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**Specialist Advice**

**Report on Geotechnical Investigation**

**Proposed Seniors Housing**

**2-32 Junction Street, Forest Lodge NSW**

**Prepared for Corio Projects Pty Ltd**

**Project 229796.00**

**26 May 2025**

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

### Signature

### Date

<b>Author</b>		26 May 2025
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# Report on Geotechnical Investigation

## Proposed Seniors Housing

### 2-32 Junction Street, Forest Lodge NSW

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#### 1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a geotechnical investigation undertaken for a proposed seniors housing development at 2-32 Junction Street, Forest Lodge NSW (the site). The investigation was commissioned by email instructing to proceed dated 30 July 2023 from Chris West of Corio Projects Pty Ltd and was undertaken in accordance with Douglas' proposal 229796.00.P.001.Rev0 dated 31/05/2024.

It is understood that the proposed development of the site involves the partial demolition of the existing buildings and pavements on the site, and construction of a new five storey building with two levels of parking at Ground and Lower Ground floors.

The aim of the geotechnical investigation was to assess the subsurface soil and groundwater conditions across the site, to inform design, and to support a State Significant Development application (SSDA), addressing part of the Planning Secretary's Environmental Assessment Requirements (SEARs) pertaining to Ground and Water Conditions (SEARs Item 13).

Specifically, of the required documentation under SEARs Item 13:

- This investigation report addresses the requirement for a Geotechnical Assessment;
- Groundwater is discussed in this investigation report, and this report may also satisfy the requirement for a Groundwater Impact Assessment report due to the limited impact of the proposed development;
- This investigation report does not address surface water impacts and is not a Surface Water Impact Assessment report, which is typically prepared by the Civil consultant;
- Salinity and Acid Sulfate Soils are assessed in this investigation report, but this report is not a Salinity Management Plan or Acid Sulfate Soils management plan. A separate Acid Sulfate Soil management plan will be required.

Douglas has previously completed geotechnical investigations on the site in 1998; the results of which have been considered in the preparation of this report. Additional investigation was undertaken to supplement the existing information and to assess acid sulfate soils, salinity and groundwater at the site.

The additional investigation included the auger drilling of two (2) boreholes, auger and rock core drilling of one (1) borehole and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on geotechnical issues.

The (additional) geotechnical investigation was undertaken concurrently with a detailed (contamination) site investigation (DSI), the results of which are reported separately (reference: 229796.01.R.001.Rev0).

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

## 2. Site description

The site located at 2-32 Junction Street, Forest Lodge and is approximately rectangular in shape covering an area of approximately 4,860 m<sup>2</sup>. The site is surrounded by multi-storey residential properties and bounded by Junction Street to the north-east. The site is also accessible by Larkin Street south-west of the site. The site is currently occupied by a three to four-storey brick building (part of which is understood to be of heritage significance, closest to Junction Street) and a single storey brick building in the centre of the property, surrounded by outdoor on-grade car parks. The site is shown on Drawing 1, Appendix A.

The site slopes down to the south-west, from approximately RL 14 m AHD on the north-eastern site boundary along Junction Street to RL 11 m AHD along the south-western site boundary. A sandstone boulder retaining wall of approximately 1.5 m to 2 m height runs along the north-eastern site boundary, to the south of the existing office building. Smaller retaining walls and batters (less than 0.5 m height) run along the southern half of the south-east site boundary, and along the western half of the north-western site boundary.

There is a buried concrete culvert stormwater drainage channel running approximately parallel to the south-west site boundary. The concrete channel is a formalisation of the largely backfilled Orphan School Creek, a natural watercourse connecting from Sydney University through Forest Lodge and ultimately feeding into Blackwattle Bay.

## 3. Previous Investigation

Douglas has previously carried out a contamination and geotechnical investigation on the site in March 1998 (Douglas Project 27259) for a proposed redevelopment comprising of light industrial warehouses and factories above a basement car park.

This investigation included thirteen (13) augered boreholes (BH1 to BH13) drilled to depths of between 0.7 m and 5.3 m and four (4) augered and cored boreholes (BH14 to BH17) drilled to depths of between 3.8 m and 9.5 m. The subsurface conditions encountered in the previous investigation included:

- An asphaltic concrete (AC) pavement over sand and gravel roadbase, overlying;
- Gravelly sandy clay fill, which was encountered at all locations, to depths of between 0.3 m to 4.65 m, overlying;
- Residual stiff silty sandy clay or medium dense clayey sand to depths of between 0.7 m and 5.3 m in all but four borehole locations; overlying
- Sandstone bedrock, initially low or medium strength, increasing to medium and high strength with increasing depth.

Whilst augering, free groundwater was encountered at depths of 2.8 m in two boreholes located on the south side of the site. It was recorded in the previous report that the groundwater

observed at these locations may be related to a covered stormwater channel that runs on the south-west boundary of the site, which was formerly an open creek.

It is noted that elevation data from the time of the previous investigation is not available for the augered boreholes (BH1-BH13). Elevation data is available, however, for the cored boreholes (BH14-BH17).

## 4. Published data

### 4.1 Geology

Reference to the NSW Seamless Geology Map indicates that the site is underlain Ashfield Shale, which generally comprises dark grey shale and laminite; but is also close to the border of the Hawkesbury Sandstone formation that underlies the Ashfield Shale formation, so either formation may be present at the surface. An extract of the NSW Seamless Geology Map is shown in Figure 1. The mapping also indicates the presence of anthropogenic (i.e., fill) material in the southwest of the site where the former creek extended.

The site investigations encountered residual clays and medium to coarse grained sandstone with minor laminite, from the Hawkesbury Sandstone formation, and also encountered deeper fill material in the southwest of the site. The investigation results are consistent with the site context and geological mapping, although noting that Ashfield Shale was not encountered.



**Figure 1: NSW Seamless Geology map with site location.**

### 4.2 Hydrogeology

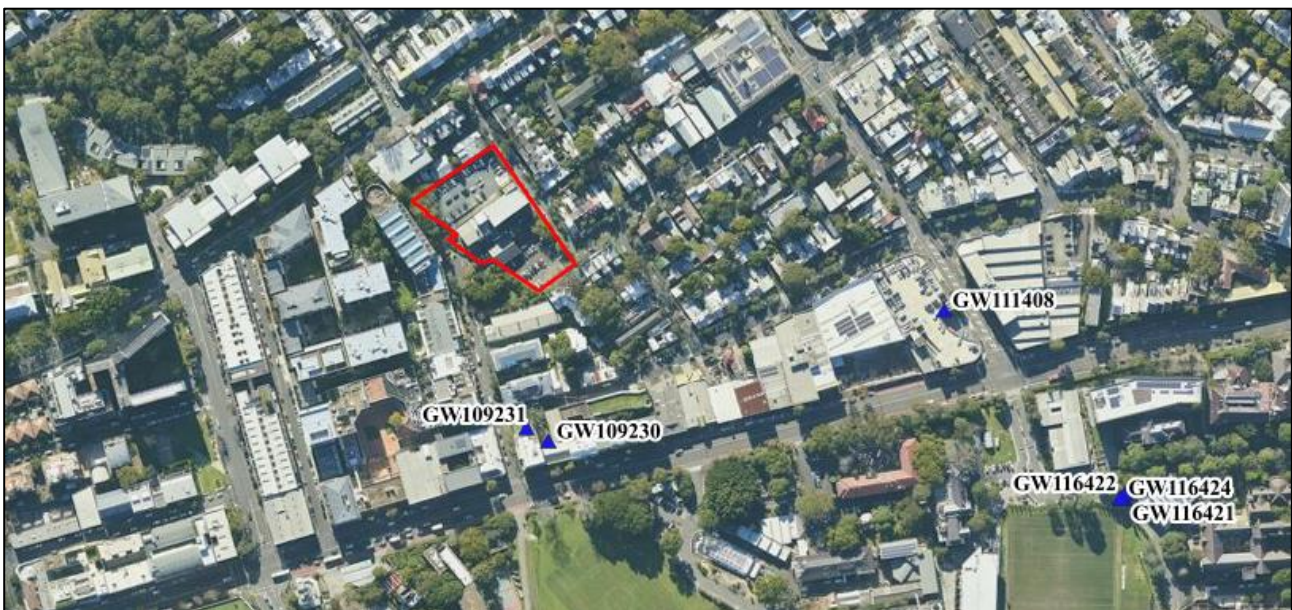
A search of registered groundwater wells indicates that there are six registered groundwater wells within 500 m of the site. The wells are generally to the south-east of the site at distances

between 150 m and 450 m from the site. The locations of the nearby registered groundwater wells are shown on Figure 2.

Water levels are noted on four of the six well records. The standing water level depths noted on the well records, where present, are summarised in Table 1. Elevation survey data is not available for the wells.

**Table 1: Summary of Nearby Registered Groundwater Well Water Levels**

Well ID	Depth to Groundwater (m)	Date
GW111408	2.07	5 February 2011
GW116421	3.20	22 September 2017
GW116422	3.20	22 September 2017
GW116424	2.90	22 September 2017



**Figure 2: Nearby registered groundwater wells with site location**

### 4.3 Soil landscape

Reference to the 1:100 000 Sydney Soils Landscape Sheet indicates that the Blacktown Residual Soil Landscape (bt) is mapped over the site with the Gynea Erosional Soil Landscape mapped to the north of the site. The Blacktown residual landscape is characterised by undulating rises on Wianamatta Group Shales, with local relief of 30 m, and slopes usually >5%. This soil landscape is shallow to moderately deep (>100cm) hard-setting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines. The Gynea landscape to the north of the site is characterized by undulating to rolling rises and low hills with rock outcrops and shallow, highly permeable sands. An extract of the soil landscape map is shown in Figure 3.



**Figure 3: Soil landscape mapping with site location**

#### 4.4 Acid sulfate soils

Reference to the NSW Acid Sulfate Soils Risk Mapping indicate that the site is near to an area mapped as disturbed terrain, elevation >4 m AHD. This layer follows Orphan School Creek to the north-west of the site, along the same alignment as the backfilled historical drainage line on the south-western boundary of the site. An extract of the Acid Sulfate Soil map is shown in Figure 4.



**Figure 4: Acid sulfate soil mapping with approximate site location**

## 4.5 Salinity

Reference to NSW Salinity Potential mapping indicates that the site is not within a region of mapped salinity risk.

## 5. Field work

### 5.1 Field work methods

The current geotechnical investigation was carried out on 30 August 2024 and included:

- Drilling of three boreholes using a tracked drilling rig. Two boreholes, BH101 and BH102, were auger drilled to the top of rock at depths of 7.05 m and 5.84 m, respectively. One borehole, BH103, was auger drilled to the top of rock (at 1.4 m depth) then continued using NMLC diamond core drilling methods to obtain (51 mm diameter) continuous samples of the bedrock to a depth of 6.8 m;
- Standard Penetration Tests (SPTs) were completed at regular intervals in the soil profile to assess the consistency of the subsurface soils;
- Following completion of drilling, the three boreholes were converted into standpipe piezometers (i.e., monitoring wells) and finished at the surface with a steel cover flush with the surrounding surface. The wells were developed immediately following installation, by removing at least three well volumes of water from the wells;
- The field work was supervised by an engineering geologist who logged the encountered subsurface conditions and collected samples for subsequent laboratory testing.

The parallel contamination investigation (DSI) also included the drilling of an additional 10 boreholes, BH201 to BH210, auger drilled to depths of between 0.3 m and 3.5 m. The drilling of these boreholes was supervised by an environmental scientist. No geotechnical testing was carried out in these boreholes.

The locations of the boreholes are shown on Drawing 1 in Appendix B.

The borehole locations and elevations were surveyed using a high precision differential GPS with a stated accuracy of  $\pm 0.1$  m vertically and horizontally.

### 5.2 Field work results

Details of the subsurface conditions encountered are given in the borehole logs in Appendix C, together with notes defining classification methods and descriptive terms used in their preparation, and colour photographs of the rock core.

