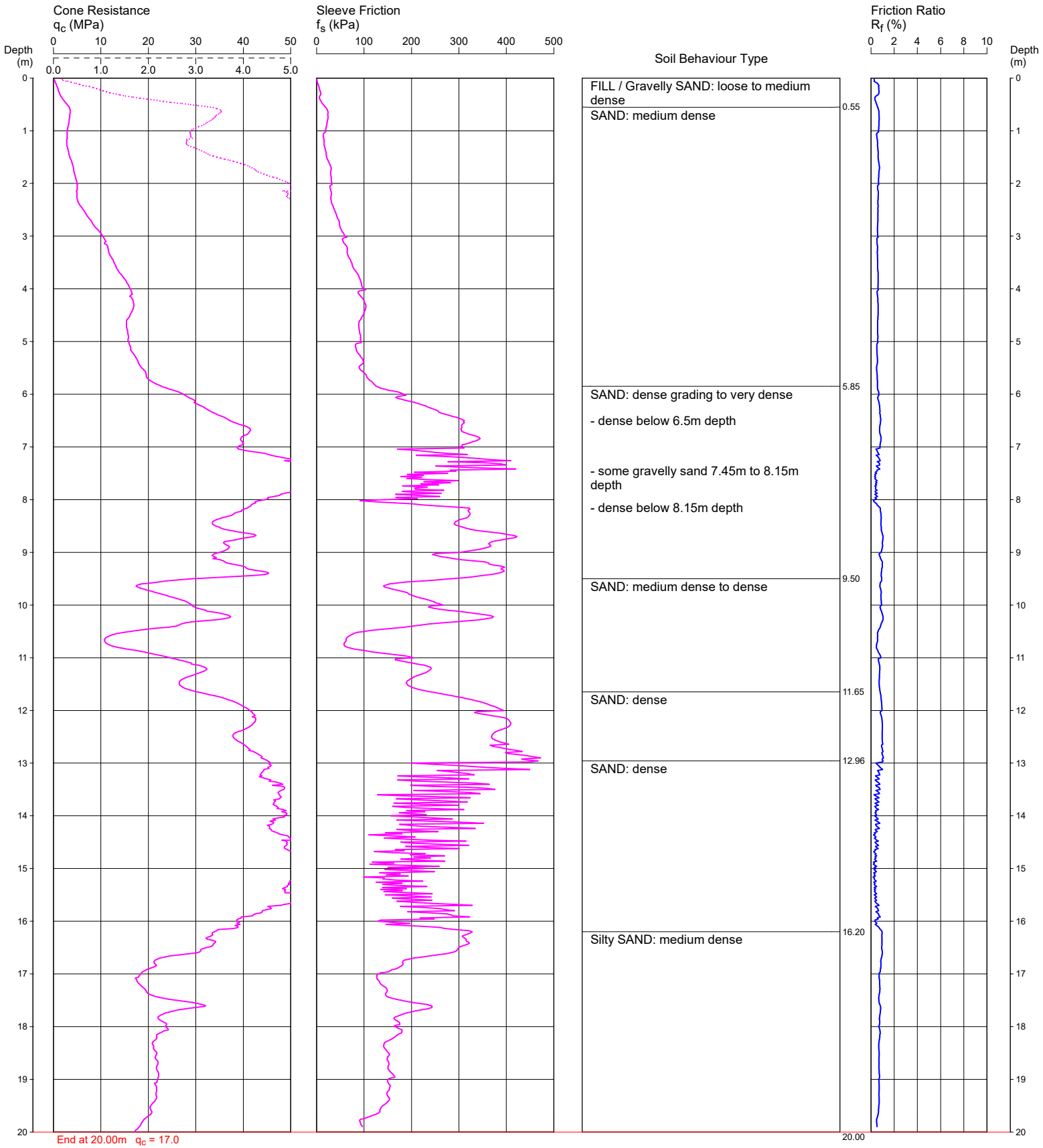
REDUCED LEVEL: 22.9 AHD

COORDINATES: 419580.6E 6379280.2N GDA20 Zone 56

CPT2

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT2.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

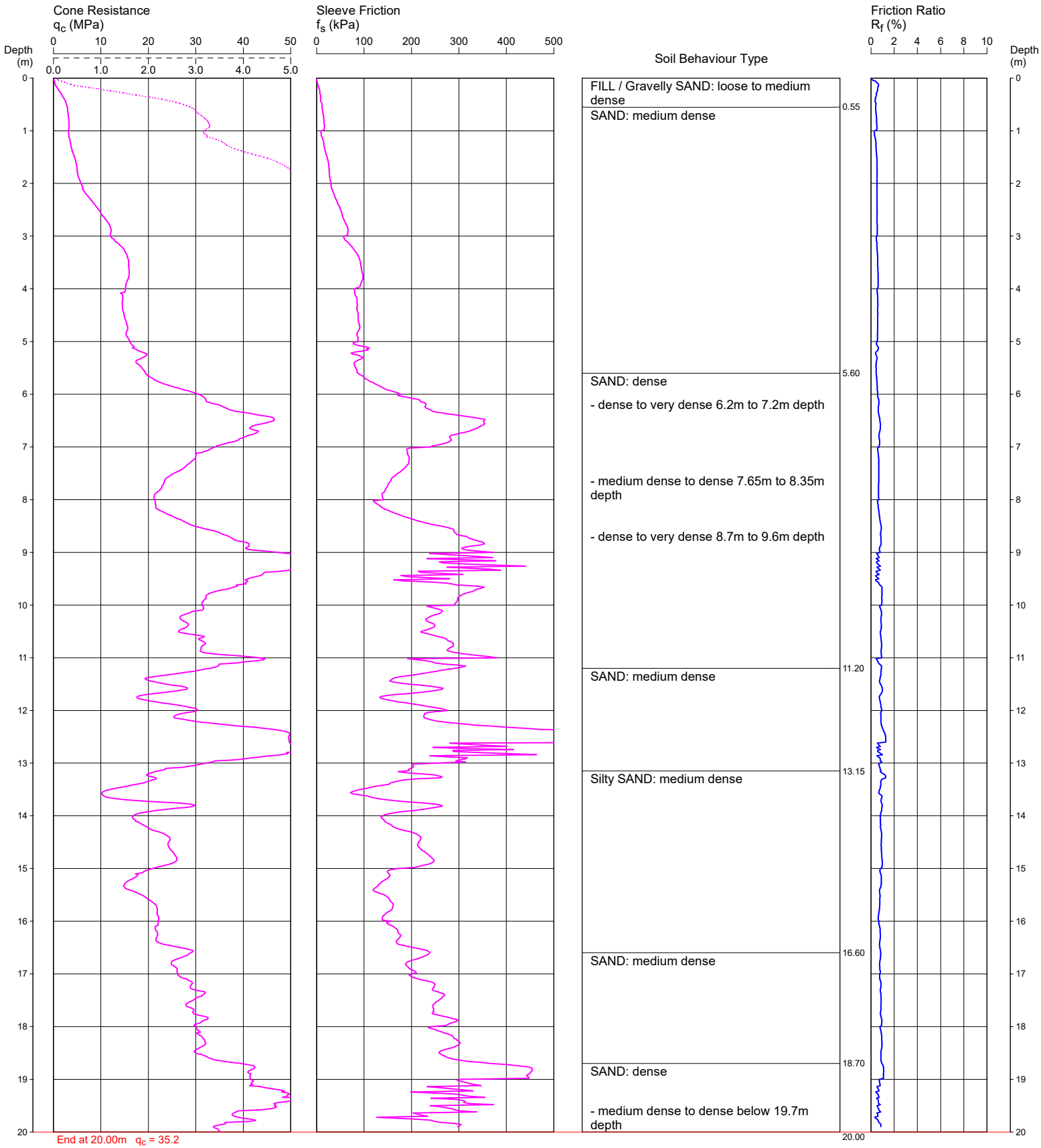
REDUCED LEVEL: 25.0 AHD

COORDINATES: 419547.8E 6379273.1N GDA20 Zone 56

CPT3

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT3.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

REDUCED LEVEL: 21.6 AHD

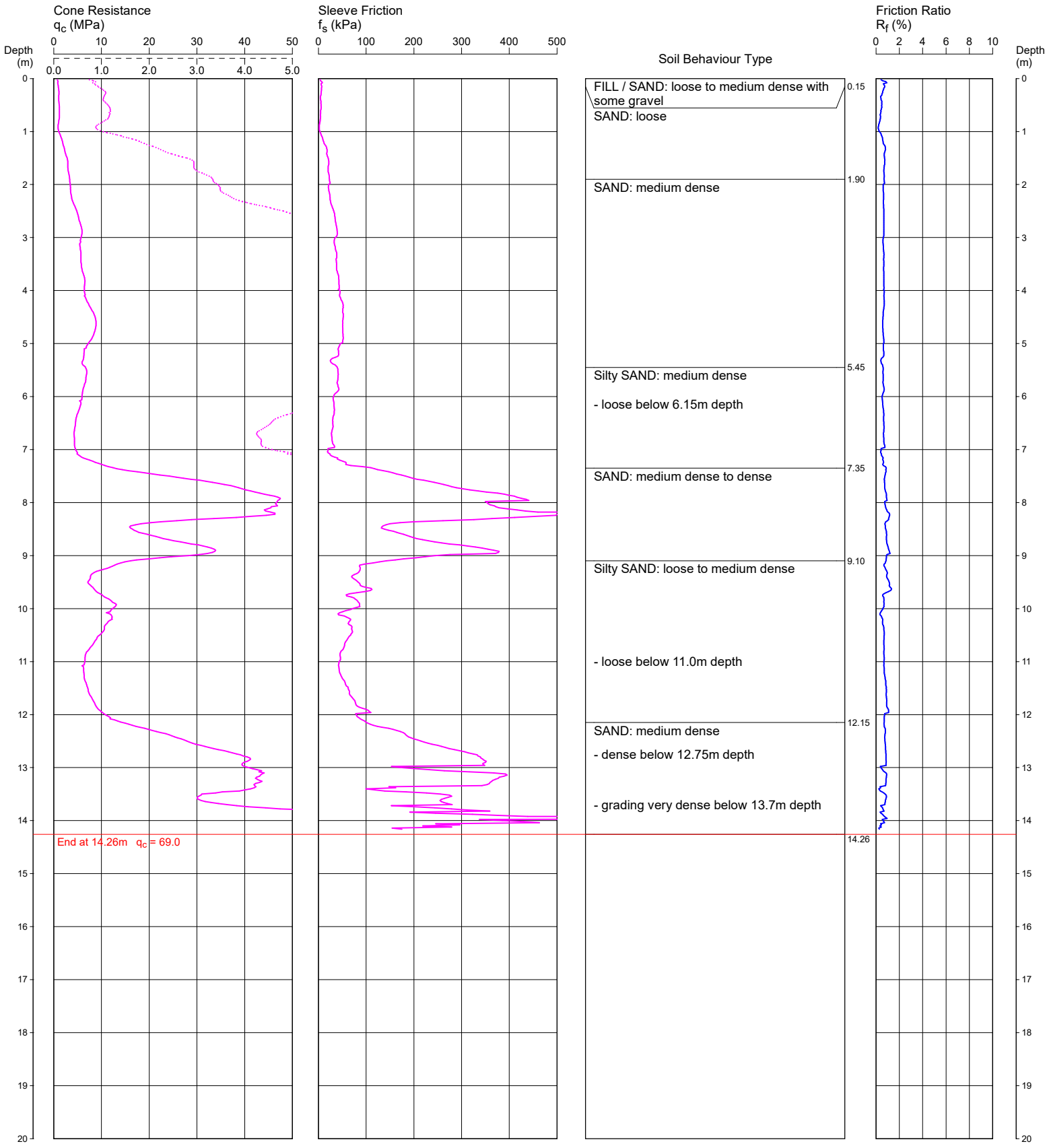
COORDINATES: 419594.6E 6379281.1N GDA20 Zone 56

CPT4

Page 1 of 1

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT4.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