The sequence of subsurface materials encountered within the boreholes encountered at the current boreholes may be summarised as follows:

- **FILL:** Surficial pavements comprising either approximately 20-60 mm of asphaltic concrete (AC), or a 140-150 mm thick concrete slab, overlying variable grey, brown and dark brown, sand and clay fill with varied proportions of clay, sand, sandstone ironstone and igneous gravels, cobbles

and boulders, and fragments of anthropogenic materials including slag, glass, ceramic, brick, concrete, metal, and plastic; encountered to depths of between approximately 0.3 m and 4.8 m, observed in every borehole;

Overlying,

**POSSIBLE ALLUVIAL SOIL:** Dark brown and grey-brown, medium and high plasticity, fine to medium grained, sandy clay and clayey sand with ironstone and sandstone gravel, observed in BH101 and BH102 to depths of between 4.7 m and 5.5 m, generally in a soft to firm or loose condition.

The depth of the interface between this soil and the overlying fill is not well defined based on the observations in the boreholes, and the depths provided should be considered approximate.

Overlying,

**RESIDUAL SOIL & EXTREMELY WEATHERED SANDSTONE:** Red and orange-brown clayey sand, observed in BH101 and BH102 to depths of between 5.8 m and 6.7 m, generally in a loose condition.  
Overlying,

**SANDSTONE:** Hawkesbury Sandstone bedrock. Initially red and yellow, highly weathered, low, medium or high strength, grading with increasing depth, to pale grey, slightly weathered to fresh, medium to high strength.

The sandstone recovered from BH103 was typically slightly fractured to unbroken, however, discrete zones of inferred softer or more fractured material were not recovered in the upper weathered profile, and it is noted that during drilling between approximately 2.5 m and 2.9 m depth in BH103, the core barrel dropped rapidly without rotation, possibly indicating the presence of a void, or at least a soft clay seam.

Groundwater was observed during auger drilling of BH101, BH102 and BH208. After five days following completion of the drilling and development of the wells (i.e., purging), the groundwater levels were measured in the monitoring wells installed in BH101, BH102 and BH103. The groundwater observations from BH101-103 are summarised in Table 2.

**Table 2: Summary of Groundwater Observations**

<b>Borehole</b>	<b>Observation Type</b>	<b>Observation Date</b>	<b>Groundwater Depth (m) and [RL] (m AHD)</b>
BH101	Auger drilling	30 August 2024	3.4 [8.0]
	Standpipe measurement	4 September 2024	4.2 [7.2]
BH102	Auger drilling	30 August 2024	3.0 [7.7]
	Standpipe measurement	4 September 2024	3.2 [7.5]
BH103	Standpipe measurement	4 September 2024	2.4 [8.4]

It is noted that groundwater levels are transient and may vary over time due to climatic, seasonal, and other factors.

## 6. Laboratory testing

Following completion of the investigation field work, laboratory testing was undertaken on selected samples for the following:

- Aggressivity to buried steel and concrete (pH, electrical conductivity, sulphate and chloride ion content);
- Emerson class, for dispersion potential;
- Cation exchange capacity / exchangeable sodium percentage, electrical conductivity and textural classification (dispersion and salinity);
- Acid sulfate soil (ASS) field screening (pH and oxidised pH);
- Chromium reducible sulfur ( $S_{cr}$ ) for laboratory ASS; and,
- Suspension peroxide oxidation combined acidity & sulfate (SPOCAS) suite laboratory ASS and treatment assessment.

The results of the laboratory testing are summarised in Table 3, Table 4, Table 5 and Table 6. The laboratory test certificates are included in Appendix D

The chemical analysis results listed above are discussed further in Sections 8.9, 8.10 and 8.11

**Table 3: Summary of Aggressivity Laboratory Tests**

Borehole	Depth (m)	Electrical Conductivity (µS/cm)	pH	Cl (mg/kg)	SO <sub>4</sub> (mg/kg)
101	6.0-6.1	33	6.0	28	< 10
102	4.5-4.6	170	7.4	< 10	86
103	0.9-1.0	32	7.1	< 10	10

Notes: Cl=chloride content SO<sub>4</sub>=sulphate content

**Table 4: Summary of Salinity Laboratory Tests**

Borehole	Depth (m)	Emerson Class	CEC (%)	ESP (%)	ECe (dS/m)	Salinity
BH101	0.9-1.0	6	6.5	6	2.4	Slightly saline
BH101	3.9-4.0	6	8.8	-	< 2	Non saline
BH101	5.0-5.1	6	1.9	-	< 2	Non saline
BH101	6.0-6.1	5	1.8	-	< 2	Non saline

Notes: ESP=Exchangeable Sodium Percentage ECe=saturated extract electrical conductivity

**Table 5: Summary of Acid Sulfate Soil Screening Laboratory Tests**

Borehole	Depth (m)	pH (pH units)	pH <sub>fox</sub> (pH units)	Reaction
BH01	0.5-0.6	7.9	5.4	Medium
BH01	0.9-1.0	5.9	4.5	Medium
BH01	1.5-1.6	6.2	4.2	Medium
BH01	2.0-2.1	7.8	6.1	Medium
BH01	2.5-2.6	7.6	5.9	Medium
BH01	3.0-3.1	7.6	5.6	High
BH01	3.5-3.6	7.7	5.7	High
BH01	3.9-4.0	6.9	3.2	Extreme
BH01	4.5-4.6	7.7	4.2	Extreme
BH01	5.0-5.1	7.1	2.6	Medium
BH01	6.0-6.1	7.6	4	Medium
BH02	0.5-0.6	8.1	5.3	Medium
BH02	0.9-1.0	8.8	6.5	Medium
BH02	1.5-1.6	8.4	6.2	Medium
BH02	2.0-2.1	8.4	5.7	Medium
BH02	2.4-2.5	8.4	5.4	Medium

Borehole	Depth (m)	pH (pH units)	pH <sub>fox</sub> (pH units)	Reaction
BH02	3.0-3.1	7.7	3.2	Extreme
BH02	3.5-3.6	7	2	Medium
BH02	3.9-4.0	7.8	2.4	Medium
BH03	0.5-0.6	7.9	5.5	Medium
BH03	0.9-1.0	7.4	5	Medium

**Table 6: Summary of S<sub>cr</sub> and SPOCAS Laboratory Tests**

Location	Depth	S <sub>cr</sub> (%w/w S)	Net Acidity (%w/w S)
BH01	3.0-3.1	0.008	< 0.01
BH01	3.5-3.6	0.01	< 0.01
BH01	3.9-4.0	0.02	0.03
BH01	4.5-4.6	0.06	< 0.01
BH01	5.0-5.1	0.03	< 0.01
BH02	3.0-3.1	0.04	0.05
BH02	3.5-3.6	0.12	0.15
BH02	3.9-4.0	0.1	< 0.01

## 7. Proposed development

The proposal involves the construction and operation of a Seniors Housing at 2-32 Junction Street, Forest Lodge, comprising, as indicated by the project planner:

- Earthworks involving cut and fill;
- Augmentation of existing services and infrastructure such as water, power and sewer;
- Construction of car parking comprising 79 car parking spaces on Lower Ground Floor and Ground Floor;
- Construction of a 5-storey building containing a Residential Aged Care Facility (RACF) and Independent Living Units (ILUs), including;
  - o 71 ILUs. Including 4 one-bedroom units, 43 two-bedroom units and 24 three-bedroom units, split across Levels G-5;
  - o Residential Care Units comprising 12 beds, located on Level 1;
  - o Staff administration areas;
  - o Amenities including cinema, hair salon, café, courtyard and multipurpose space;
- Construction of publicly accessible open space located at the rear of the building and expanding on the existing Larkin Street Reserve;

- Construction of a paved accessway along the north boundary of the site;
- Construction of a dedicated pedestrian laneway along the south boundary of the site; and
- Provision of associated landscaping.

From a groundworks perspective the proposed development of the site may be summarised as the partial demolition of the existing buildings and pavements on the site, and construction of a new five storey building with two levels of parking at Ground and Lower Ground floor levels, over a Loading Bay Lower Floor level.. It is understood that the existing heritage frontage onto Junction street will be retained to some extent.

As shown on the provided architectural drawings prepared by WMK Architecture, attached in Appendix B, the parking levels will generally be suspended above existing ground levels across most of the site. The lowest proposed 'Loading Bay Lower Floor' level (generally comprising a loading dock and storage areas), for which the proposed floor level is at RL 10.6 m AHD, which is close to or only slightly below existing site levels at the southwest edge of the site, and generally below existing site levels towards the northeast, up to a maximum of approximately 3 m below existing site levels near the northern end of the site and the driveways adjacent to either side of the existing office building, where maximum existing surface levels are up to approximately RL 14 m. It is expected that bulk excavation to form the 'Loading Bay Lower Floor' will be required up to maximum depths of approximately 3.5 m.

The key geotechnical issues relevant to the proposed development are expected to be the design and construction of floor slabs over varied subgrades and a combination of shallow and piled foundations to support column loads, temporary and permanent excavation support along the northeast site boundary, and the management of acid sulphate soils and fill materials that will need to be excavated and disposed of offsite.

## 8. Comments

### 8.1 Geotechnical Model

The interpreted subsurface profile encountered during the current investigation and previous investigations has been grouped into six geotechnical units. Two geotechnical cross-sections (Section A-A' and B-B') showing the interpreted subsurface profile across the site are shown on Drawing 4 and Drawing 5 in Appendix B. Contour plans showing the interpreted top of rock, and interpreted top of (generally consistent) medium to high strength rock, across the site, are shown on Drawing 2 and Drawing 3 in Appendix B.

It should be noted that the subsurface profile may vary between, and particularly away from the borehole locations. The interpreted boundaries between geotechnical units are accurate only at the test locations at which those units were encountered and are indicative only elsewhere (or where noted otherwise).

The interpreted geotechnical units are summarised as follows:

- UNIT 1: FILL** Surficial pavements comprising either approximately 20-60 mm of asphaltic concrete (AC), or a 140-150 mm thick concrete slab, overlying variable but apparently poorly

compacted sand and clay fill with varied proportions of clay, sand, sandstone ironstone and igneous gravel and cobbles, and fragments of anthropogenic materials including slag, glass, ceramic, brick, concrete, metal, and plastic.

The fill is considered uncontrolled and was generally less than 1 – 1.5m deep over the majority of the site, but increased to 4 m to 5 m depth within about 15 m of the south-western site boundary and former creek channel.

Overlying,

**UNIT 2: POSSIBLE  
ALLUVIAL SOIL**

Dark brown and grey-brown, medium and high plasticity, fine to medium grained, sandy clay and clayey sand with ironstone and sandstone gravel, generally in a soft to firm or loose condition.

This material is possibly a combination of alluvial and colluvial sediment, although some disturbance or mixing with the overlying fill may have occurred historically, or during drilling due to the drilling method (augering below groundwater).

The interface between this soil and the overlying fill is not well defined based on the observations in the boreholes, but this unit was only encountered along the southwest site boundary (in the vicinity of the backfilled creek), below depths of approximately 3.5 m.

This material is also indicated, by laboratory testing, to be potential acid sulfate soil (see Section 8.9).

Overlying,

**UNIT 3: RESIDUAL SOIL &  
EXTREMELY WEATHERED  
SANDSTONE**

Red and orange-brown clayey sand, interpreted to be residual soil, or extremely weathered rock, generally loose or medium dense where encountered;

Overlying,

**UNIT 4a: VL-L & L-M  
SANDSTONE**

Red, brown and yellow, fine to coarse grained, highly weathered, very low to low and low to medium strength Hawkesbury Sandstone;

Overlying,

**UNIT 4b: VARIABLE M-H  
SANDSTONE**

Red, brown and grey, fine to coarse grained, moderately and highly weathered, mostly medium and high strength Hawkesbury sandstone, with numerous discrete layers of highly fractured or extremely weathered material, and occasional voids or possible soft seams;

Overlying;

**UNIT 4c: M-H SANDSTONE** Grey and pale grey, fine to coarse grained, slightly weathered to fresh, slightly fractured to unbroken, medium and high strength Hawkesbury Sandstone.

The subsurface profile at the site is characterised by the buried alluvial channel running along the south-western site boundary. In the north-eastern approximate two-thirds of the site, the depth of Unit 1 fill is relatively shallow, generally directly overlying Unit 4 sandstone (or with a thin residual soil profile), which gradually falls towards the southwest. Close to the south-western boundary, the depth of fill increases and the rock level falls significantly over a short distance, where the site crosses over the backfilled creek. In this area, the Unit 1 fill is underlain by Unit 2 possible alluvial and Unit 3 residual / extremely weathered soils, overlying the Unit 4 sandstone.

The three soil Units (1-3) comprise soils in variable or generally poor conditions (i.e., soft to firm clays, loose or medium dense sands).

The sandstone bedrock has been subdivided into three geotechnical units (4a, 4b and 4c), owing to the variability of the rock across the site. The Unit 4a sandstone is variable but generally highly weathered, and of low strength. The Unit 4b and 4c sandstones are both generally of medium and high strength, but the Unit 4b sandstone is characterised by a significantly higher degree of weathering, fracturing and greater proportion of seams and lower strength bands.

Of particular note is the potential presence of voids in the Unit 4b sandstone in proximity to the buried creek, as encountered in BH103, which are interpreted as being associated with possible undercutting of the rock face in the (now buried) creek valley.

The boundary between the 4a and 4b sandstone units is not well defined at many locations across the site (particularly where relying on auger-only borehole information), and these units have been 'lumped' together on the cross-sections and contour plans for this reason. In general, the upper 0 m (i.e., absent) to 1 m thickness of the combined 4a/4b (rock) strata is expected to be characterised by Unit 4a very low and low to medium strength sandstone, with the remainder of the combined strata expected to be characterised by the Unit 4b variable medium and high strength sandstone, but with substantial defects and possible voids or soft seams.

Groundwater was encountered within the soil profile along the south-western boundary (i.e., in the backfilled creek) between RL 7 m and 8 m AHD, and within the rock profile slightly upgradient to the north-east of the creek at RL 8.4 m AHD. Given the surface topography and observed subsurface conditions, it is expected that surface and subsurface flows on this site will generally tend towards the south-west, recharging the Orphan Creek groundwater system and ultimately flowing out to Blackwattle Bay, to the north.

## 8.2 Excavation Conditions

Bulk excavation is expected to be required to maximum depths of approximately 3.5 m. Such excavations are expected to mostly encounter fill materials overlying sandstone bedrock (particularly in the northeast of the site at relatively shallow depth), which may be of medium or high strength close to the top of rock surface.

Excavations in soils (including the fill) should be readily achievable using conventional earthmoving equipment (e.g., hydraulic excavators fitted with digging buckets).

Very low to low strength sandstone may require ripping using large bulldozers or excavators fitted with ripping tynes or rock hammers.

The slightly fractured to unbroken medium and high strength sandstone is likely to prove effectively 'un-rippable' and will require large hydraulic rock hammers and / or rock saws / grinders for effective excavation. Relatively slow production rates in such material should be expected.

Detailed excavation for footings, services and excavation side walls within low strength or stronger rock will generally require the use of a rotary rock saw or grinder, or hydraulic rock hammers.

The excavation rate that can be achieved, particularly within high and very high strength rock varies considerably and is dependent upon the degree of jointing in the rock, the rock strength, the type of machinery being used and the skill of the operator. It is suggested that bulk excavation tenderers be required to make their own assessment of the equipment required to carry out the work.

### 8.3 Waste Disposal

Disposal of waste must be to an appropriately licensed waste facility, as per the *Protection of the Environment Operations Act 1997 NSW* (POEO Act) and the *Protection of the Environment (Waste) Regulation N2014 NSW*. This includes disposal of fill and natural materials that may be removed from the site. Reference should be made to Douglas' Detailed Site (contamination) Investigation report for the site (reference: 229796.01.R.001.Rev1) and Remediation Action Plan report for the site (reference: 229796.01.R.002.Rev1).

### 8.4 Site Preparation and Earthworks

The site is underlain by variable depths of uncontrolled fill and loose/soft soils. Long term settlement of uncontrolled fill is unpredictable and there are inherent risks associated with supporting slabs or any structural loads on uncontrolled fill. On this site, it may be feasible to strip and replace uncontrolled fill across parts of the site where the fill depths are expected to be less than about 2 m. However, it is not expected to be practical to remove and replace the uncontrolled fill and soft/loose soils in the backfilled creek in the southwest of the site. Depending on loading requirements and settlement tolerances it may be necessary to fully or partially suspend ground floor slabs (or the sub-floor area slab). Slab on ground settlements would be almost entirely differential to the columns, which will likely be supported on a combination of spread footings and piles on rock.

Suitable site preparation methods will depend on the applied loads and settlement tolerances. The following general subgrade preparation measures are recommended for the placement of fill for site levelling, and the construction of working platforms or pavements where long term settlements are acceptable:

- Strip existing fill to expose the natural subgrade material, or to a maximum depth of 1.5 m;

- Proof roll the exposed surface using a minimum 10 tonne smooth drum roller in non-vibration mode. The surface should be rolled a minimum of six times with the last two passes observed by an experienced geotechnical engineer to identify any 'soft spots';
- Any soft or heaving materials identified during proof rolling should be removed, or otherwise treated (e.g., with geosynthetics and/or rock fill bridging layers), as directed by the geotechnical engineer;
- Fill should be placed in layers of 300 mm maximum (loose) thickness and compacted to a dry density ratio of between 98% and 102% Standard compaction, with the moisture content maintained within 2% of Standard optimum moisture content (OMC).

Excavated fill material from the site may be suitable for re-use as engineered fill from a geotechnical point of view, provided it does not contain peaty clays or excessively silty material, organic material, or other deleterious materials (e.g., rubbish). Oversize material (> 100 mm diameter) will inhibit compaction and should also be removed. The suitability for re-use will also depend on the contamination and acid sulphate soil status of the material.

Imported fill should be free of oversize, organic and deleterious materials, and be non-dispersive, have a plasticity index of less than 25%, and a CBR of greater than 5% (but subject to final design requirements and specifications).

Density testing of placed fill should be carried out in accordance with AS3798 "Guidelines for Earthworks for Commercial and Residential Developments".

## 8.5 Working Platforms

Piling rigs and cranes will need a suitable working platform during construction to reduce the risk of bearing capacity failures or substantial differential settlement, either of which could lead to overturning or toppling of plant.

The design of working platforms will be dependent on the maximum applied track pressures and track dimensions of any piling rigs or cranes that will be used. It is expected that moderately sized plant will be required for efficient construction of foundation piles in medium and high strength rock, and piling platforms will be required in areas with loose/soft subgrades, particularly following demolition / removal of hardstands. It may be beneficial to keep the existing hardstands in place for piling works to help reduce the platform requirements, however, concrete slabs or flexible pavements alone are often not sufficient to support heavy piling rig and crane loads, and can inhibit a complete assessment of the subgrade.

Demolished concrete could potentially be crushed down to use as working platform material, but should be well graded with no particles larger than 70 mm. Imported durable granular material could also be used, or a combination of imported and site-won material. Material used to construct working platforms should be placed in accordance with the previous advice provided in Section 8.4 for placement of engineered fill, or preferably, as specified in the working platform design.

All working platforms will require detailed design. Where relevant, specific assessment of the additional stresses caused by track or outrigger loadings on underground utilities should be undertaken in conjunction with the structural engineer. Methods of keeping the applied pressures to acceptable levels may include the placement of extra rock fill thicknesses to 'bridge

over' the subject structures/services and/or the use of steel road plates to distribute the applied track pressure.

The proximity of the groundwater table to the working platform surface in the backfilled creek area should be noted. Where the water table is within approximately 2 m of the working surface, the bearing capacity of the subgrade or platform material could be reduced and will need to be considered in the platform design. Where the water table is found to be within 2 m of the working platform (surface), further geotechnical advice should be sought.

Most of the incidents relating to the stability of piling rigs (or cranes) occur due to localised problems and variability such as poorly compacted fill, soft/spongy spots or working too close to batter slopes or excavations. Accordingly, it will be important that the site controller and earthworks contractor are vigilant in inspecting and maintaining the integrity of the piling platform throughout the construction programme.

In areas where plant will operate directly on existing ground slabs or pavements, there will always be a risk that subgrade conditions are different to those assumed for design. For example, if a weak or soft subgrade is present this could result in the sudden shear or 'punching' failure of the concrete slab or flexible pavement, which may result in rig instability. Similar concerns would obviously prevail if there were voids beneath existing ground slabs. Where existing slabs or pavements are to support piling rigs, crane outriggers or other heavy plant, the subgrade conditions should be assessed on a case-by-case basis, most likely including testing of the subgrade conditions below the slabs or pavements in the subject areas.

## 8.6 Excavation Support

### 8.6.1 Batters and Vertical Cuts in Rock

Vertical excavations in soils (including fill) and very low strength rock (i.e., Units 1, 2, 3 and 4a) cannot be relied upon to be self-supporting. Temporary batters may be feasible where the groundwater table is not intersected, and should be cut no steeper than 1.5(H):1(V), up to a maximum excavation depth of 3 m. Permanent batters (above groundwater) should be cut no steeper than 2(H):1(V), although flatter batters (e.g., 3(H):1(V) may be necessary for access for maintenance, such as mowing plant. Permanent batters should incorporate drainage to reduce surficial flows over the crest of the batters, and face protection against erosion, such as vegetation, jute-mesh matting, or shotcrete.

Where batters intersect the groundwater table, surcharge loads are applied near the crest (within a distance equal to the height of the batter), or any movement sensitive structures or services are near the crest, then specific geotechnical review and advice will be required (and potentially flatter batters).

Competent low to medium strength or stronger sandstone will generally be stable when cut vertically provided there are no adversely oriented joints or other defects present. If excavations in rock are required, all vertical faces in rock should be inspected by an experienced geotechnical engineer as the excavation progresses in depth intervals of no deeper than 1.5 m. The purpose of the inspections is to identify the extent of shotcrete face protection required and to check for the presence of any adverse defects daylighting into the excavation face which may require additional stabilisation measures (such as rock bolts or shotcrete).

### 8.6.2 Retaining Walls / Shoring

Where batter slopes cannot be used, shoring walls will be required to support the fill, soils and very low to low strength rock. Anchored soldier pile walls are often used to provide temporary retaining support to soils and weathered rock. The soldier piles are usually spaced at approximately 2 m to 2.5 m centres, however, more closely spaced piles (e.g., contiguous) may be required to reduce wall movements or prevent collapse of infill materials (e.g. the sandy fill at the site), particularly where pavements, structures or services are located in close proximity to the excavation. It is noted that if any locally deeper excavations extend below the groundwater table, adoption of watertight or semi-watertight shoring methods will be required (e.g., secant pile wall).

Preliminary design of cantilevered retaining walls or retaining walls with a single row of props or anchors, up to 3 m high, could be undertaken on the basis of a triangular earth pressure distribution using the parameters in Table 7. If retaining walls with multiple rows of anchors, or walls greater than 3 m high are required, additional advice should be sought.

**Table 7: Summary of retaining wall design parameters**

Unit	Material	Unit Weight (kN/m <sup>3</sup> )	Earth Pressure Coefficient	
			Active (K <sub>a</sub> )	At Rest (K <sub>o</sub> )
1-3	Fill and Natural Soils	20	0.4	0.6
4a/4b	VL-L, L-M & Variable M-H Sandstone	22	0.1*	0.3*
4c	M-H Sandstone	24	0*	0*

Note \* subject to geotechnical inspection, 'at rest' coefficient does not account for stress relief movements

It is not recommended that the uncontrolled fill or natural soils in the creek are relied upon for passive support of piles. Where shoring piles are embedded into rock, the passive support provided by the rock can be assessed based on the lateral limiting pressures provided in Table 8, which can be assumed to be applied to a maximum area equal to three pile diameters (or equal to the pile spacing, if the pile spacing is less than three pile diameters). The contribution of the upper 0.5 m of rock below the bulk level on the passive side of any shoring should be ignored in design.