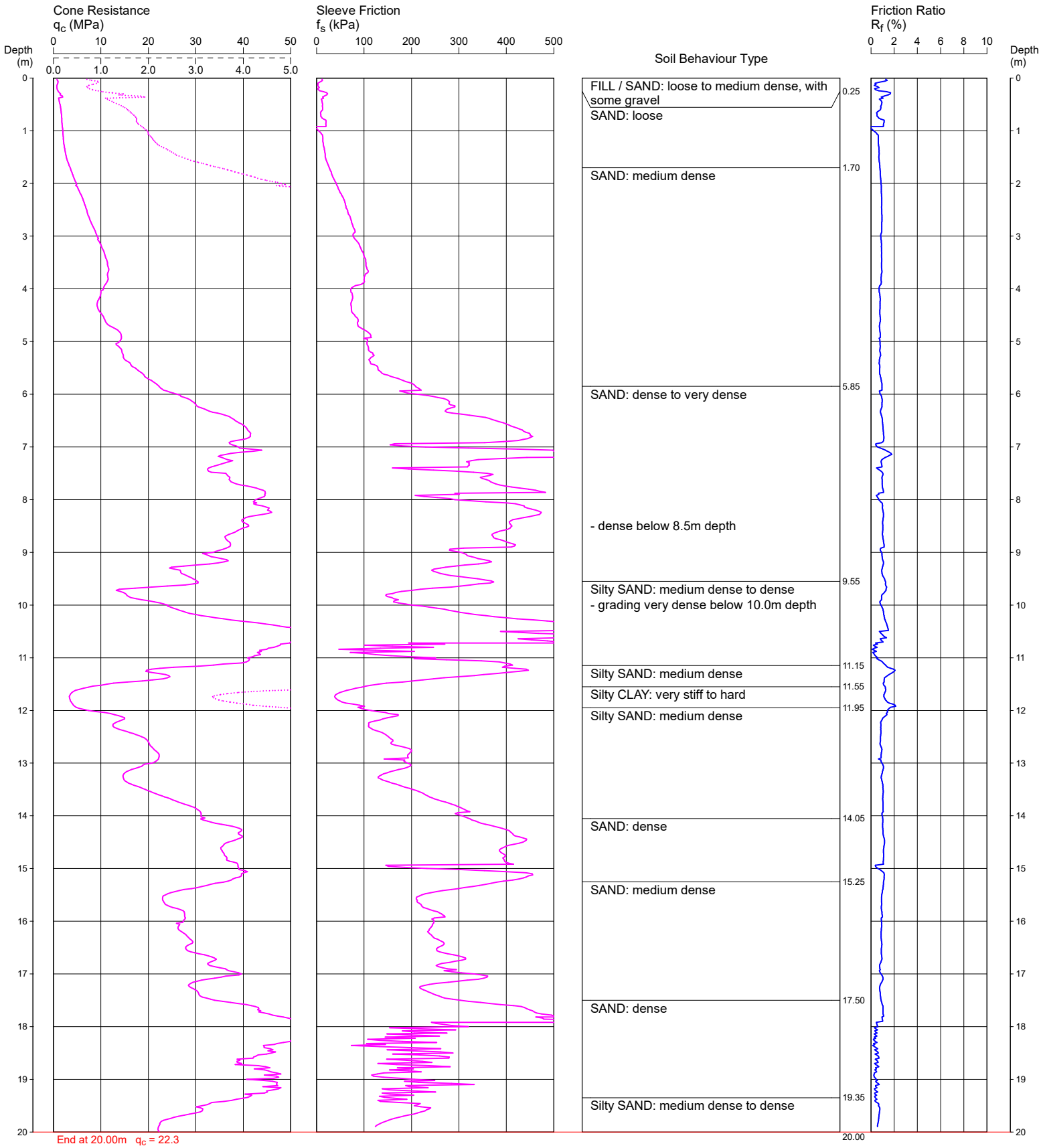
REDUCED LEVEL: 22.8 AHD

COORDINATES: 419566.5E 6379259.0N GDA20 Zone 56

CPT5

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT5.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Development - The Belverde
LOCATION: 5-7 Church & 42 Donald Street, Nelson Bay, NSW

SURFACE LEVEL: 24.5 AHD
COORDINATE: E:419566.3, N:6379292.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 6
PROJECT No: 227295.00
DATE: 16/07/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
16/07/24 No free groundwater observed	24	0.10	FILL / Silty SAND: brown; fine to medium; trace brick, tile, plastic.		FILL	NA	M		B/D/ES		0.10	PID	<1ppm
			SAND: pale brown; fine to medium.			L to MD			B			PID	<1ppm
	23	1							D/ES		1.00	PID	<1ppm
		2									2	PID	<1ppm
	22				AEO		M						
		3				NA			D/ES		3.00	PID	<1ppm
	21												
		4	From 4.20m-4.30m: brown						D/ES		4.00	PID	<1ppm
	20												
		5							D/ES		5.00	PID	<1ppm
	19	5.50	Silty SAND: brown dark brown; fine to medium; (indurated sand).		AEO	NA	M						
		6							D/ES		6.00	PID	<1ppm
	18		Borehole discontinued at 6.00m depth. Limit of investigation.										
	17	7											
		8											
	16												
		9											
	15												

DCP9150

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

PLANT: Geoprobe
OPERATOR: Tucker Environmental Drilling
LOGGED: Lambert
METHOD: Push Tube 0-6.0m
CASING: Uncased

REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of ±0.1m, depending on satellite coverage and site condition

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Development - The Belverde
LOCATION: 5-7 Church & 42 Donald Street, Nelson Bay, NSW

SURFACE LEVEL: 23.2 AHD
COORDINATE: E:419582.4, N:6379289.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 7
PROJECT No: 227295.00
DATE: 16/07/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(^)	DENSITY.(^)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	SAMPLE DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
16/07/24 No free groundwater observed	23	0.10	FILL / Silty SAND: dark brown; fine to medium; trace rootlets.		FILL	NA		M		B/D/ES		0.10	PID	<1ppm
			SAND: pale brown; fine to medium.			L		M		D/ES		0.50	PID	<1ppm
	22	1								D/ES		1.00	PID	<1ppm
	21	2			AEO					D/ES		2.00	PID	<1ppm
	20	3				NA		M		D/ES		3.00	PID	<1ppm
	19	4								D/ES		4.00	PID	<1ppm
		4.70	Silty SAND: brown dark brown; fine to medium; (indurated sand).											
	18	5			AEO	NA		M		D/ES		5.00	PID	<1ppm
		6	Borehole discontinued at 6.00m depth. Limit of investigation.							D/ES		6.00	PID	<1ppm
	17	7												
	16	8												
	15	9												
	14													

DCP@150

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

PLANT: Geoprobe
OPERATOR: Tucker Environmental Drilling
LOGGED: Lambert
METHOD: Push Tube 0-6.0m
CASING: Uncased

REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of ±0.1m, depending on satellite coverage and site condition

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Development - The Belverde
LOCATION: 5-7 Church & 42 Donald Street, Nelson Bay, NSW

SURFACE LEVEL: 21.2 AHD
COORDINATE: E:419591.8, N:6379274.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 8
PROJECT No: 227295.00
DATE: 16/07/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(^)	DENSITY.(^)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
16/07/24 No free groundwater observed	21	0.10	FILL / Silty SAND: dark brown; fine to medium; trace rootlets.		FILL	NA		M		D/ES		0.10	PID	<1ppm
										B/D/ES				
	20	1	SAND: pale brown; fine to medium.			L						1	PID	<1ppm
													PID	<1ppm
	19	2								D/ES		2.00	PID	<1ppm
	18	3			AEO		NA	M		D/ES		3.00	PID	<1ppm
	17	4								D/ES		4.00	PID	<1ppm
	16	5								D/ES		5.00	PID	<1ppm
	15	6	Borehole discontinued at 6.00m depth. Limit of investigation.							D/ES		6.00	PID	<1ppm
	14	7												
	13	8												
	12	9												

DCP9 50 5 10 15

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

PLANT: Geoprobe
OPERATOR: Tucker Environmental Drilling
LOGGED: Lambert
METHOD: Push Tube 0-6.0m
CASING: Uncased

REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of ±0.1m, depending on satellite coverage and site condition

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Development - The Belverde
LOCATION: 5-7 Church & 42 Donald Street, Nelson Bay, NSW

SURFACE LEVEL: 24.5 AHD
COORDINATE: E:419548.9, N:6379262.8
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 9
PROJECT No: 227295.00
DATE: 16/07/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	SAMPLE DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
16/07/24 No free groundwater observed	24	0.60	FILL / Silty SAND: grey; fine to medium; trace brick, tile, glass. 0.00m: fibro fragment 0.50m: fibro fragment		FILL	NA	M		B/D/ES		0.10	PID	<1ppm
									D/ES		0.50	PID	<1ppm
	23	1	SAND: pale grey; fine to medium.			MD			D/ES		1.00	PID	<1ppm
	22	2			AEO	NA	M		D/ES		2.00	PID	<1ppm
	21	3							D/ES		3.00	PID	<1ppm
		3.50	Silty SAND: brown; fine to medium; (indurated sand).										
	20	4			AEO	NA	M		D/ES		4.00	PID	<1ppm
	19	5							D/ES		5.00	PID	<1ppm
	18	6							D/ES		6.00	PID	<1ppm
	17	7	Borehole discontinued at 6.00m depth. Limit of investigation.										
	16	8											
	15	9											

DCP9 50 — 5 10 15

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

PLANT: Geoprobe
OPERATOR: Tucker Environmental Drilling
LOGGED: Lambert
METHOD: Push Tube 0-6.0m
CASING: Uncased

REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of ±0.1m, depending on satellite coverage and site condition

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Development - The Belverde
LOCATION: 5-7 Church & 42 Donald Street, Nelson Bay, NSW

SURFACE LEVEL: 23.3 AHD
COORDINATE: E:419568.2, N:6379269.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 10
PROJECT No: 227295.00
DATE: 16/07/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
16/07/24 No free groundwater observed	23	0.30	FILL / Silty SAND: dark brown; fine to medium; trace brick, tile.		FILL	NA	M		B/D/ES		0.10	PID	<1ppm
			SAND: pale brown ; fine to medium.			VL to L			D/ES		0.50	PID	<1ppm
	22	1							D/ES		1.00	PID	<1ppm
		2			AEO	NA	M		D/ES		2.00	PID	<1ppm
	21	3							D/ES		3.00	PID	<1ppm
	20	3.50	Silty SAND: brown dark brown; fine to medium; (indurated sand).										
		4			AEO	NA	M		D/ES		4.00	PID	<1ppm
	19	5							D/ES		5.00	PID	<1ppm
	18	6							D/ES		6.00	PID	<1ppm
	17		Borehole discontinued at 6.00m depth. Limit of investigation.										
	16	7											
	15	8											
	14	9											

DCP9 50 5 10 15

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

PLANT: Geoprobe
OPERATOR: Tucker Environmental Drilling
LOGGED: Lambert
METHOD: Push Tube 0-6.0m
CASING: Uncased

REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of ±0.1m, depending on satellite coverage and site condition

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Appendix C

Laboratory Test Results

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 356894

Client Details

Client	Douglas Partners Newcastle
Attention	Kate Fulham
Address	Box 324 Hunter Region Mail Centre, Newcastle, NSW, 2310

Sample Details

Your Reference	**227295.00 Nelson Bay**
Number of Samples	12 Soil, 8 Material
Date samples received	18/07/2024
Date completed instructions received	18/07/2024

Analysis Details

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

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

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

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

Report Details

Date results requested by	25/07/2024
Date of Issue	25/07/2024

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vTRH(C6-C10)/BTEXN in Soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTRH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
Naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	94	108	85	86	83

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		356894-8	356894-19
Your Reference	UNITS	10	D1/JCL
Depth		0-0.1	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	19/07/2024	19/07/2024
Date analysed	-	22/07/2024	22/07/2024
TRH C_6 - C_9	mg/kg	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25
vTRH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25
Benzene	mg/kg	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
Naphthalene	mg/kg	<1	<1
Total +ve Xylenes	mg/kg	<1	<1
Surrogate aaa-Trifluorotoluene	%	102	105

svTRH (C10-C40) in Soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	20/07/2024	20/07/2024	20/07/2024	20/07/2024	20/07/2024
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (C10-C36)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} -C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	75	77	78	76	77

svTRH (C10-C40) in Soil			
Our Reference		356894-8	356894-19
Your Reference	UNITS	10	D1/JCL
Depth		0-0.1	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	19/07/2024	19/07/2024
Date analysed	-	20/07/2024	20/07/2024
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
Total +ve TRH (C10-C36)	mg/kg	<50	<50
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} -C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	74	74

PAHs in Soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	0.07	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	0.5	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	100	101	103	103	101

PAHs in Soil			
Our Reference		356894-8	356894-19
Your Reference	UNITS	10	D1/JCL
Depth		0-0.1	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	0.2	0.3
Pyrene	mg/kg	0.2	0.2
Benzo(a)anthracene	mg/kg	<0.1	0.1
Chrysene	mg/kg	<0.1	0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	0.2
Benzo(a)pyrene	mg/kg	0.09	0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	0.4	1.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	98	102