**Table 8: Lateral Limiting Pressures for Embedded Pile Walls**

Unit	Material	Ultimate Lateral Limiting Pressure (kPa)
4a/4b	VL-L, L-M & Variable M-H Sandstone	1,000
4c	M-H Sandstone	6,000

The values in Table 7 and Table 8 are ultimate design values and should be applied with a suitable factor of safety, or for limit state design, appropriately factored in accordance with AS4678-2002 "Earth Retaining Structures". The at-rest earth pressure coefficient should be used if wall deflections are to be minimised.

Shoring walls should also be designed for full hydrostatic pressures unless drainage of the ground behind impermeable walls can be provided, if appropriate. Drainage could comprise 150 mm wide strip drains pinned to the face at 1 m to 2 m centres behind shotcrete in-fill panels. The base of the strip drains should extend out from the shoring wall to allow any seepage to flow into a

perimeter toe drain which is connected to the stormwater drainage system. Where strip drains are used in conjunction with piled shoring walls it is important that mortar patching or shotcreting is undertaken progressively as excavation proceeds, every 1 – 1.5 m depth, to reduce the potential for soil loss or collapse in between the shoring piles.

Retaining wall/shoring design should also include consideration of lateral earth pressures due to sloping ground behind the wall where appropriate, and any surcharge loads acting behind the walls that can result in additional lateral loading.

It may be possible to terminate shoring piles within unsupported medium or high strength sandstone above the bulk excavation level. In this case it will be essential for an experienced geotechnical engineer or engineering geologist to assess the stability of the rock directly beneath each pile toe immediately after it is exposed during bulk excavation. Also, no passive resistance will be available to restrain the pile toes in this case, and as such it will generally be necessary to restrain the toe of the piles with temporary or permanent rock bolts or anchors, as appropriate.

## 8.7 Foundations

It is expected that bulk earthworks will generally expose a combination of uncontrolled fill (predominantly in the southwest) and sandstone bedrock (predominantly in the northeast) at the bulk surface.. Footings should not be supported on the uncontrolled fill, or the generally loose/soft natural soils encountered on the site, due to the risk of significant differential settlements.

It is recommended that the proposed structure should be founded uniformly on the underlying Unit 4c sandstone bedrock. While it may be possible to support some foundations in the Unit 4b sandstone, this is considered risky due to the observed variability and presence of voids or soft seams in the Unit 4b sandstone, in proximity to the buried creek. If a heavily loaded pile terminates a short distance above a void or weak seam in the Unit 4b material this may have significant implications on the performance of the pile. Verification of the foundation suitability in the Unit 4b material during construction would require proof coring or load testing during construction.

Further investigation (i.e., additional cored boreholes) may aid in more accurately delineating the top of the Unit 4c sandstone across the site, including potentially 'upgrading' some of the Unit 4b rock to Unit 4c if the additional investigations indicate less variability than inferred, based on the currently available information. This is most likely to be feasible in the central to northeastern portions of the site.

To achieve uniform support in the Unit 4c material, it is expected that piles will be required across much of the site, and potentially some high-level footings (pads, strips, etc.) could be used in lieu of piles closer to the northeast site boundary.

Conventional bored piles are expected to be a suitable piling method at this site, although an allowance should be made for the provision of temporary casing to support open pile holes in the variable fill and natural soils across the site; especially in the southwest of the site, in proximity to the buried creek, where such casing will be required to keep the pile holes open during drilling. Groundwater inflows into pile holes in the southwest of the site during construction will also likely require that some conventional bored piles are tremie poured, and allowance for this should be made if conventional bored piles are adopted.

Consideration could be given to using continuous flight auger (CFA) grout injected piles in lieu of conventional bored piles for some or all piles on the site. If CFA piles are adopted, decompression of soils overlying rock during drilling must be considered, and the advice of an experienced piling contractor should be sought in this regard.

Driven piles are unlikely to be suitable for use at this site due to vibrations associated with installation.

Note that the method(s) chosen will need to be capable of penetrating into medium and high strength sandstone. It would be advisable to contact a number of specialist piling contractors to discuss appropriate piling methods.

Further, consideration should be given to the possible presence of boulders in the fill which may present difficulties for any piling method. It may be feasible to simply dig out boulders that obstruct piles where they are close to the surface. Where boulders are encountered at greater depth, it may be necessary to use coring buckets to progress pile holes. Some provisional allowance should be made for issues encountered during piling through fill.

### 8.7.1 Design for Axial Loading

Preliminary design of shallow footings and bored (or CFA) piles supported within the Unit 4c medium to high strength sandstone may be based on the working stress parameters in Table 9 or the Limit State parameters in Table 10. For piles, all values provided assume a minimum embedment of one pile diameter into the Unit 4c sandstone and adequately cleaned and roughened sockets of category "R2" or better (Pells, Mostyn, & Walker, 1998).

**Table 9: Working Stress Parameters for Axial Loading**

Unit	Material	Allowable End Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)
4c	M-H Sandstone	3,500	300

**Table 10: Limit State Parameters for Axial Loading**

Unit	Material	Ultimate End Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)	Range of Elastic Modulus, $E_v$ (MPa)	Range of Static Shear Modulus, $G_v$ (MPa)
4c	M-H Sandstone	25,000	800	800 – 1,500	333 – 1,500

Notes:

- Ultimate parameters mobilised at large settlements (>5% of pile diameter / foundation width)

The design parameters provided are intentionally somewhat conservative owing to the observed variability, modest coverage of cored boreholes across the site, and limited depth of investigation into the Unit 4c sandstone. It is considered very likely that higher bearing pressures in the order of 6 MPa allowable end bearing could be justified for the design of piles supported in the Unit 4c sandstone with additional coverage of deeper cored boreholes across the site, which may also result in better delineation of the top of the Unit 4c material as mentioned previously.

The shaft adhesion parameters provided in Table 9 and Table 10 may be adopted for axial compression loading. For uplift or tension loading, 70% of the above shaft adhesion parameters may be adopted for design of foundations or large anchors. In addition to traditional sidewall slip / 'piston pull out' failure mechanisms, the uplift capacity should be checked for 'cone pull out' failure modes. This should be based on an assumed cone angle of 90° from pile toe considering the submerged / buoyant unit weight of the rock and resistance from the soil overburden above the rock and adopting a factor of safety of 1.1 against cone pull out. Uplift capacity for groups of piles will need to consider interaction between individual foundations, which will generally lead to a lesser capacity than the sum of the capacity of individual foundations in the group.

The design of rock-socketed foundations is usually governed by settlement criteria and performance or Serviceability Limit State (SLS) rather than the ultimate bearing capacity or Ultimate Limit State (ULS) condition. The SLS should be assessed for normal 'static' load cases using the elastic modulus values given in Table 10. These modulus values are considered appropriate for the anticipated working stress values, or strain levels expected under serviceability loading. Non-linear effects may need to be considered depending on the working loads, as the material behaviour is non-linear at high stresses.

It should be noted that the allowable pressures for a working stress approach given in Table 9 are based on a limiting settlement of about 1% of the pile diameter.

Where the ultimate bearing pressures are adopted for Limit State Design, a geotechnical strength reduction factor ( $\phi_g$ ) should be applied to the Ultimate geotechnical strength of the foundation ( $R_{d,ug}$ ), in accordance with AS2159 – 2009 (Piling – Design and Installation). The  $\phi_g$  value adopted is dependent on the level of confidence in the selected design parameters, design methods and construction/installation methods. The level of site investigation and pile load testing are key inputs in this respect. Given the relatively modest coverage of boreholes over the building footprint and the variability in rock depth and quality, a Site Individual Risk Rating (IRR) of not less than 3 is considered appropriate. This risk rating should be combined with appropriate IRR's for the design and installation of the piles to yield an overall Average Risk Rating (ARR) and basic geotechnical strength reduction factor ( $\phi_{gb}$ ). This factor may be increased dependent on the amount of pile load testing employed, to give a  $\phi_g$  value that is greater than  $\phi_{gb}$ .

Excavation of all deep foundations should be witnessed by an experienced geotechnical professional and a high level of certification in terms of base cleanliness and sidewall roughness/cleanliness from the contractor is, therefore, warranted for these foundation types. In the case of CFA piles however, geotechnical inspection of cuttings is generally not possible. For this reason, it is important that there is an increased coverage of boreholes if CFA piling is adopted.

### 8.7.2 Design for Lateral Loading

The preliminary design of individual foundations and foundation groups for lateral or moment loadings may be based on elastic analysis methods using the parameters in Table 11. The detailed design of pile groups for lateral loading will depend on the group layout and direction of loading; and will require iterative geotechnical analysis of pile group effects in coordination with the structural engineer.

**Table 11: Static Design Parameters for Lateral Loading**

Unit	Unit Weight, (kN/m <sup>3</sup> )	Range of Static Elastic Modulus E <sub>h</sub> (MPa)	Range of Static Shear Modulus, G <sub>h</sub> (MPa)	Horizontal Modulus of Subgrade Reaction for pile diameter d, in mm, k <sub>h</sub> (kPa/mm)	Lateral Limiting Pressure for k <sub>h</sub> (kPa)
Unit 1-3	20	5– 8	2 – 3	(5,000 to 8,000) / d	$\sigma_v \times K_p$ K <sub>p</sub> = 2.0
Unit 4a/4b	22	200 – 700	80 – 280	(200,000 to 700,000) / d	300
Unit 4c	24	500 – 900	210 – 375	(500,000 to 900,000) / d	2,000

Notes to:

- For soil, the modulus is valid for a typical foundation working strain (i.e., 1% to 5% strain) and within the elastic stress range; no effect of pile interaction is taken into account and larger modulus values may be appropriate for small strain circumstances.
- For the rock, modulus values only applicable over linear elastic range with maximum strain of 1% and should only be used when there is no interaction between piles
- The modulus of subgrade reaction values shown are intended for single pile with no pile group effects, for which more sophisticated assessment will need to be carried out using pile group analysis methods.
- The lateral limiting pressures should always be used together with the elastic modulus of subgrade reaction. The limiting pressures define the points after which the reaction pressure is no longer increasing linearly with lateral deflections.

The lateral capacity based on the provided lateral limiting pressures can be approximated assuming that a laterally loaded foundation pile engages an area up to a maximum of three pile diameters wide, or less if in close proximity to other piles.

## 8.8 Groundwater

Observed groundwater levels range between RL 7.2 m and 8.4 m AHD, although it is noted that no long-term monitoring has been undertaken and significant rises in the groundwater level may occur in response to heavy rainfall or seasonal variations.

It is expected that bulk excavations will not intercept the perennial groundwater table, although it is expected that seepage will occur along the top of rock, and through joints and along bedding planes within rock exposed in the subfloor area floor and walls. During relatively dry periods the seepage may be minimal and this may increase temporarily following periods of rainfall.

It is noted that the internal building areas at the Loading Bay Lower Floor level (RL 10.6 m) are very close to the existing surface levels in a locally 'low' area in proximity to Orphan School Creek, which will receive significant groundwater recharge from the surrounding catchment. In periods of heavy rainfall, groundwater levels in the backfilled creek may rise by several metres compared to observations during the investigation and encroach on the proposed Loading Bay Lower Floor Level. Given that RL 10.6 m is only marginally below existing ground levels at the west of the site, this is considered to be a flood design issue more so than a groundwater issue, and the structural, civil and drainage designers should consider the potential for 'groundwater' to rise above the surface to relevant design flood levels during severe rainfall events.

During construction and in the long term, it is anticipated that seepage could be controlled by perimeter and subfloor drainage connected to a sump-and-pump system. On this basis, a drained excavation may be considered for this site, however, this will be subject to approval by Council and relevant authorities. Generally, water collected from dewatering operations should be suitable for disposal by pumping to stormwater drains subject to confirmation testing of groundwater quality and approval from the Council. It is possible that seepage into the excavation may give rise to precipitation of red brown iron oxide residue from the oxidation of soluble iron likely to be present within the groundwater and therefore perimeter and subfloor drains should be designed for easy access to allow for inspection, maintenance and periodic cleaning.