Organochlorine Pesticides in soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	0.4	1.3
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate 4-Chloro-3-NBTF	%	103	105	101	106	103

Organochlorine Pesticides in soil			
Our Reference		356894-8	356894-19
Your Reference	UNITS	10	D1/JCL
Depth		0-0.1	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024
alpha-BHC	mg/kg	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1
Mirex	mg/kg	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1
Surrogate 4-Chloro-3-NBTF	%	99	101

Organophosphorus Pesticides in Soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Mevinphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phorate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Disulfoton	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyrifos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion-Methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenthion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methidathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenamiphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phosalone	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Coumaphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate 4-Chloro-3-NBTF	%	103	105	101	106	103

Organophosphorus Pesticides in Soil			
Our Reference		356894-8	356894-19
Your Reference	UNITS	10	D1/JCL
Depth		0-0.1	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024
Dichlorvos	mg/kg	<0.1	<0.1
Mevinphos	mg/kg	<0.1	<0.1
Phorate	mg/kg	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1
Disulfoton	mg/kg	<0.1	<0.1
Chlorpyrifos-methyl	mg/kg	<0.1	<0.1
Parathion-Methyl	mg/kg	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1
Fenthion	mg/kg	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1
Methidathion	mg/kg	<0.1	<0.1
Fenamiphos	mg/kg	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1
Phosalone	mg/kg	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1
Coumaphos	mg/kg	<0.1	<0.1
Surrogate 4-Chloro-3-NBTF	%	99	101

PCBs in Soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate 2-Fluorobiphenyl	%	102	103	96	100	101

PCBs in Soil			
Our Reference		356894-8	356894-19
Your Reference	UNITS	10	D1/JCL
Depth		0-0.1	-
Date Sampled		16/07/2024	16/07/2024
Type of sample		Soil	Soil
Date extracted	-	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024
Aroclor 1016	mg/kg	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1
Surrogate 2-Fluorobiphenyl	%	95	95

Acid Extractable metals in soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	<1	<1	1	1	<1
Copper	mg/kg	3	<1	17	4	<1
Lead	mg/kg	6	2	21	53	9
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	2	<1	<1	<1	<1
Zinc	mg/kg	38	7	64	82	34
Iron	mg/kg	1,200	80	950	940	100
Manganese	mg/kg	5	<1	31	25	3
Beryllium	mg/kg	<1	<1	<1	<1	<1
Boron	mg/kg	<10	<10	<10	<10	<10
Molybdenum	mg/kg	<1	<1	<1	<1	<1
Selenium	mg/kg	<2	<2	<2	<2	<2

Acid Extractable metals in soil				
Our Reference		356894-8	356894-19	356894-21
Your Reference	UNITS	10	D1/JCL	6 - [TRIPLICATE]
Depth		0-0.1	-	0-0.1
Date Sampled		16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	22/07/2024	22/07/2024	22/07/2024
Arsenic	mg/kg	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	5	4	<1
Copper	mg/kg	15	15	1
Lead	mg/kg	160	120	3
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	1	1	<1
Zinc	mg/kg	200	220	23
Iron	mg/kg	1,900	1,500	120
Manganese	mg/kg	65	68	<1
Beryllium	mg/kg	<1	<1	<1
Boron	mg/kg	<10	<10	<10
Molybdenum	mg/kg	<1	<1	<1
Selenium	mg/kg	<2	<2	<2

Moisture						
Our Reference		356894-1	356894-2	356894-3	356894-4	356894-5
Your Reference	UNITS	6	6	7	8	8
Depth		0-0.1	2	0-0.1	0-0.1	6
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Moisture	%	5.4	4.5	5.1	10	4.7

Moisture					
Our Reference		356894-6	356894-7	356894-8	356894-19
Your Reference	UNITS	9	9	10	D1/JCL
Depth		0-0.1	0.5	0-0.1	-
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	19/07/2024	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	22/07/2024	22/07/2024	22/07/2024	22/07/2024
Moisture	%	3.8	4.1	13	11

Asbestos ID - soils NEPM						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	24/07/2024	24/07/2024	24/07/2024	24/07/2024	24/07/2024
Sample mass tested	g	640.44	778.54	555.05	962	613.53
Sample Description	-	Grey sandy soil	Grey sandy soil	Grey sandy soil	Grey sandy soil	Grey sandy soil
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	Chrysotile asbestos detected Crocidolite asbestos detected Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	1.0637
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	See Above
ACM >7mm Estimation*	g	–	–	–	–	0.6526
FA and AF Estimation*	g	–	–	–	–	–
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001
Asbestos comments	-	Nil	Nil	Nil	Nil	YES

Asbestos ID - soils NEPM		
Our Reference		356894-8
Your Reference	UNITS	10
Depth		0-0.1
Date Sampled		16/07/2024
Type of sample		Soil
Date analysed	-	24/07/2024
Sample mass tested	g	603.87
Sample Description	-	Grey sandy soil
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected
ACM >7mm Estimation*	g	–
FA and AF Estimation*	g	–
FA and AF Estimation*#2	%(w/w)	<0.001
Asbestos comments	-	Nil

Misc Inorg - Soil						
Our Reference		356894-1	356894-3	356894-4	356894-6	356894-7
Your Reference	UNITS	6	7	8	9	9
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0.5
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	24/07/2024	24/07/2024	24/07/2024	24/07/2024	24/07/2024
Date analysed	-	24/07/2024	24/07/2024	24/07/2024	24/07/2024	24/07/2024
pH 1:5 soil:water	pH Units	5.8	5.4	5.6	6.3	7.1
Electrical Conductivity 1:5 soil:water	µS/cm	15	11	50	42	20

Misc Inorg - Soil					
Our Reference		356894-8	356894-16	356894-17	356894-18
Your Reference	UNITS	10	6	8	10
Depth		0-0.1	3	6	6
Date Sampled		16/07/2024	16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	24/07/2024	24/07/2024	24/07/2024	24/07/2024
Date analysed	-	24/07/2024	24/07/2024	24/07/2024	24/07/2024
pH 1:5 soil:water	pH Units	6.1	6.3	5.9	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	52	3	2	14
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	<10	<10	10

PFAS in Soils Short				
Our Reference		356894-2	356894-5	356894-6
Your Reference	UNITS	6	8	9
Depth		2	6	0-0.1
Date Sampled		16/07/2024	16/07/2024	16/07/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	19/07/2024	19/07/2024	19/07/2024
Date analysed	-	19/07/2024	19/07/2024	19/07/2024
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	112	108	109
Surrogate $^{13}C_2$ *PFOA*	%	100	104	101
Extracted ISTD $^{18}O_2$ *PFHxS*	%	106	101	103
Extracted ISTD $^{13}C_4$ *PFOS*	%	100	97	98
Extracted ISTD $^{13}C_4$ *PFOA*	%	106	100	112
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	108	105	142
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	133	107	160
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	<0.1
Total Positive PFAS	µg/kg	<0.1	<0.1	<0.1

Asbestos ID - materials						
Our Reference		356894-9	356894-10	356894-11	356894-12	356894-13
Your Reference	UNITS	9/0-0.6/F1	F1	F5	F8	F12
Depth		-	-	-	-	-
Date Sampled		16/07/2024	05/07/2024	05/07/2024	05/07/2024	05/07/2024
Type of sample		Material	Material	Material	Material	Material
Date analysed	-	24/07/2024	24/07/2024	24/07/2024	24/07/2024	24/07/2024
Mass / Dimension of Sample	-	35x20x5mm	45x20x5mm	25x20x5mm	70x30x5mm	110x80x5mm
Sample Description	-	Grey fibre cement material	Grey fibre cement material	Grey fibre cement material	Grey fibre cement material	Brown organic fibrous board
Asbestos ID in materials	-	Chrysotile asbestos detected Amosite asbestos detected Crocidolite asbestos detected	Chrysotile asbestos detected Amosite asbestos detected	Chrysotile asbestos detected Amosite asbestos detected	Chrysotile asbestos detected	No asbestos detected Organic fibres detected
Trace Analysis	-	[NT]	[NT]	[NT]	[NT]	No asbestos detected

Asbestos ID - materials				
Our Reference		356894-14	356894-15	356894-20
Your Reference	UNITS	F16	F17	9/0-0.6/F2
Depth		-	-	-
Date Sampled		05/07/2024	05/07/2024	16/07/2024
Type of sample		Material	Material	Material
Date analysed	-	24/07/2024	24/07/2024	24/07/2024
Mass / Dimension of Sample	-	70x50x5mm	66x40x5mm	60x40x5mm
Sample Description	-	Beige fibre cement material	Grey fibre cement material	Grey fibre cement material
Asbestos ID in materials	-	No asbestos detected Organic fibres detected	Chrysotile asbestos detected Amosite asbestos detected Crocidolite asbestos detected	Chrysotile asbestos detected Amosite asbestos detected Crocidolite asbestos detected
Trace Analysis	-	No asbestos detected	[NT]	[NT]

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. NOTE#1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF relative to the sample mass tested) NOTE#2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.

Method ID	Methodology Summary
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021/022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date extracted	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			22/07/2024	1	22/07/2024	22/07/2024		22/07/2024	22/07/2024
TRH C_6 - C_9	mg/kg	25	Org-023	<25	1	<25	<25	0	111	110
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	1	<25	<25	0	111	110
Benzene	mg/kg	0.2	Org-023	<0.2	1	<0.2	<0.2	0	112	112
Toluene	mg/kg	0.5	Org-023	<0.5	1	<0.5	<0.5	0	112	107
Ethylbenzene	mg/kg	1	Org-023	<1	1	<1	<1	0	109	109
m+p-xylene	mg/kg	2	Org-023	<2	1	<2	<2	0	111	111
o-Xylene	mg/kg	1	Org-023	<1	1	<1	<1	0	113	112
Naphthalene	mg/kg	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	83	1	94	105	11	109	107

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date extracted	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			20/07/2024	1	20/07/2024	20/07/2024		20/07/2024	20/07/2024
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	1	<50	<50	0	93	89
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	1	<100	<100	0	92	87
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	1	<100	<100	0	86	126
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	1	<50	<50	0	93	89
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	1	<100	<100	0	92	87
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	1	<100	<100	0	86	126
Surrogate o-Terphenyl	%		Org-020	81	1	75	80	6	94	76

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date extracted	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	88
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	92
Fluorene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	90	84
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	92
Anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	102	106
Pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	100	94
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	82	61
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	1	<0.05	<0.05	0	90	84
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	104	1	100	102	2	105	98

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date extracted	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	94	86
HCB	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	94	80
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	100	68
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	102	96
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	112	102
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	98	94
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	106	106
Endrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	60	84
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	102	98
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	88	76
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Mirex	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	102	1	103	103	0	104	101

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date extracted	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	88	92
Mevinphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Phorate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Disulfoton	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyrifos-methyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Parathion-Methyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	86	86
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	84	92
Malathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	78	86
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	90
Fenthion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	80	88
Bromophos-ethyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Methidathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fenamiphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	88	104
Phosalone	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Coumaphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	102	1	103	103	0	104	101

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date extracted	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Aroclor 1016	mg/kg	0.1	Org-021/022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021/022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021/022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021/022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021/022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021/022/025	<0.1	1	<0.1	<0.1	0	111	100
Aroclor 1260	mg/kg	0.1	Org-021/022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate 2-Fluorobiphenyl	%		Org-021/022/025	100	1	102	97	5	100	94

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date prepared	-			19/07/2024	1	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			22/07/2024	1	22/07/2024	22/07/2024		22/07/2024	22/07/2024
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	105	100
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	96	92
Chromium	mg/kg	1	Metals-020	<1	1	<1	<1	0	100	96
Copper	mg/kg	1	Metals-020	<1	1	3	2	40	103	102
Lead	mg/kg	1	Metals-020	<1	1	6	4	40	100	95
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	94	90
Nickel	mg/kg	1	Metals-020	<1	1	2	<1	67	101	97
Zinc	mg/kg	1	Metals-020	<1	1	38	29	27	100	91
Iron	mg/kg	10	Metals-020	<10	1	1200	180	148	106	#
Manganese	mg/kg	1	Metals-020	<1	1	5	<1	133	110	96
Beryllium	mg/kg	1	Metals-020	<1	1	<1	<1	0	105	100
Boron	mg/kg	10	Metals-020	<10	1	<10	<10	0	100	##
Molybdenum	mg/kg	1	Metals-020	<1	1	<1	<1	0	99	93
Selenium	mg/kg	2	Metals-020	<2	1	<2	<2	0	100	95

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	[NT]
Date prepared	-			24/07/2024	[NT]	[NT]	[NT]	[NT]	24/07/2024	[NT]
Date analysed	-			24/07/2024	[NT]	[NT]	[NT]	[NT]	24/07/2024	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	113	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	110	[NT]

QUALITY CONTROL: PFAS in Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-16	356894-6
Date prepared	-			19/07/2024	2	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Date analysed	-			19/07/2024	2	19/07/2024	19/07/2024		19/07/2024	19/07/2024
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	101	92
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	100	93
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	80	79
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	91	89
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	92	99
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	106	2	112	114	2	109	106
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	2	100	95	5	99	100
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	106	2	106	105	1	98	101
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	93	2	100	98	2	93	98
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	110	2	106	107	1	106	110
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	107	2	108	98	10	103	133
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	102	2	133	111	18	112	143

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

Acid Extractable Metals in Soil:
-The laboratory RPD acceptance criteria has been exceeded for 356894-1 for Fe. Therefore a triplicate result has been issued as laboratory sample number 356894-21.
-# Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.
-## Poor spike recovery was obtained for this sample. Sample matrix interference is suspected. However, an acceptable recovery was obtained for the LCS.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Factual description of asbestos identified in the soil samples: NEPM
Sample 356894-7; Chrysotile & Crocidolite asbestos identified in 4.3509g of fibre cement material >7mm

Appendix D

Pile Capacity Plots

PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.45
CALCULATION METHOD: Douglas Method

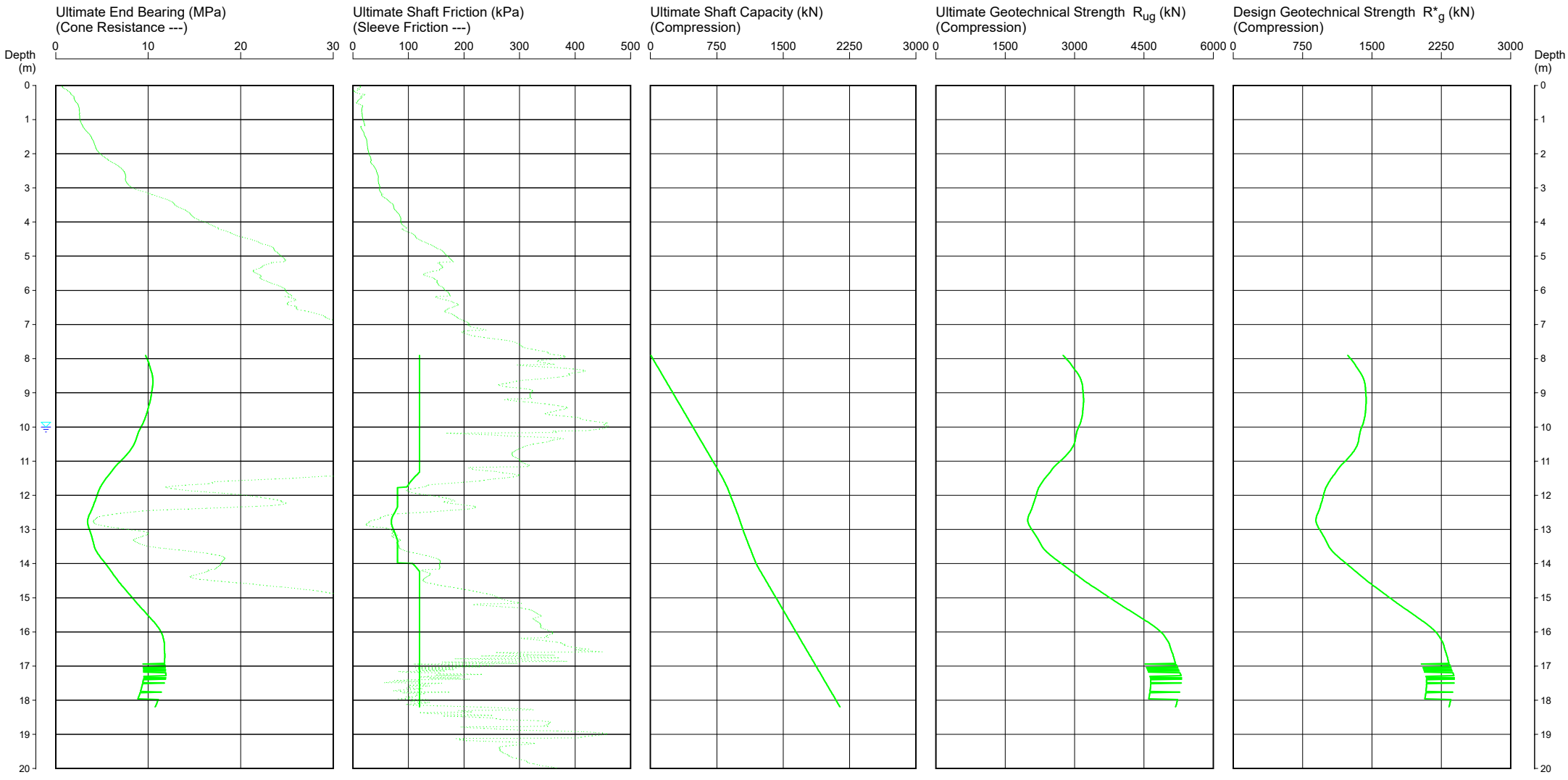
PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

CLIENT: FORTEZZA GROUP PTY LTD

CPT1

DATE 9/07/2024
PROJECT No: 227295.00
SURFACE RL: 24.9 AHD



DISCLAIMER:
These capacities have been estimated using accepted static theory, and are a guide only. Suitable verification procedures should be adopted (refer to AS2159), and piling contractors should confirm pile suitability and capacities. Structural capacity should be checked, and due allowance made for inclined or eccentric loads, and possible corrosion effects.

Water depth after test: 10.00m depth

Coordinates: 419557.4 6379291.2

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT1.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePile Version 5.9.1

Douglas Partners
Geotechnics / Environment / Groundwater

PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.45
CALCULATION METHOD: Douglas Method

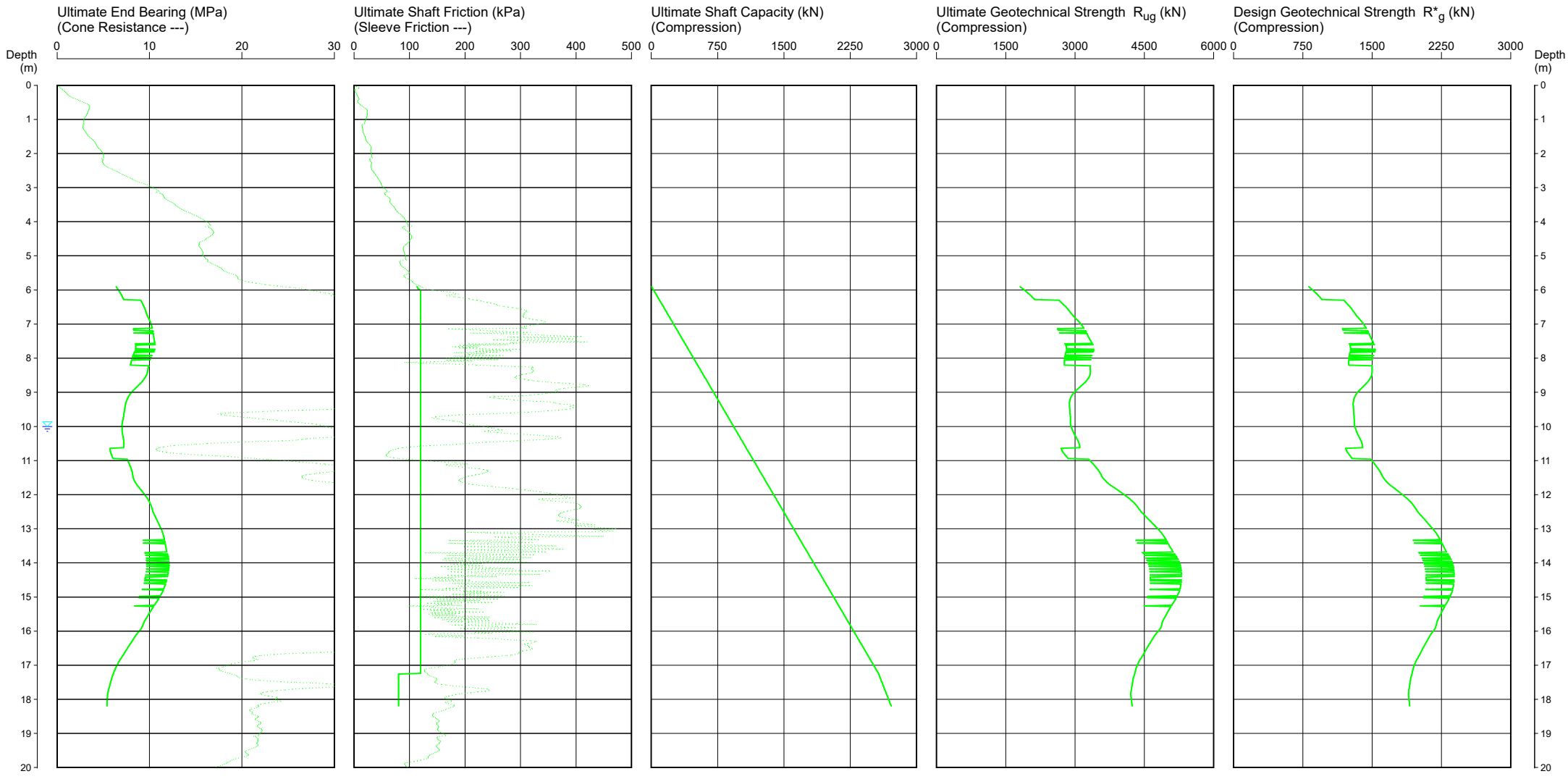
PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

CLIENT: FORTEZZA GROUP PTY LTD

CPT2

DATE 9/07/2024
PROJECT No: 227295.00
SURFACE RL: 22.9 AHD



DISCLAIMER:
These capacities have been estimated using accepted static theory, and are a guide only. Suitable verification procedures should be adopted (refer to AS2159), and piling contractors should confirm pile suitability and capacities. Structural capacity should be checked, and due allowance made for inclined or eccentric loads, and possible corrosion effects.

Water depth after test: 10.00m depth

Coordinates: 419580.6 6379280.2

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT2.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePile Version 5.9.1

Douglas Partners
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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.45
CALCULATION METHOD: Douglas Method

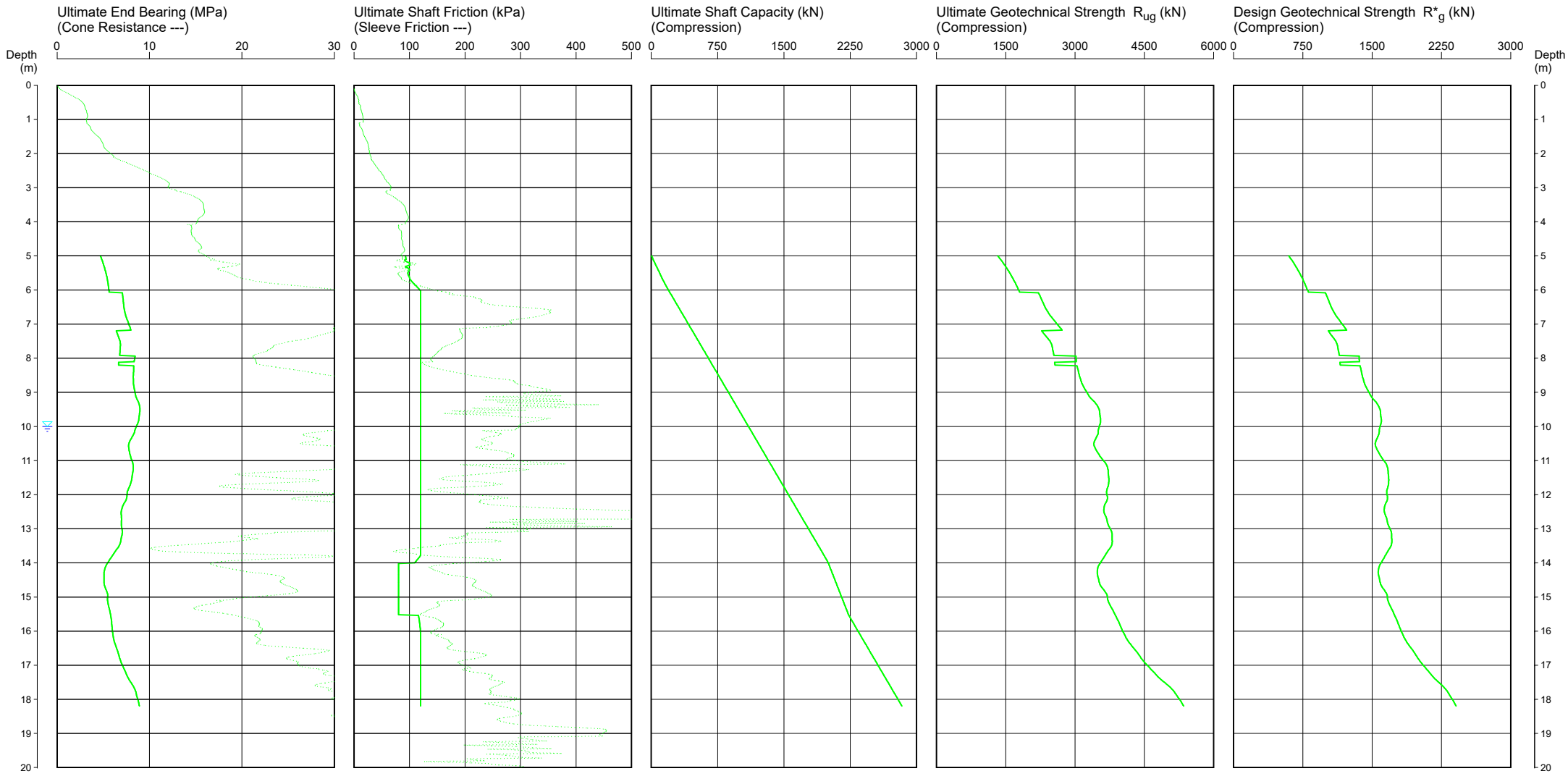
PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