## 8.9 Acid Sulfate Soils

The current ASS screening and laboratory testing regime and assessment process was developed in general accordance with the procedures outlined in (Sullivan, et al., 2018).

Twenty-one (21) samples of soil collected from three boreholes (BH101 to BH103) were tested / screened in an external laboratory for preliminary signs of actual acid sulfate soils (AASS) and potential acid sulfate soils (PASS). The screening involves measurement of the pH value of each soil sample after the addition of distilled water ( $pH_F$ ). Hydrogen peroxide is then added to oxidise the sample, and the pH value ( $pH_{FOX}$ ) is measured again after at least one hour. The results for the pH screening, previously presented in Table 5 in Section 6, are assessed for the possible presence of AASS or PASS and the need for 'further assessment', based on the following guidance indicators:

- $pH_F \leq 4$  strongly indicates oxidation has occurred in the past and that AASS are likely to be present;
- $pH_{FOX} < 3$  **and** preferably one or more of the following strongly indicates the presence of PASS:
  - o A  $pH_{FOX}$  reading at least one pH unit below the corresponding  $pH_F$ ; or
  - o A strong reaction with peroxide; or
  - o Change in soil colour from grey tones to brown tones; or
  - o A release of sulphurous gases.

Based on the above, the following is noted:

- All  $pH_F$  values were well above pH 4, indicating that AASS are unlikely to be present on the site;
- Three  $pH_{FOX}$  values are less than or equal to 3, with the difference between  $pH_F$  and  $pH_{FOX}$  being greater than 1 pH units in all such cases;
- Five other samples exhibited a 'high' or 'extreme' reaction with Hydrogen peroxide.

The results of the screening tests and assessment are summarised in Table 12.

**Table 12: Summary of Acid Sulfate Soil Screening Assessment Results**

Borehole	Depth (m)	pH (pH units)	pHfox (pH units)	Change in pH	Reaction
BH01	0.5-0.6	7.9	5.4	2.5	Medium
BH01	0.9-1.0	5.9	4.5	1.4	Medium
BH01	1.5-1.6	6.2	4.2	2	Medium
BH01	2.0-2.1	7.8	6.1	1.7	Medium
BH01	2.5-2.6	7.6	5.9	1.7	Medium
BH01	3.0-3.1	7.6	5.6	2	High
BH01	3.5-3.6	7.7	5.7	3.7	High
BH01	3.9-4.0	6.9	3.2	2	Extreme
BH01	4.5-4.6	7.7	4.2	3.5	Extreme
BH01	5.0-5.1	7.1	2.6	4.5	Medium
BH01	6.0-6.1	7.6	4	3.6	Medium
BH02	0.5-0.6	8.1	5.3	2.8	Medium
BH02	0.9-1.0	8.8	6.5	2.3	Medium
BH02	1.5-1.6	8.4	6.2	2.2	Medium
BH02	2.0-2.1	8.4	5.7	3	Medium
BH02	2.4-2.5	8.4	5.4	2.7	Medium
BH02	3.0-3.1	7.7	3.2	5	Extreme
BH02	3.5-3.6	7	2	5.4	Medium
BH02	3.9-4.0	7.8	2.4	4.5	Medium
BH03	0.5-0.6	7.9	5.5	2.4	Medium
BH03	0.9-1.0	7.4	5	2.4	Medium
<b>Action Criteria For Further Assessment</b>		<b>≤ 4</b>	<b>≤ 3.5</b>	<b>&gt; 1</b>	-

Note: 2.7 = red font: exceeds action criteria

■ = yellow highlight: samples selected for further testing

Eight samples providing a positive indicator of PASS were tested for a SPOCAS Suite and  $S_{cr}$ . The results of the testing, previously summarised in Table 6 in Section 6, were compared against the action criteria outlined in (Sullivan, et al., 2018) for a disturbed volume of 1 to 1000 tonnes (given the relatively minor bulk excavation is proposed). The results of the additional testing and the assessment are summarised in Table 13.

**Table 13: Summary of Additional Acid Sulfate Soil Assessment Results**

Borehole ID	Depth (m)	Material Description	S <sub>cr</sub> (%w/w S)	SPOCAS Net Acidity (%w/w S)
BH01	3.0-3.1	Light to Medium Clay	0.008	< 0.01
BH01	3.5-3.6	Sandy Clay	0.01	< 0.01
BH01	3.9-4.0	Sandy Clay	0.02	0.03
BH01	4.5-4.6	Sandy Clay	0.06	< 0.01
BH01	5.0-5.1	Clayey Sand	0.03	< 0.01
BH02	3.0-3.1	Sandy Clay	0.04	0.05
BH02	3.5-3.6	Sandy Clay	0.12	0.15
BH02	3.9-4.0	Sandy Clay	0.1	< 0.01
<b>Action Criteria (1 to 1000 tonnes disturbed)</b>	<b>Sands to loamy sands</b>		<b>0.03</b>	<b>0.03</b>
	<b>Clayey sand to light clays</b>		<b>0.06</b>	<b>0.06</b>
	<b>Light, medium to heavy clays</b>		<b>0.1</b>	<b>0.1</b>

Note: 2.7 = red font: exceeds action criteria

The results of the laboratory testing undertaken to assess the presence of acid sulphate soils indicate that potential acid sulphate soils (PASS) are present on the site, within the alluvial sediments below the water table in proximity to the buried creek, at depths ranging from approximately 3 m to 5 m below ground level (approximately RL 5.5 m to 7.5 m AHD), which will be encountered during piling. Given the variability of the sediments across the site, all soils below the water table should be treated as PASS.

Soils excavated from above the water table should be stockpiled separately where practical to allow further testing to be completed upon excavation to confirm the presence or absence of ASS/PASS. Separation of materials during piling activities may not be practical and where soils above and below the water table are mixed the spoil should all be treated as PASS.

As a result of the confirmed presence of PASS, an acid sulphate soils management plan (ASSMP) will be required prior to the commencement of excavation and piling works. The management of the excavated spoil would include (but not be limited to) the following:

- Adopting suitable construction measures to limit the amount of spoil produced on site as best as is practicable;
- Placement of excavated materials into appropriately isolated stockpile areas, in accordance with the recommendations of the NSW Acid Sulphate Soil Manual. Soils above the water table should be stockpiled separately to soils excavated from below the water table (where practical);
- Soils excavated from below the water table (or mixed soils from pile returns) should be considered to be PASS and treated with lime to neutralise the acidity;

- Soils excavated from above the water table should be inspected and re-tested to determine if treatment (with lime) is required prior to disposal;
- Any water seepage from stockpiled materials is likely to require separate treatment, and should be isolated (via bunding etc);
- Keeping the excavated spoil lightly wetted at all times to limit potential oxidation and formation of acidic leachate; and
- Any dewatering activities for excavations should be limited and where required should consider the effects of local lowering of the water table on the surrounding PASS.

Once neutralised, the ASS must be re-tested to confirm that the soil has been neutralised and re-classified in accordance with the requirements of the Department of Environment, Climate Change and Water (2009) for off-site disposal. However, the receiving site must be informed that the soil was ASS and has been appropriately treated.

The above comments should be considered preliminary only, and an Acid Sulphate Soil Management Plan (ASSMP) will be required for this site. The ASSMP will need to detail how the ASS is to be managed, treated, and disposed of or re-used on site. The results of the laboratory testing, presented in Appendix D, could be used to aid in the preparation of the ASSMP.

#### 8.10 **Salinity**

Saline soils are not typically present in areas underlain by Hawkesbury Sandstone or Ashfield Shale, which are characterised by lower salt content and topography that facilitates drainage, resulting in a reduced accumulation of salts.

It is expected that the proposed development will not meaningfully alter the topography and surface or subsurface flow regimes on and around the site. Further, the results of the laboratory testing indicate that the tested soils are slightly saline and non-saline.

On the basis of the above, it is considered that soil salinity is unlikely to be an issue for this development, and no further assessment or special management of salinity is required for the proposed development.

#### 8.11 **Aggressivity**

In accordance with AS2159-2009, the results of the chemical laboratory testing indicate that the tested soils vary from 'mildly' aggressive to 'non-aggressive' to buried concrete and are 'non-aggressive' to buried steel. It would be prudent to adopt an aggressivity exposure classification of at least 'mild' for all structural elements in contact with the ground.

It should be noted that these results are not indicative of the aggressivity that may occur due to oxidation of potential acid sulphate soils and it will be important to minimise the disturbance and oxidation of PASS that will be in permanent contact with pile shafts, during construction of piles.

#### 8.12 **Earthquake Design**

In accordance with the earthquake loading standard, AS1170.4-2024, the site has a hazard factor (Z) of 0.08 and a site sub-soil class of shallow soil ( $C_e$ ).

It is noted that it may be possible to rationalise a site sub-soil class of B<sub>e</sub> (rock) based on the methods permitted in the Standard if additional in-situ testing is completed to directly measure the seismic shear wave velocity of materials in the backfilled creek, to inform an assessment of the low amplitude natural site period at the deepest part of the site.

### 8.13 Pavements

On-grade pavements may be considered across parts of the site where all uncontrolled fill and soft/loose natural soil can be stripped and replaced. In areas where this is not practical, on-grade pavements should only be considered if some settlements are acceptable. It is not possible to accurately predict settlements based on the currently available information as this requires detailed history of site filling, previous slab/structural loads, and targeted geotechnical investigation (particularly of soft compressible clays) and analysis. If slab on ground is to be considered over the backfilled creek area, then further detailed geotechnical review and analysis would be required.

If settlements cannot be tolerated, then new pavements will need to be supported by suspended slabs supported on piles founded on bedrock.

If some settlements are acceptable, preliminary flexible pavement design could be based on a preliminary design subgrade California Bearing Ratio (CBR) of 3%, which must be confirmed subject to earthworks and the final condition of the soils within the upper 1 m of the design subgrade level. To maintain this design value, or any other amended / alternate design value, it will be necessary to prepare the subgrade soils into a well-compacted condition, free of significant adverse long-term or differential settlements under service loading. The pavement designer should consider the following:

- Undertaking CBR tests on the prepared surface after earthworks completion to confirm the ongoing validity of the preliminary design CBR value;
- The loads applied to the various pavements over their design life, including normal road vehicle pavements, commercial in-service truck loads and possibly construction machinery loads;
- The magnitude and frequency of load repetitions of the various vehicles using each pavement;
- The need to provide edge constraints to the pavement, particularly along the crest of batters, immediately behind retaining walls and along the edge of landscaped areas;
- The position and grading of subsurface drainage lines, particularly with reference to pavement edges and internal landscaped openings;
- Pavement surface gradients and water flow to drainage lines. One-way cross fall pavements may be beneficial, otherwise regularly spaced and centralised drainage collection pits should be installed;
- The backfilling and compaction of service trenches, particularly below heavily loaded pavements; and
- The ability of any filled subgrade to carry the load of the pavement.

Surface and subsoil drainage should be incorporated into the pavement and floor slab designs to prevent the ingress of moisture into the pavement and sub-floor working platform layers and any

subsequent weakening of the pavement and subgrade layers. Given the potential for long term settlement of on-grade pavements, due to consolidation of the underlying materials in the backfilled creek area, it will be important to incorporate exaggerated cross falls and pipe grades with flexible connections and suitable construction joints. This measure should reduce the potential for future surface ponding of water or flow problems with pipes.

In addition, a regular and long-term inspection and maintenance programme should be adopted by the operator of the pavement. The maintenance program should be primarily aimed at limiting the amount of moisture infiltrating to the subgrade (e.g. inspecting drainage lines and repairing as required, maintaining construction joints and sealing or repairing cracks as they develop). It is noted that flexible pavements are typically more readily maintained or repaired, compared to rigid concrete pavements. This should be taken into consideration if on-grade pavements are adopted over filled areas (where some settlements would be expected).