CLIENT: FORTEZZA GROUP PTY LTD

CPT3

DATE 9/07/2024
PROJECT No: 227295.00
SURFACE RL: 25.0 AHD



DISCLAIMER:
These capacities have been estimated using accepted static theory, and are a guide only. Suitable verification procedures should be adopted (refer to AS2159), and piling contractors should confirm pile suitability and capacities. Structural capacity should be checked, and due allowance made for inclined or eccentric loads, and possible corrosion effects.

Water depth after test: 10.00m depth

Coordinates: 419547.8 6379273.1

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Cone ID: 161226 **Type:** I-CFXY-10

ConePile Version 5.9.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.45
CALCULATION METHOD: Douglas Method

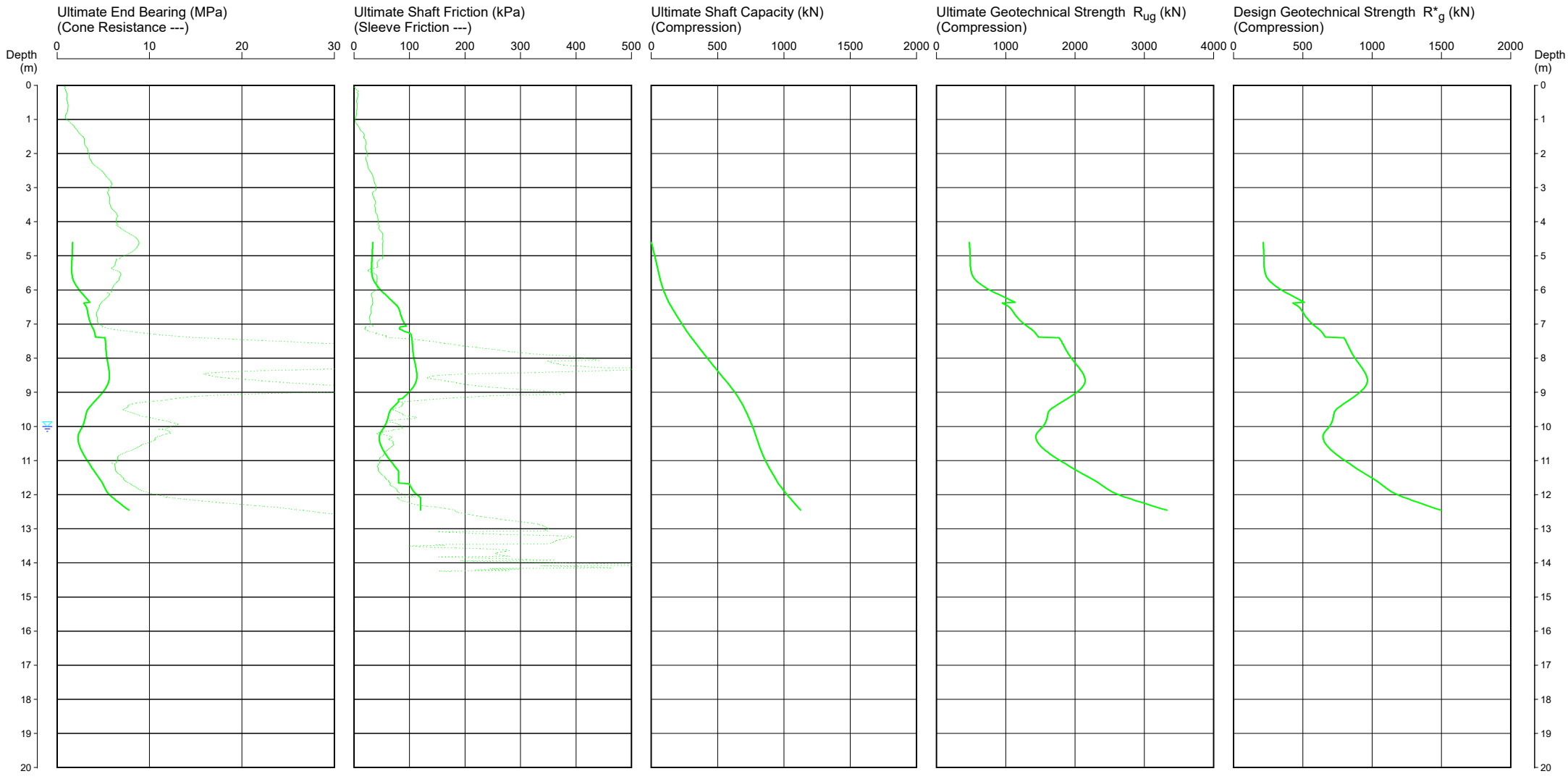
PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

CLIENT: FORTEZZA GROUP PTY LTD

CPT4

DATE 9/07/2024
PROJECT No: 227295.00
SURFACE RL: 21.6 AHD



DISCLAIMER:
These capacities have been estimated using accepted static theory, and are a guide only. Suitable verification procedures should be adopted (refer to AS2159), and piling contractors should confirm pile suitability and capacities. Structural capacity should be checked, and due allowance made for inclined or eccentric loads, and possible corrosion effects.

Water depth after test: 10.00m depth

Coordinates: 419594.6 6379281.1

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT4.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePile Version 5.9.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Grout-Injected
PILE SHAPE: Round
PILE SIZE: Diameter = 0.60
STRENGTH REDUCTION FACTOR $Ø_g$: 0.45
CALCULATION METHOD: Douglas Method

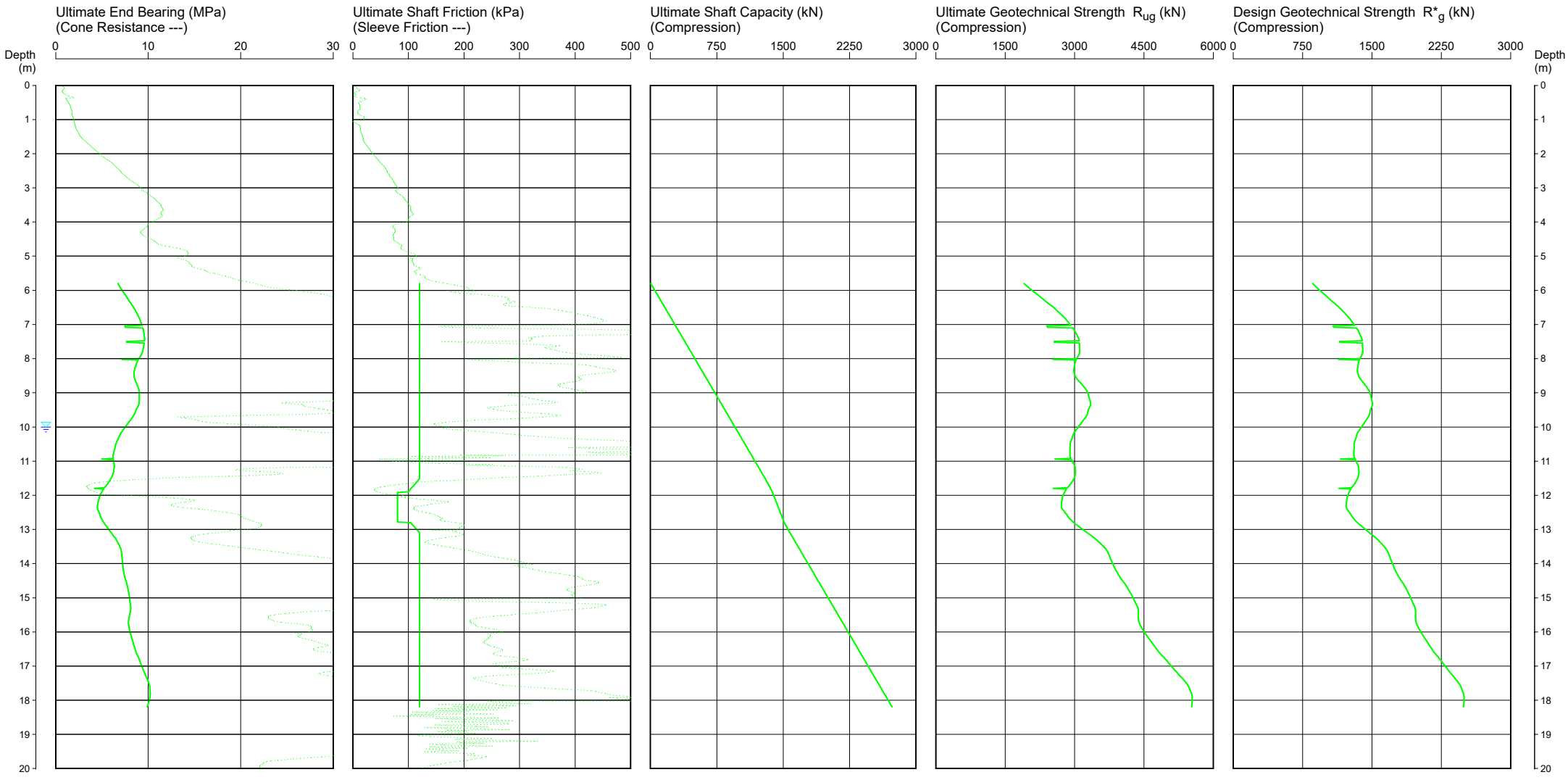
PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

CLIENT: FORTEZZA GROUP PTY LTD

CPT5

DATE 9/07/2024
PROJECT No: 227295.00
SURFACE RL: 22.8 AHD



DISCLAIMER:
These capacities have been estimated using accepted static theory, and are a guide only. Suitable verification procedures should be adopted (refer to AS2159), and piling contractors should confirm pile suitability and capacities. Structural capacity should be checked, and due allowance made for inclined or eccentric loads, and possible corrosion effects.

Water depth after test: 10.00m depth

Coordinates: 419566.5 6379259.0

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT5.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePile Version 5.9.1

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Appendix E

Drawing 1 – Site and Test Location Plan

Drawing 2 – Test Location Plan and Proposed Finished Floor Levels (FFL)

Proposed development drawings (Hayes Anderson Lynch Architects Pty Ltd drawings SD101 to SD312 revision Q dated 05/06/2024)

Site Location

Legend

Approximate Test Location and Number

- Cone Penetration test
- Borehole
- 2m Contour
- Approximate Lot Boundary
- Approximate Site Boundary

NOTE:
1. Drawing adapted from aerial imagery from Metromap dated 30 May 2024.
2. Test locations are approximate only and were located using differential GPS typically accurate to ± 0.1 m depending on satellite coverage.

0 10 20 30 m

Douglas PARTNERS

CLIENT:	Fortezza Group Pty Ltd		
OFFICE:	Newcastle	DRAWN BY:	KMF
SCALE:	1:300 @A3	DATE:	19.August.2024

TITLE: **Site and Test Location Plan**
Proposed Residential Development
5 to 7 Church Street & 42 Donald Street, Nelson Bay NSW

Project:	227295.00
DRAWING No:	1 (R.002)
REVISION:	0

DP:QGIS.A3LandscapeDrawingLayout.Rev2 - P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\7.0 Drawings\7.2 Out\227295.00.qgz

Site Location

Legend

Approximate Test Location and Number (Surface Elevation, AHD)

- Cone Penetration test
- Borehole

Proposed Finished Floor Levels (From HAL Drawing No. SD312 Issue Q dated 5.06.2024)

- 17.5 AHD
- 20.5 AHD

Proposed Retaining Walls and Approximate Height

- External
- Internal

NOTE:
1. Drawing adapted from aerial imagery from Metromap dated 30 May 2024.
2. Test locations are approximate only and were located using differential GPS typically accurate to ± 0.1 m depending on satellite coverage.

0 10 20 30 m

Douglas PARTNERS

CLIENT:	Fortezza Group Pty Ltd		
OFFICE:	Newcastle	DRAWN BY:	KMF
SCALE:	1:300 @A3	DATE:	19.August.2024

TITLE: **Test Location Plan & Proposed Retaining Walls and Finished Floor Levels (FFLs)**
Proposed Residential Development
5 to 7 Church Street & 42 Donald Street, Nelson Bay NSW

N

Project:	227295.00
DRAWING No:	2 (R.002)
REVISION:	0

Sketch Design Drawings
The Belvedere

Massing Model

Sketch Design

fortezza GROUP

THE BELVEDERE
Developed by Fortezza Group

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05/06/24	Q	Sketch Design	RH
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07/07/23	A	Sketch Design	GL

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Project
The Belvedere
5-7 Church st, 42 Donald st , NSW 2315

Drawing Title
Coversheet

Scale @ A3	Drawn:	Checked:
1:1.25, 1:100	SD	RH

Project Number	Drawing Number	Issue
H4700DON	SD101	Q

Sketch Design Drawings
The Belvedere

KEY PROPOSAL STATISTICS - MULTIPLE DWELLING	
Site Area:	2,202 m² (approx)
Frontage:	94.55 m (approx)
Number of Storeys:	09
Maximum Building Height :	29.7 m AHD (approx)
Car Spaces - Resident	76
Car Spaces - Visitor	18
Common	315.58 (14%)

DWELLING/ OFFICE/ RETAIL SUMMARY	
2 BED	33
3 BED	22
OFFICE	1
TOTAL	56

GROSS FLOOR AREA	
TOTAL GFA	**5,974.87 m²**
TOTAL FSR	**2.7:1**

Home Storey	App Number	Apartment Type	# Cars	Internal Area (m2)	POS (m2)
Ground					
	001	2 BED	1	93.90	152.22
	002	2 BED	1	83.07	74.73
	003	2 BED	1	83.07	74.73
	004	2 BED	1	93.90	126.65
	005	2 BED	1	84.62	167.71
	006	2 BED	1	84.61	185.26
	006	OFFICE	2	78.76	
Level 01					
	101	2 BED	1	93.90	17.42
	102	2 BED	1	83.07	16.05
	103	2 BED	1	83.07	16.05
	104	2 BED	1	83.07	16.05
	105	2 BED	1	83.07	16.05
	106	2 BED	1	93.90	17.42
	107	2 BED	1	84.62	48.19
	108	2 BED	1	79.04	26.40
	109	2 BED	1	84.61	47.38
Level 02					
	201	2 BED	1	93.90	17.42
	202	2 BED	1	83.07	16.05
	203	2 BED	1	83.07	16.05
	204	2 BED	1	83.07	16.05
	205	2 BED	1	83.07	16.05
	206	2 BED	1	93.90	17.42
	207	2 BED	1	84.62	48.19
	208	2 BED	1	79.04	26.40
	209	2 BED	1	84.61	47.38
Level 03					
	301	2 BED	1	93.90	17.42
	302	2 BED	1	83.07	16.05
	303	2 BED	1	83.07	16.05
	304	2 BED	1	83.07	16.05
	305	2 BED	1	83.07	16.05
	306	2 BED	1	93.90	17.42
	307	2 BED	1	84.62	48.19
	308	2 BED	1	79.04	26.40
	309	2 BED	1	84.61	47.38
Level 04					
	401	3 BED	2	124.33	17.42
	402	3 BED	2	120.80	28.29
	403	3 BED	2	120.80	28.29
	404	3 BED	2	124.33	17.42
	405	3 BED	2	125.07	73.72
	406	3 BED	2	123.56	59.49
Level 05					
	501	3 BED	2	124.33	17.42
	502	3 BED	2	120.80	28.29
	503	3 BED	2	120.80	28.29
	504	3 BED	2	124.33	17.42
	505	3 BED	2	125.07	73.72
	506	3 BED	2	123.56	59.49
Level 06					
	601	3 BED	2	124.33	17.42
	602	3 BED	2	120.80	28.29
	603	3 BED	2	120.80	28.29
	604	3 BED	2	124.33	17.42
	605	3 BED	2	125.07	73.72
	606	3 BED	2	123.56	59.49
Level 07					
	701	3 BED	2	133.41	17.42
	702	3 BED	2	135.08	28.29
	703	3 BED	2	135.08	28.29
	704	3 BED	2	132.51	17.42
Level 08					
	701	3 BED	2	45.58	110.60
	702	3 BED	2	44.10	106.94
	703	3 BED	2	37.80	111.60
	704	3 BED	2	46.49	109.70
				5,833.70 m²	**2,648.48 m²**

GFA Schedule	
Home Story	**Area (m2)**
Ground	743.10
Level 01	768.35
Level 02	768.35
Level 03	768.35
Level 04	738.89
Level 05	738.89
Level 06	738.89
Level 07	536.08
Level 08	173.97
	5,974.87 m²

GFA Including Apartment and office Internals, measured from the external face of external walls and centres of common walls - not including communal recreation

Sketch Design

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Drawing Title
Development Matrix

Scale @ A3	Drawn:	Checked:
1:1.25, 1:1.67	SD	RH

Project Number	Drawing Number	Issue
H4700DON	**SD102**	Q

Context Plan

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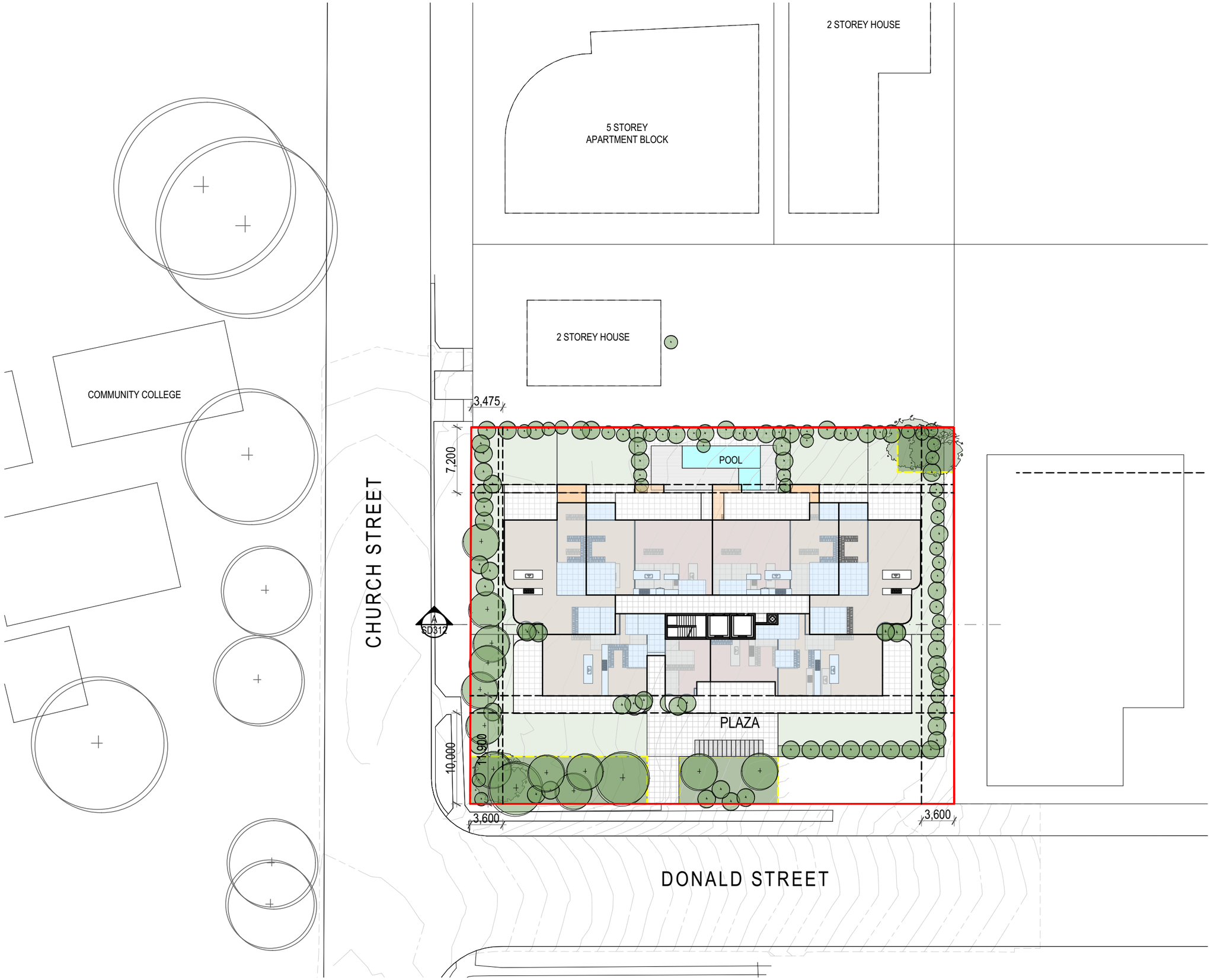
Drawing Title
Context Plan

Scale @ A3	Drawn:	Checked:
	SD	RH

Project Number	Drawing Number	Issue
H4700DON	**SD201**	Q



Site Plan
1:400

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Drawing Title
Site Plan

Scale @ A3	Drawn:	Checked:
1:400	SD	RH
Project Number	**Drawing Number**	**Issue**
H4700DON	**SD202**	Q

200 Basement 02
1:250

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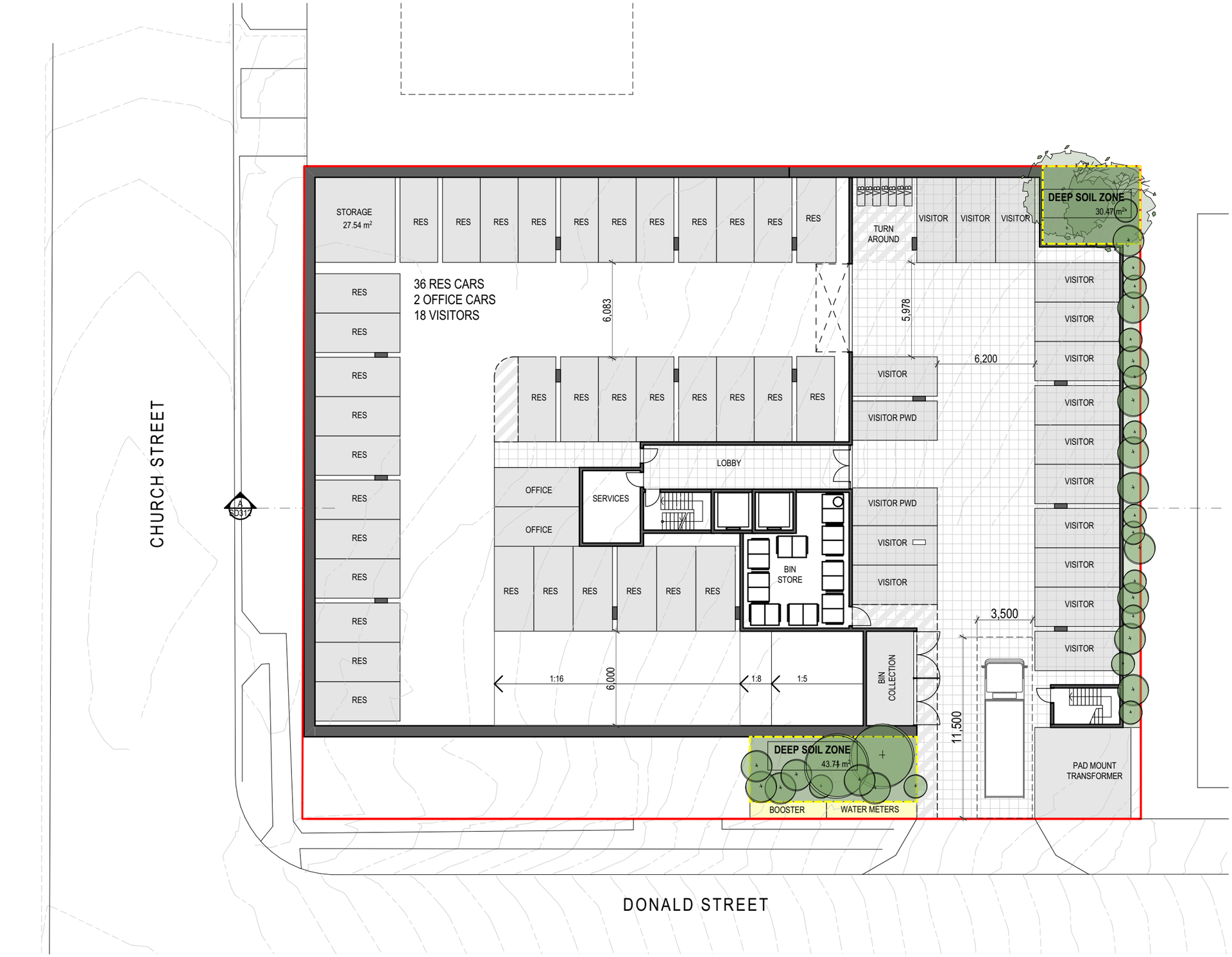
Drawing Title
GA Plan - Basement 02