## 9. References

Pells, P. J., Mostyn, G., & Walker, B. F. (1998). Foundations on Sandstone and Shale in the Sydney Region. *Australian Geomechanics, No 33 Part 3*, 17-29.

Sullivan, L., Ward, N., Toppler, N., & Lancaster, G. (2018). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual*. Canberra ACT CC BY 4.0: Department of Agriculture and Water Resources.

## 10. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 2-32 Junction Street, Forest Lodge NSW in line with Douglas' proposal dated 31/05/2024 and acceptance received from Chris West of Corio Projects Pty Ltd. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Corio Projects 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 and previous investigations. 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.

The scope of work for this report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials. Reference should be made to Douglas' contamination investigation report for the site in this regard (reference: 229796.01.R.001.Rev0).

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).

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## **Appendix A**

About this Report

Terminology, Symbols and Abbreviations

Soil Descriptions

Rock Descriptions

Sampling, Testing and Excavation Methodology

## Introduction

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

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

## Copyright

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

## Borehole and Test Pit Logs

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

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

## Groundwater

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

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

the time of construction as are indicated in the report; and

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

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

## Reports

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

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

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

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

continued next page

## About this Report

### Site Anomalies

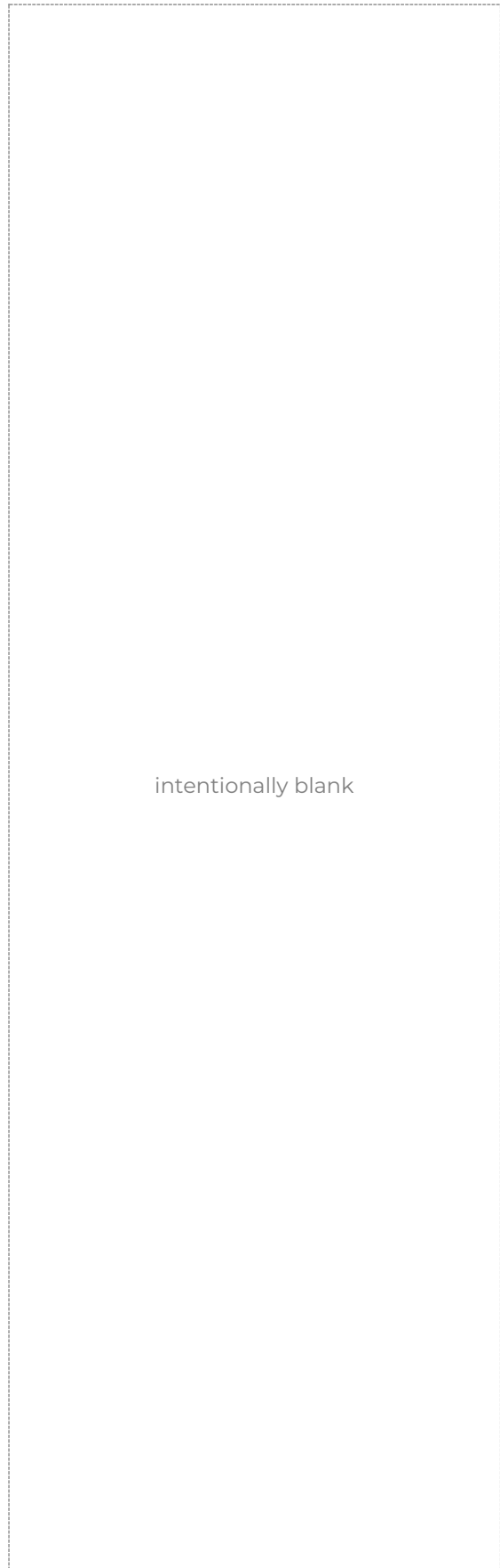
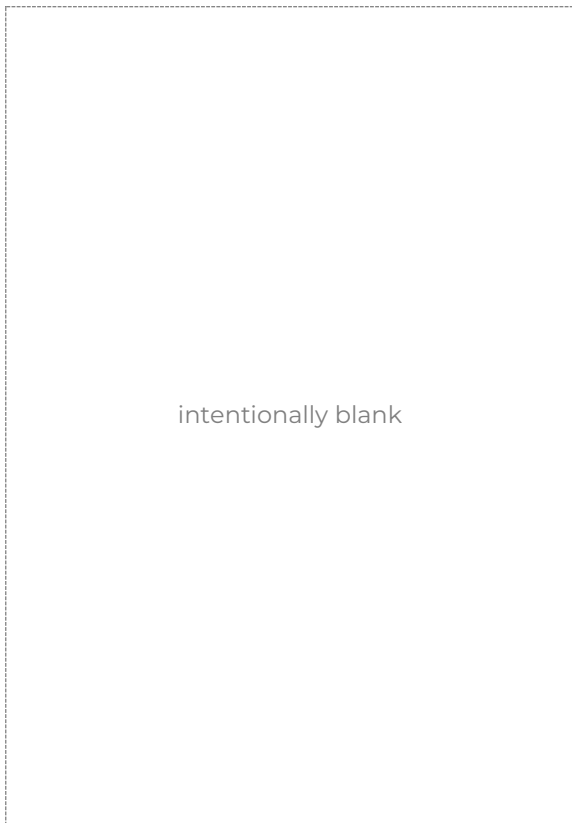
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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

### Information for Contractual Purposes

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

### Site Inspection

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





## 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)).

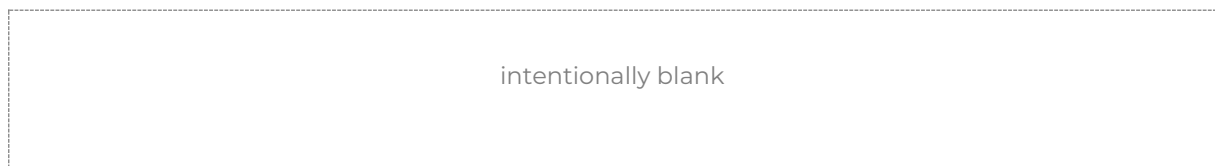
### Data Integrity Codes

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

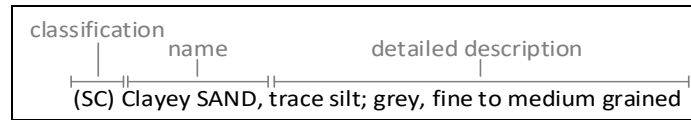
Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has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





## 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 <sup>1</sup>	2.36 - 63	Coarse	>65%
Sand <sup>1</sup>	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

<sup>1</sup> – 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 <sup>1</sup>	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 <sup>2</sup>	Present in the soil, but not significant to its engineering properties	All other components	All other components

<sup>1</sup> As defined in AS1726-2017 6.1.4.4

<sup>2</sup> In the detailed material description, minor components are split into two further sub-categories. Refer “identification of minor components” below.

### Composite Materials

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

## Classification

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

## Soil Name

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

Component <sup>1</sup>	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

<sup>1</sup> – for determination of component proportions, refer component proportions on previous page

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

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

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

## Identification of minor components

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

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

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

## Soil Composition

### Plasticity

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

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

### Grain Size

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

### Grading

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

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

## Soil Condition

### Moisture

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

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

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

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

### Consistency/Density/Compaction/Cementation/Extremely Weathered Material

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

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

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

#### Consistency (fine grained soils)

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

#### Relative Density (coarse grained soils)

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

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

## 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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## Rock Strength

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

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

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

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

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

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

## Degree of Weathering

The degree of weathering of rock is classified as follows:

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

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

## Degree of Alteration

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

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

## Degree of Fracturing

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

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

## Rock Quality Designation

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

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

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

## Stratification Spacing

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

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

## Defect Descriptions

### Defect Type

Term	Abbreviation Code
Bedding plane	B
Cleavage	CL
Crushed seam	CS
Crushed zone	CZ
Drilling break	DB
Decomposed seam	DS
Drill lift	DL
Extremely Weathered seam	EW
Fault	F
Fracture	FC
Fragmented	FG
Handling break	HB
Infilled seam	IS
Joint	JT
Lamination	LAM
Shear seam	SS
Shear zone	SZ
Vein	VN
Mechanical break	MB
Parting	P
Sheared Surface	S

### Rock Defect Orientation

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

### Rock Defect Coating

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

### Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLAY
Iron oxide	FE
Manganese	MN
Pyrite	Py
Secondary material	MS
Silt	M
Quartz	Qz
Unidentified material	MU

### Rock Defect Shape/Planarity

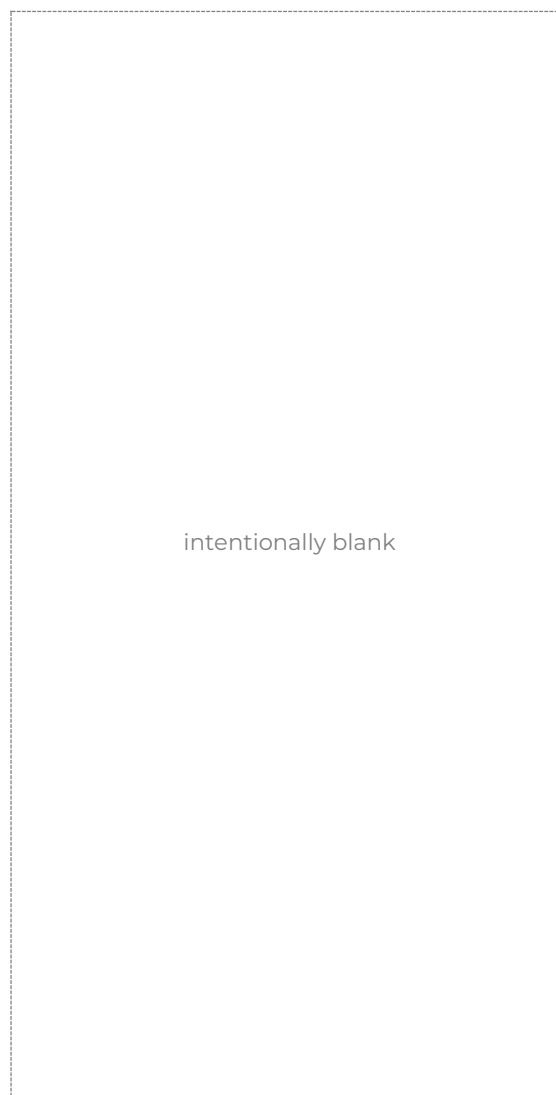
Term	Abbreviation Code
Curved	CU
Discontinuous	DIS
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

### Rock Defect Roughness

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

### Defect Orientation

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





## Sampling and Testing

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

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

### Sampling

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

Sample Type	Code
Auger sample	A
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 <sup>1</sup>
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

<sup>1</sup> – numeric suffixes indicate tube diameter/width in mm

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

### Field and Laboratory Testing

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

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

Field and laboratory testing (continued)

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

### Groundwater Observations

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

### Drilling or Excavation Methods/Tools

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

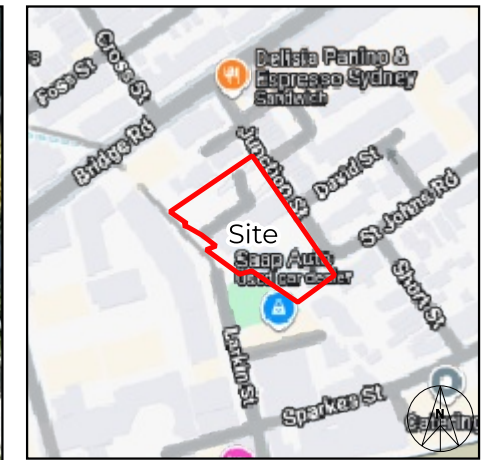
Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD <sup>1</sup>
Air Track	AT
Diatube	DT <sup>1</sup>
Hand auger	HA <sup>1</sup>
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA <sup>1</sup>
HQ coring	HQ3
HMLC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