Scale @ A3	Drawn:	Checked:
1:250	SD	RH
Project Number	**Drawing Number**	**Issue**
H4700DON	**SD301**	Q



200 **Basement 01**
1:250

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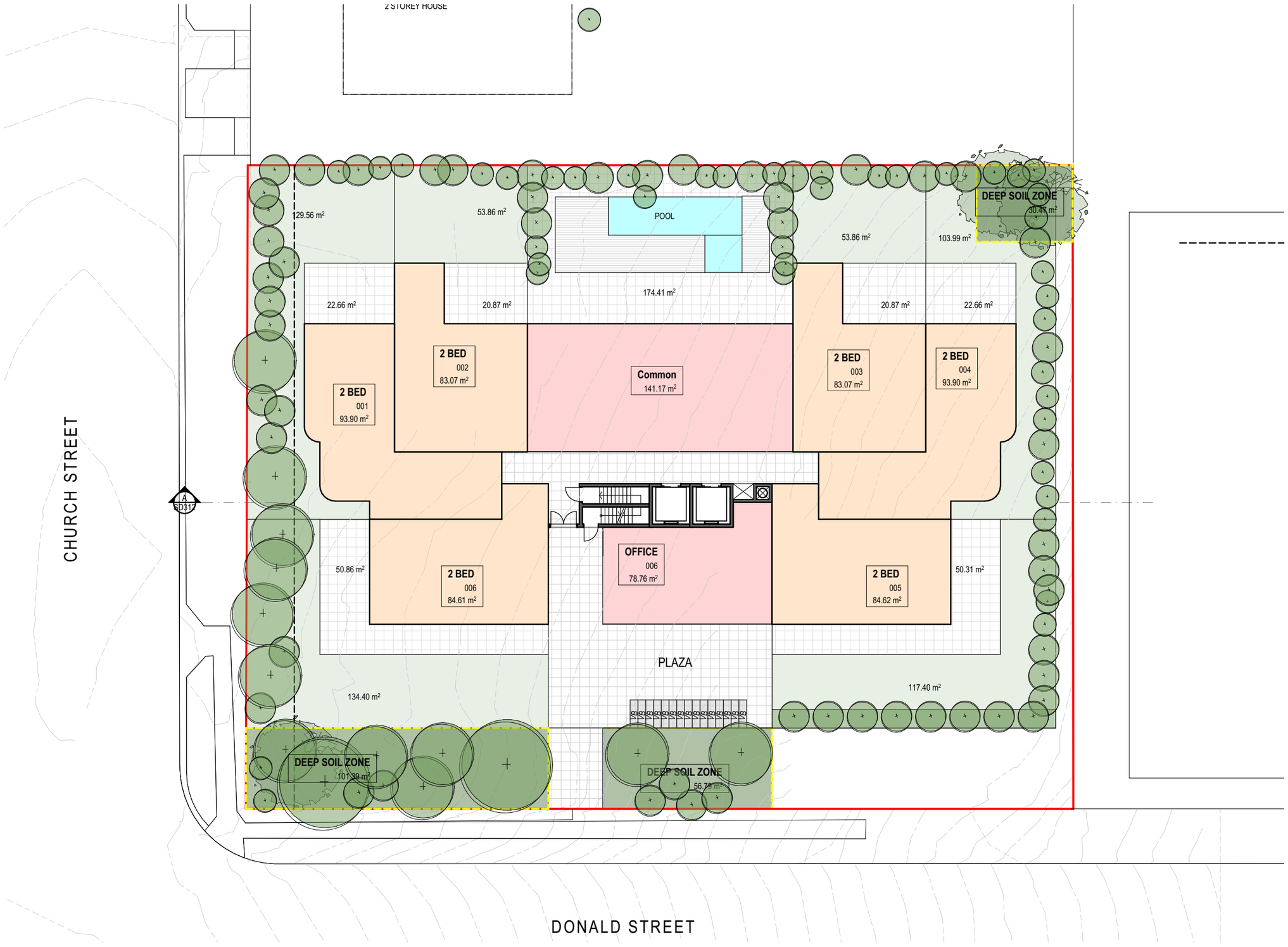
Drawing Title
GA Plan - Basement 01

Scale @ A3	Drawn:	Checked:
1:250	SD	RH
Project Number	**Drawing Number**	**Issue**
H4700DON	**SD302**	Q



200 Ground 1:250

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Drawing Title
GA Plan - Ground

Scale @ A3	Drawn:	Checked:
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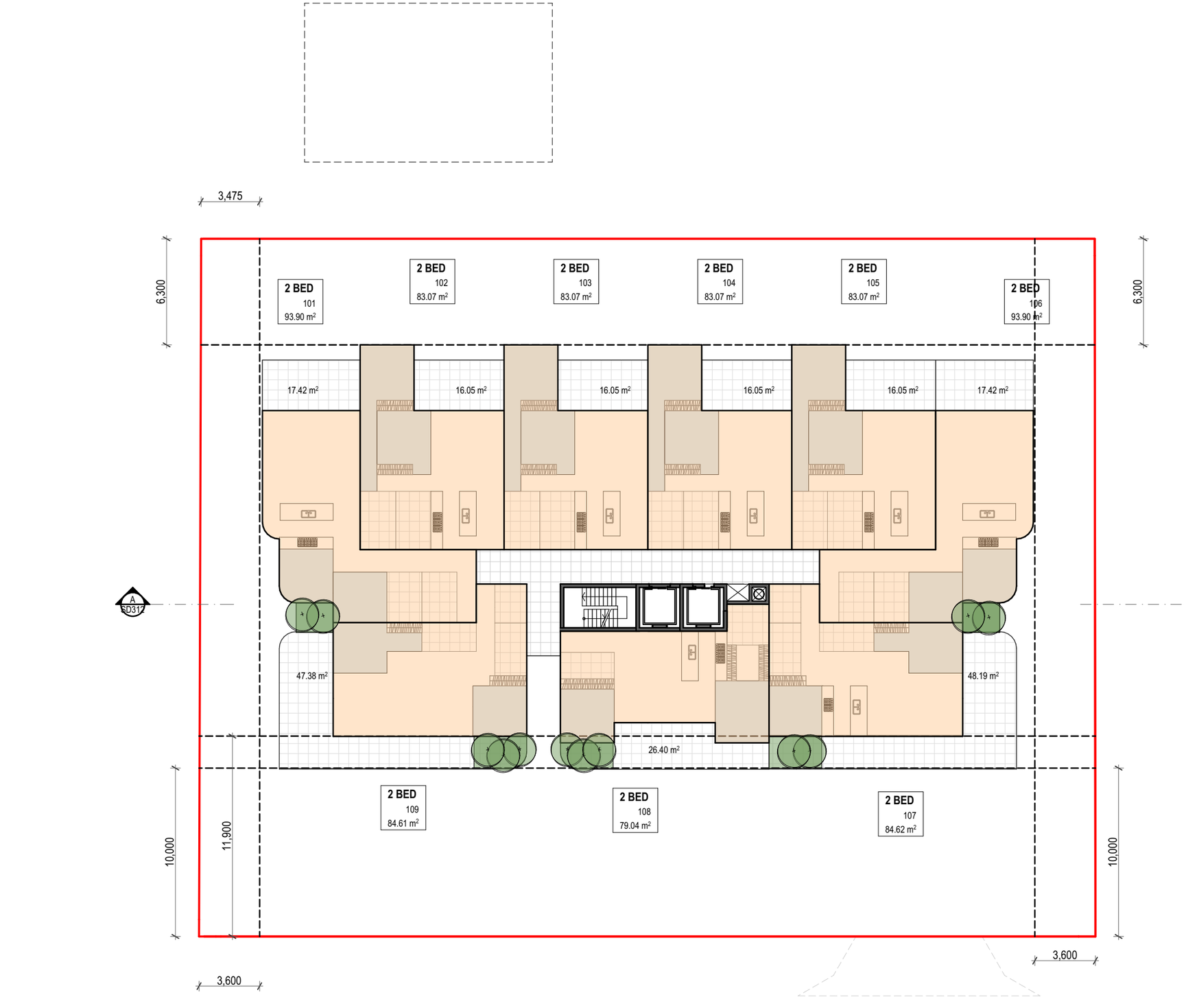
Project Number	**Drawing Number**	**Issue**
H4700DON	**SD303**	Q



200 Level 01
1:250

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Project
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Drawing Title
GA Plan- Level 01

Scale @ A3	Drawn:	Checked:
1:200, 1:250	SD	RH

Project Number	Drawing Number	Issue
H4700DON	SD304	Q

200 Level 02
1:250

Sketch Design

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Project
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Drawing Title
GA Plan- Level 02

Scale @ A3	Drawn:	Checked:
1:200, 1:250	SD	RH

Project Number	Drawing Number	Issue
H4700DON	SD305	Q

200

Level 03
1:250

Sketch Design

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Project
The Belvedere
5-7 Church st, 42 Donald st , NSW 2315

Drawing Title
GA Plan- Level 03

Scale @ A3	Drawn:	Checked:
1:200, 1:250	SD	RH
Project Number	**Drawing Number**	**Issue**
H4700DON	**SD306**	Q

200 Level 04
1:250

Sketch Design

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General Notes

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Date	Issue	Details	Checked
05/06/24	Q	Sketch Design	RH
03/06/24	P	Sketch Design	RH
24/04/24	N	Sketch Design	RH
08/04/24	M	Rear units removed	RH
20/12/23	L	2 Bed Level option	RH
05/12/23	K	2 Bed Level option	RH
16/11/23	J	Sketch Design	RH
16/11/23	H	Sketch Design	RH
09/11/23	G	Staggered Units	EA
31/10/23	F	Staggered Units	EA
09/10/23	E	Sketch Design	EA
26/09/23	D	Sketch Design	EA
08/09/23	C	Sketch Design	EA
31/08/23	B	Sketch Design	EA
07/07/23	A	Sketch Design	GL

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Drawing Title
GA Plan- Level 04

Scale @ A3	Drawn:	Checked:
1:250	SD	RH

Project Number	Drawing Number	Issue
H4700DON	**SD307**	Q

200 Level 05
1:250

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24/04/24	N	Sketch Design	RH
08/04/24	M	Rear units removed	RH
20/12/23	L	2 Bed Level option	RH
05/12/23	K	2 Bed Level option	RH
16/11/23	J	Sketch Design	RH
16/11/23	H	Sketch Design	RH
09/11/23	G	Staggered Units	EA
31/10/23	F	Staggered Units	EA
09/10/23	E	Sketch Design	EA
26/09/23	D	Sketch Design	EA
08/09/23	C	Sketch Design	EA
31/08/23	B	Sketch Design	EA
07/07/23	A	Sketch Design	GL

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Drawing Title
GA Plan- Level 05

Scale @ A3	Drawn:	Checked:
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Project Number	Drawing Number	Issue
H4700DON	SD308	Q

200 Level 06
1:250

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16/11/23	H	Sketch Design	RH
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31/10/23	F	Staggered Units	EA
09/10/23	E	Sketch Design	EA
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08/09/23	C	Sketch Design	EA
31/08/23	B	Sketch Design	EA
07/07/23	A	Sketch Design	GL