<sup>1</sup> – numeric suffixes indicate tool diameter/width in mm

---








## **Appendix B**

Drawings



SITE LOCATION

LEGEND

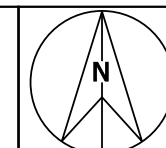
-  Cross-Section
-  Current Geotechnical Boreholes
-  Current Contamination Boreholes
-  Historical Cored Boreholes (1999)
-  Historical Auger Boreholes (1998)
-  Site Boundary
-  Proposed Lower Floor Loading Bay Excavation Extent

NOTE:  
 1. Drawing projection in GDA2020 / MGA zone 56, adapted from aerial imagery from Metromap  
 2. Test locations are approximate only and were located using differential GPS typically accurate to ± 0.1 m depending on satellite coverage

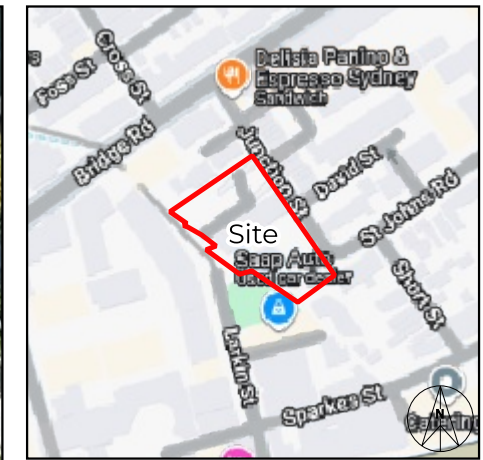


CLIENT: Corio Projects Pty Ltd	
OFFICE: Sydney	DRAWN BY: RMM
SCALE: 1:500 @A3	DATE: 20.May.2025

TITLE: **Test Location Plan**  
**Proposed Seniors Housing**  
**2-32 Junction Street, Forest Lodge, NSW**



PROJECT:	229796.00
DRAWING No:	1
REVISION:	1



SITE LOCATION

LEGEND

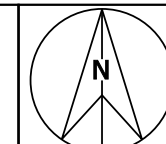
- Cross-Section
- Current Geotechnical Boreholes
- Current Contamination Boreholes
- Historical Cored Boreholes (1999)
- Historical Auger Boreholes (1998)
- Site Boundary
- Top of Unit 4a/4b (Variable Sandstone) - m AHD
- Proposed Lower Floor Loading Bay Excavation Extent

NOTE:  
 1. Drawing projection in GDA2020 / MGA zone 56, adapted from aerial imagery from Metromap  
 2. Test locations are approximate only and were located using differential GPS typically accurate to  $\pm 0.1$  m depending on satellite coverage  
 3. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations.

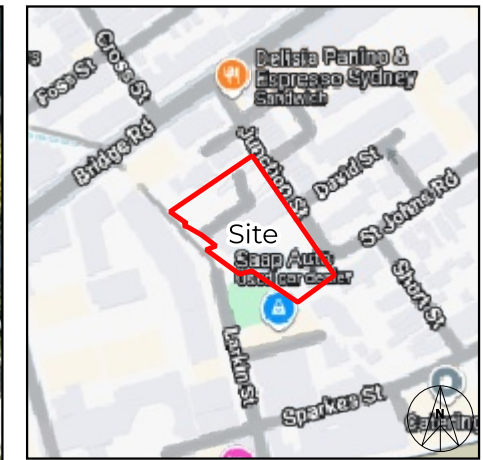


CLIENT: Corio Projects Pty Ltd  
 OFFICE: Sydney      DRAWN BY: RMM  
 SCALE: 1:500 @A3      DATE: 20.May.2025

TITLE: **Top of Rock - Unit 4a/4b (Variable Sandstone) Contour**  
**Proposed Seniors Housing**  
**2-32 Junction Street, Forest Lodge, NSW**



PROJECT: 229796.00  
 DRAWING No: 2  
 REVISION: 1



SITE LOCATION

LEGEND

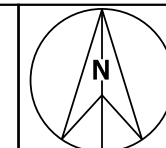
- Cross-Section
- Current Geotechnical Boreholes
- Current Contamination Boreholes
- Historical Cored Boreholes (1999)
- Historical Auger Boreholes (1998)
- Site Boundary
- Top of Unit 4c (M-H Sandstone) - m AHD
- Proposed Lower Floor Loading Bay Excavation Extent

NOTE:  
 1. Drawing projection in GDA2020 / MGA zone 56, adapted from aerial imagery from Metromap  
 2. Test locations are approximate only and were located using differential GPS typically accurate to  $\pm 0.1$  m depending on satellite coverage  
 3. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations.

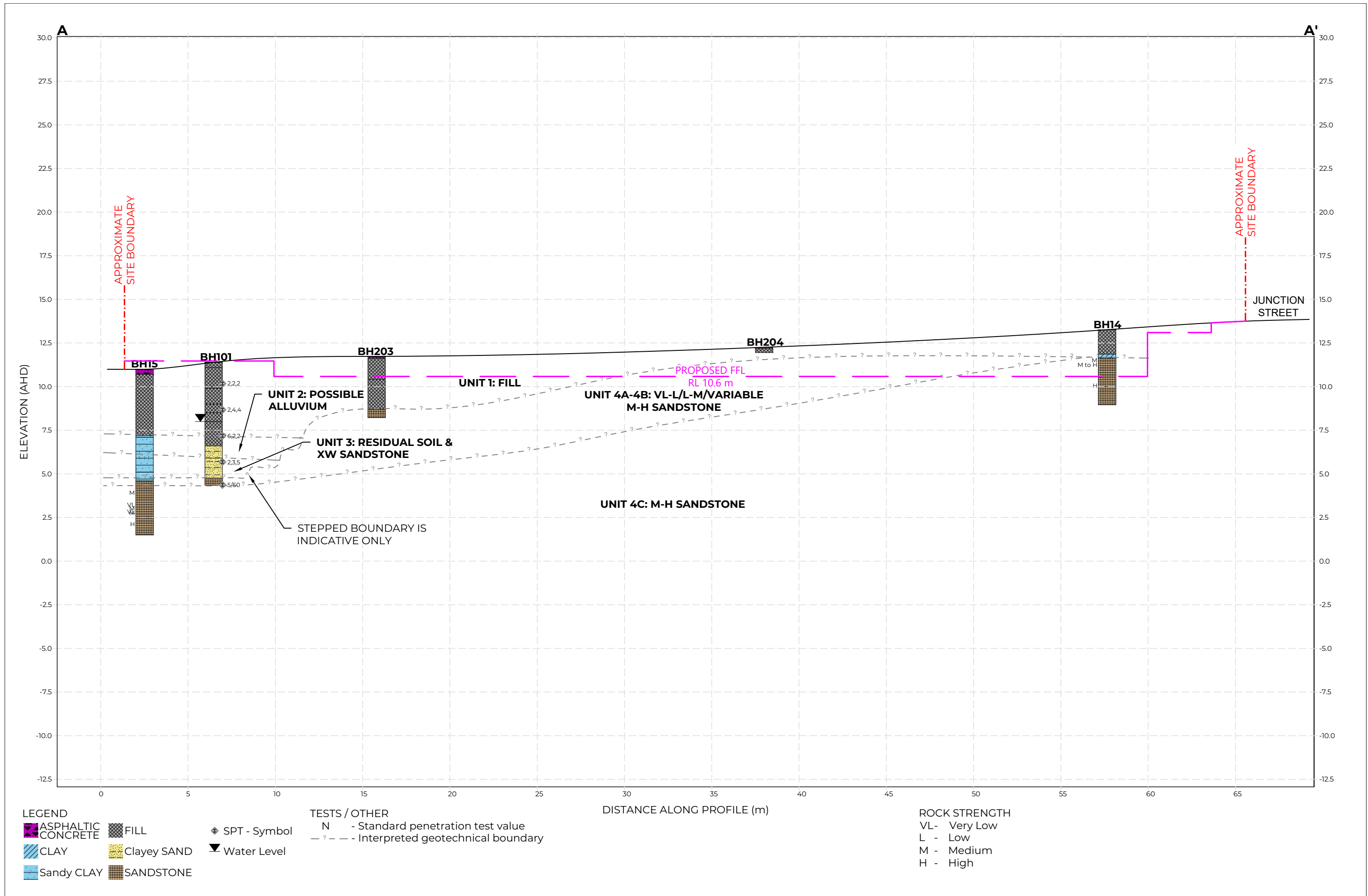


CLIENT: Corio Projects Pty Ltd  
 OFFICE: Sydney      DRAWN BY: RMM  
 SCALE: 1:500 @A3      DATE: 20.May.2025

TITLE: **Top of Unit 4c (Medium to High Strength Sandstone) Contour**  
**Proposed Seniors Housing**  
**2-32 Junction Street, Forest Lodge, NSW**



PROJECT: 229796.00  
 DRAWING No: 3  
 REVISION: 1



**LEGEND**


**TESTS / OTHER**

	N - Standard penetration test value
	- ? - - Interpreted geotechnical boundary

STEPPED BOUNDARY IS INDICATIVE ONLY

DISTANCE ALONG PROFILE (m)

**ROCK STRENGTH**

VL - Very Low
L - Low
M - Medium
H - High

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	24.09.2024	EC
1	UPDATED BEL	21.05.2025	EC

SCALE: 0 1 2 3 4 6 8 10  
1:200 @ A3  
Vertical Exaggeration = 1.0

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

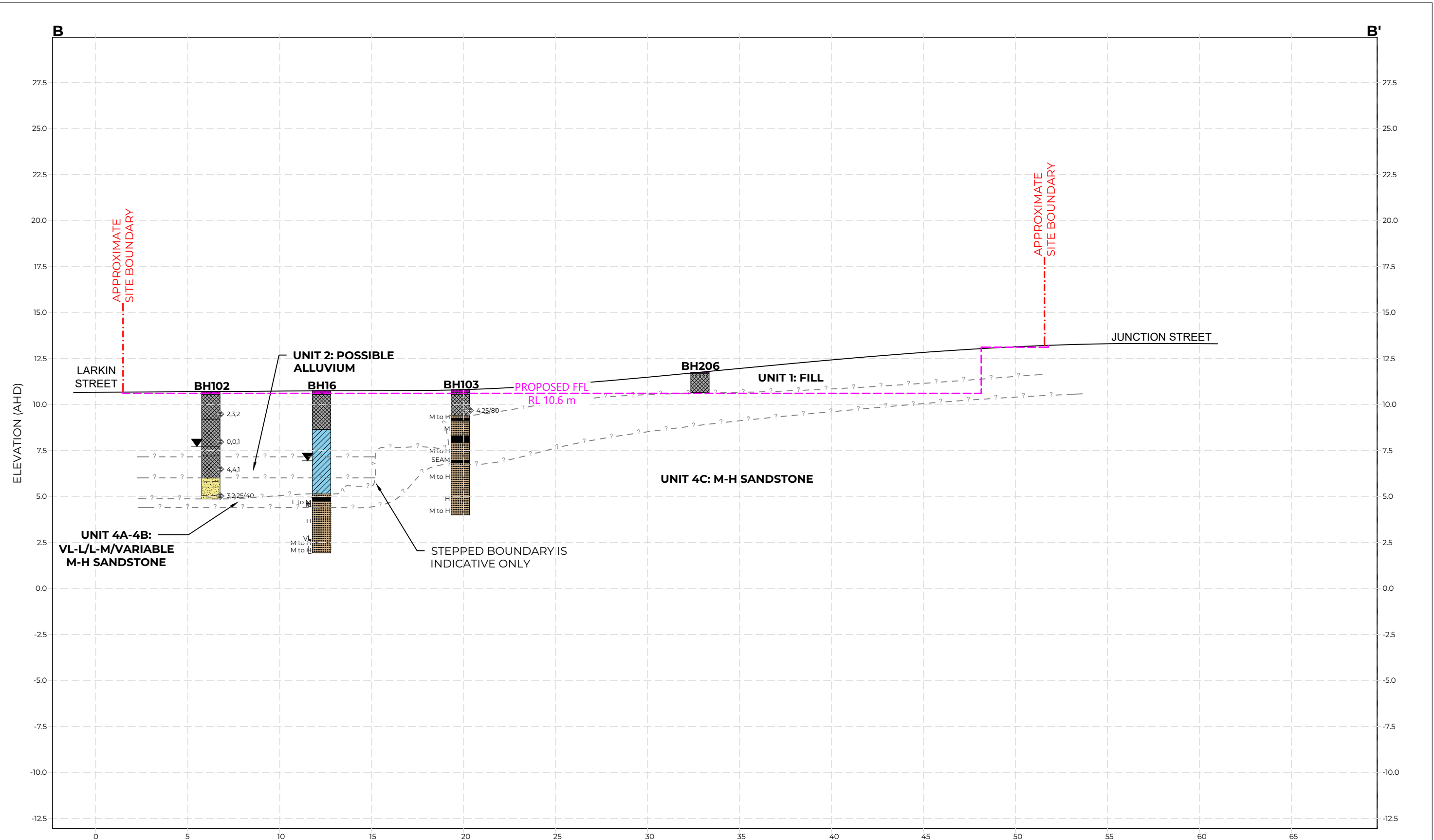
CLIENT:  
**Corio Projects Pty Ltd**

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

PROJECT NAME:  
**Proposed Seniors Housing**  
PROJECT ADDRESS:  
**2-32 Junction Street,  
Forest Lodge**