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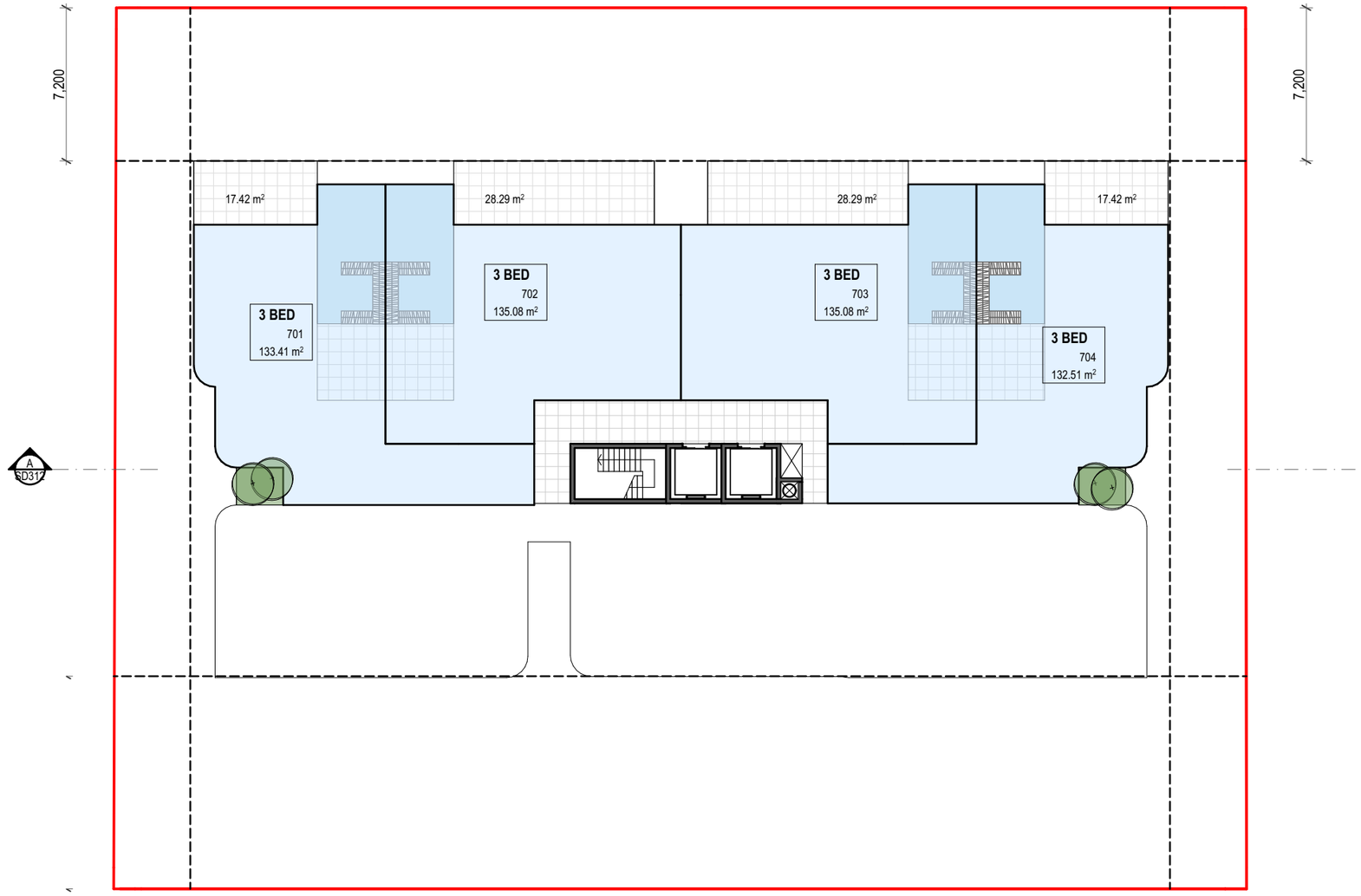
Drawing Title
GA Plan- Level 06

Scale @ A3	Drawn:	Checked:
1:200, 1:250	SD	RH

Project Number	Drawing Number	Issue
H4700DON	SD309	Q



200 Level 07
1:250

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16/11/23	J	Sketch Design	RH
16/11/23	H	Sketch Design	RH
09/11/23	G	Staggered Units	EA
31/10/23	F	Staggered Units	EA
09/10/23	E	Sketch Design	EA
26/09/23	D	Sketch Design	EA
08/09/23	C	Sketch Design	EA
31/08/23	B	Sketch Design	EA
07/07/23	A	Sketch Design	GL

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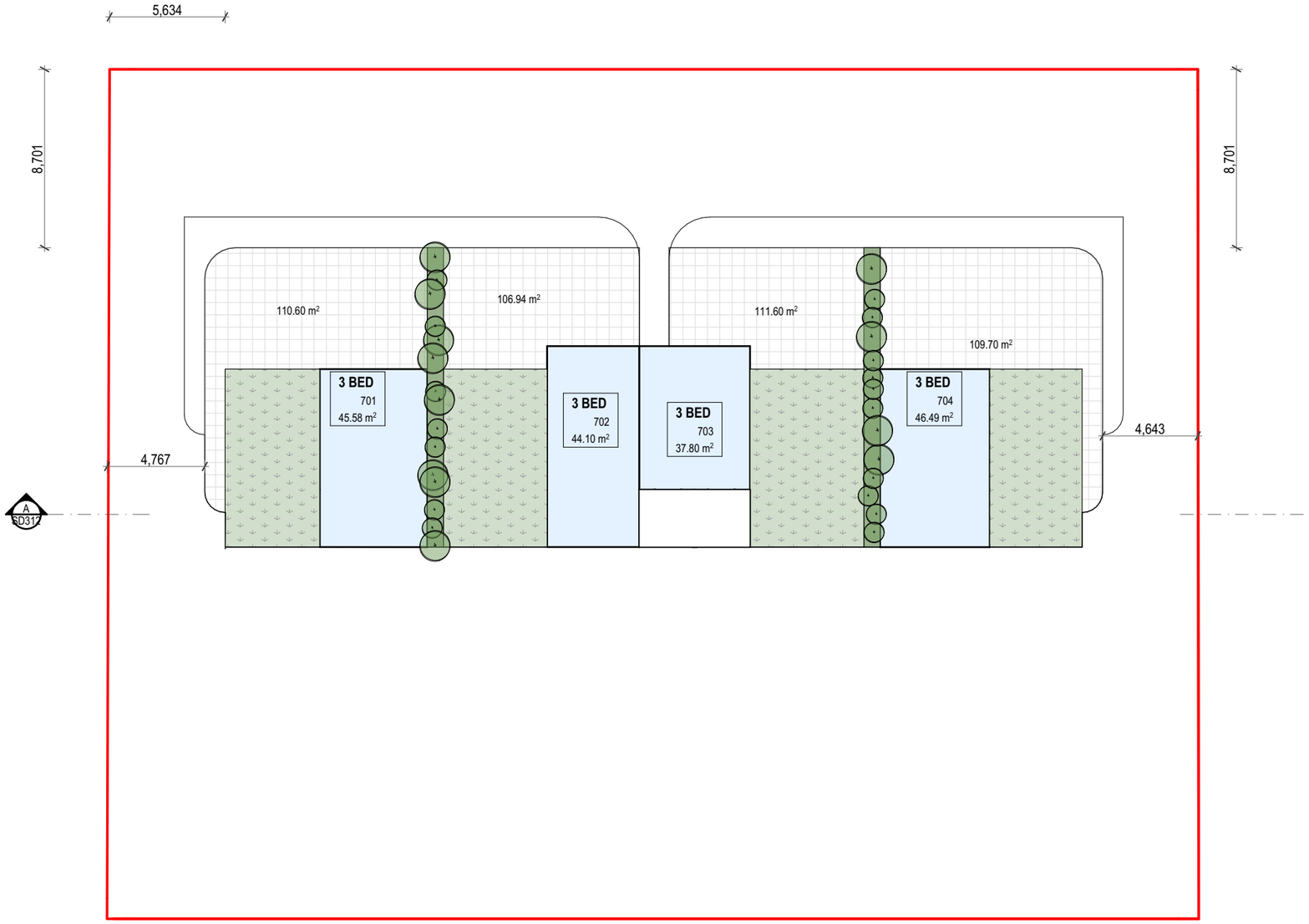
Drawing Title
GA Plan- Level 07

Scale @ A3	Drawn:	Checked:
1:250	SD	RH
Project Number	**Drawing Number**	**Issue**
H4700DON	**SD310**	Q



200 Level 08
1:250

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07/07/23	A	Sketch Design	GL

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Drawing Title
GA Plan - Level 08

Scale @ A3	Drawn:	Checked:
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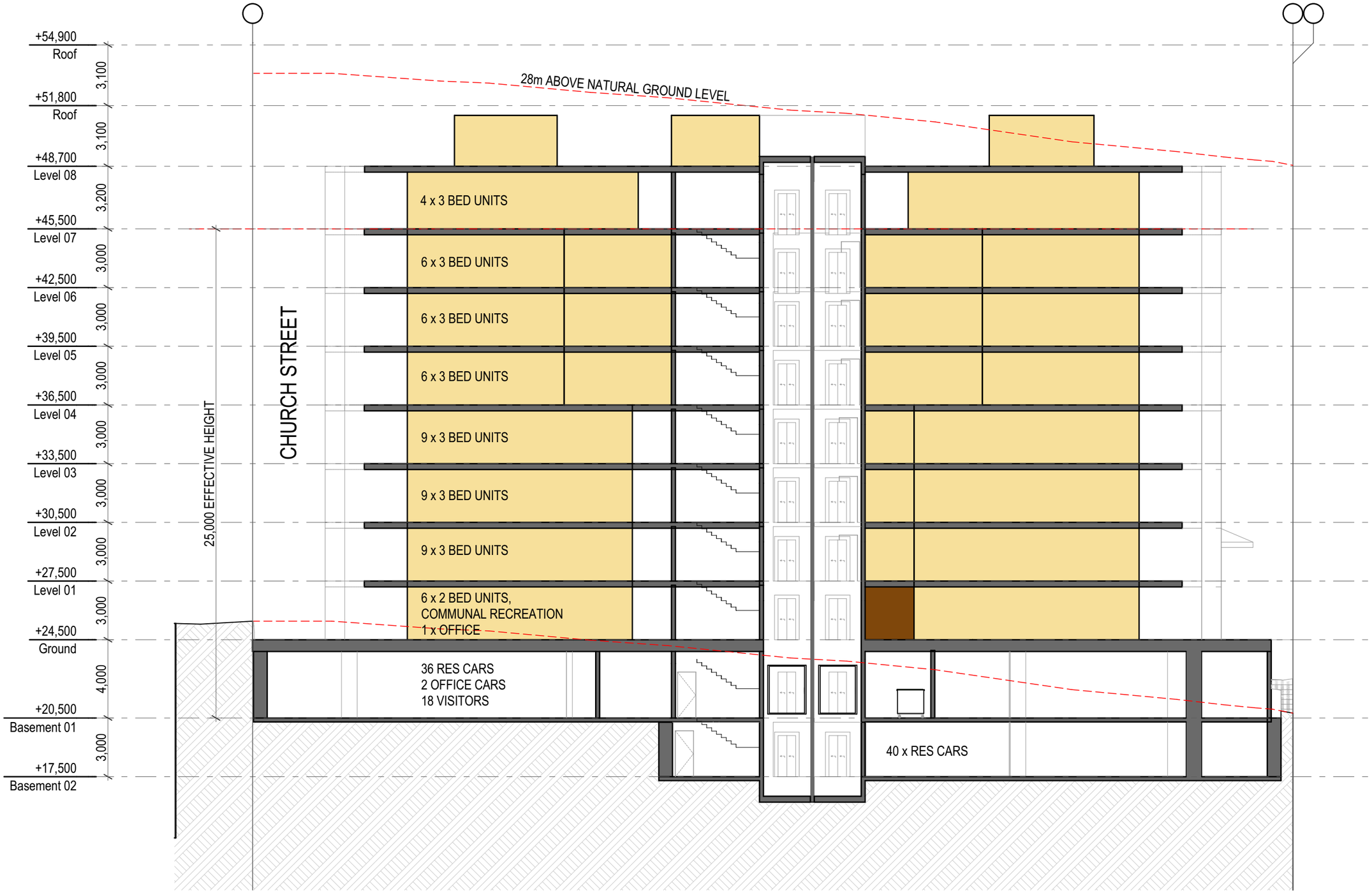
Project Number	Drawing Number	Issue
H4700DON	SD311	Q



A — **Section A**
1:200

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Drawing Title
Indicative Section

Scale @ A3	Drawn:	Checked:
1:200	SD	RH
Project Number	**Drawing Number**	**Issue**
H4700DON	**SD312**	Q