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

PROJECT No:	<b>229796.00</b>
DRAWING No:	<b>4</b>
REVISION:	<b>1</b>



LEGEND	
	ASPHALTIC CONCRETE
	CLAY
	CONCRETE
	NO CORE
	FILL
	Clayey SAND
	SANDSTONE
	Water Level
	SPT - Symbol

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

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

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	24.09.2024	EC
1	UPDATED BEL	21.05.2025	EC

SCALE: 0 1 2 3 4 6 8 10  
1:200 @ A3  
Vertical Exaggeration = 1.0

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

CLIENT:  
**Corio Projects Pty Ltd**

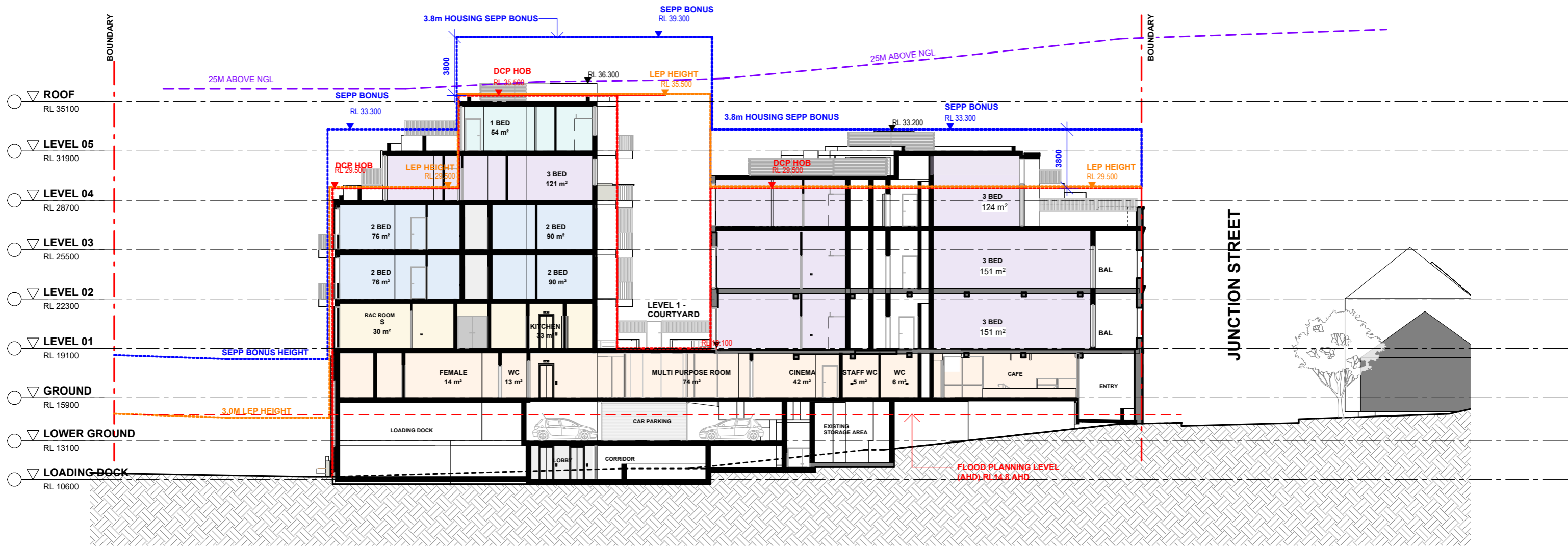
NOTES  
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.  
2. Summary logs only and should be read in conjunction with detailed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

PROJECT NAME:  
**Proposed Seniors Housing**  
PROJECT ADDRESS:  
**2-32 Junction Street,  
Forest Lodge**

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

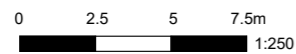
PROJECT No:	<b>229796.00</b>
DRAWING No:	<b>5</b>
REVISION:	<b>1</b>





SECTION 02 - LOADING DOCK

SCALE 1 : 250



Dimensioned drawings to take precedence over scaling. Contractor to verify all dimensions on site before construction. All inconsistencies to be reported to the Architect immediately. This drawing and its contents remain the copyright of WMK Architecture Pty Ltd © Nominated Architect Greg Barnett (NSW ARB. 6092)

Issue	Description	Date
1	Development Application	19.06.2025

Client  
CORIO PROJECTS

Project  
Seniors Living Development  
2-32 Junction Street, Forest Lodge NSW

Title  
SECTION 02 - LOADING DOCK

Drawing No.  
DA301  
Scale  
1 : 250  
Project No.  
23110

Issue  
1  
Drawing Size  
A3  
Drawn By  
JT

DEVELOPMENT APPLICATION ONLY  
NOT FOR CONSTRUCTION

CAD Reference  
19/06/2025 4:22:27 PM

---

## **Appendix C**

Field Work Results

# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.4 AHD  
**COORDINATE:** E:331730.0, N:6249203.0  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH101  
**PROJECT No:** 229796.00  
**DATE:** 30/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS						
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL
	0.02		ASPHALTIC CONCRETE	[Pattern]	FILL	(L)		D to M		ES	0.15					
	0.30		FILL / Silty Gravelly SAND: dark grey; fine to medium; fine, igneous gravel.	[Pattern]	FILL	(S) to (F)		w=PL		ES	0.50					
	1		FILL / Silty CLAY, with gravel, trace rootlets: pale grey mottled red and orange; medium plasticity; fine to coarse, igneous, slag, ceramic gravel.	[Pattern]	FILL	(S) to (F)		w=PL		ES	0.60					
	1.50		FILL / Clayey Gravelly SAND: dark grey; fine to coarse; fine to coarse, slag, ironstone gravel.	[Pattern]	FILL	(L)		D to M		SPT	0.90 - 1.00	SPT	2,2,2			
	2		FILL / Silty Gravelly SAND: dark grey; fine to coarse; fine to coarse, slag, ironstone gravel.	[Pattern]	FILL	(L)		D to M		ES	1.45					
	2.40		FILL / Sandy Gravelly CLAY: dark grey; medium plasticity; fine to medium sand; fine to coarse, slag, ironstone, sandstone gravel.	[Pattern]	FILL	(F)		w=PL		ES	1.60					
	2.90		FILL / Silty Sandy CLAY, trace glass, ceramic, trace gravel: dark grey-brown; medium plasticity; fine to medium sand; fine to medium, sandstone gravel.	[Pattern]	FILL	(F)		w=PL		SPT	2.00 - 2.10	SPT	2,4,4			
	3.40		FILL / Sandy CLAY, trace gravel: dark brown; high plasticity; fine to medium sand; fine to medium, ironstone gravel.	[Pattern]	possibly FILL / possibly ALV	(S) to (F)		w>PL		ES	2.50 - 2.60					
	4		FILL / Silty CLAY, trace gravel: dark brown; high plasticity; fine to medium sand; fine to medium, ironstone gravel.	[Pattern]	possibly FILL / possibly ALV	(S) to (F)		w>PL		SPT	2.95 - 3.10	SPT	2,4,4			
	4.80		Clayey SAND (SC): grey-brown; fine to medium; medium plasticity clay.	[Pattern]	possibly ALV	(S) to (F)		w>PL		ES	3.50 - 3.60					
	5		Clayey SAND (SC): red and orange-brown; fine to medium; medium plasticity clay.	[Pattern]	possibly ALV	(S) to (F)		w>PL		ES	3.90 - 4.00					
	5.50		Clayey SAND (SC): red and orange-brown; fine to medium; medium plasticity clay.	[Pattern]	RS	L		W		SPT	4.45 - 4.60	SPT	6,2,2			
	6		SANDSTONE: pale yellow, fine to medium grained; apparently low strength. Hawkesbury Sandstone	[Pattern]				D		ES	5.00 - 5.10					
	6.65		SANDSTONE: pale yellow, fine to medium grained; apparently low strength. Hawkesbury Sandstone	[Pattern]				D		SPT	5.40 - 5.50	SPT	2,3,5			
	7		Borehole discontinued at 7.05m depth.	[Pattern]						ES	5.95 - 6.10					
	7.05		Borehole discontinued at 7.05m depth.	[Pattern]						ES	6.50 - 6.60					
	7		Borehole discontinued at 7.05m depth.	[Pattern]						SPT	6.90 - 7.00	SPT	5/50 (HB)			

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:** Comacchio GEO305  
**METHOD:** AD/T to 7.05m  
**REMARKS:**

**OPERATOR:** Ground Test (LC)

**LOGGED:** L.Lau  
**CASING:** Uncased



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 10.7 AHD  
**COORDINATE:** E:331756.0, N:6249177.0  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH102  
**PROJECT No:** 229796.00  
**DATE:** 30/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS						
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. <sup>(1)</sup> DENSITY, <sup>(2)</sup>	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	0.15	CONCRETE: pale grey; mixed angular aggregate, up to 30mm, 5mm diameter steel reinforcement observed.	[Concrete Symbol]		NA	NA										
	1.0	FILL / CLAY, with gravel: brown mottled pale grey and red; high plasticity; fine to medium, igneous gravel.	[Fill Symbol]	FILL	(F)					ES	0.50 0.60					
	1.5	FILL / Silty CLAY, with gravel: dark brown; medium plasticity; fine to medium, sandstone gravel.	[Fill Symbol]	FILL	(VS)		w=PL			ES	0.90 1.00		SPT	2,3,2		
	2.0		[Fill Symbol]	FILL	(VS)		w=PL			ES	1.45 1.60					
	2.5		[Fill Symbol]	FILL	(VS)		w=PL			ES	2.00 2.10					
	3.0	FILL / Sandy CLAY, with gravel: dark brown-grey; medium plasticity; fine to medium sand; fine to coarse, slag, ceramic, glass gravel.	[Fill Symbol]	FILL	(F)		w>PL			ES	2.40 2.50		SPT	0,0,1		
	3.5		[Fill Symbol]	FILL	(F)		w>PL			ES	2.95 3.10					
	4.0	3.70m: Sandstone boulder 3.80m-4.70m: With tree roots/rootlets	[Sandstone Symbol]	FILL possibly ALV	(F)		w>PL			ES	3.50 3.60					
	4.5		[Sandstone Symbol]	FILL possibly ALV	(F)		w>PL			ES	3.90 4.00		SPT	4,4,1		
	4.70	Clayey SAND: red; fine to medium; medium plasticity clay; with low and low strength sandstone bands; extremely weathered; Hawkesbury Sandstone.	[Sandstone Symbol]	XWM	(L)		D			ES	4.45 4.60					
	5.0		[Sandstone Symbol]	XWM	(L)		D			ES	5.00 5.10					
	5.80	5.80m: low strength sandstone	[Sandstone Symbol]	XWM	(L)		D			SPT	5.50		SPT	3,2,25/40		
	6.0	Borehole discontinued at 5.84m depth.														

NOTES: <sup>(1)</sup>Soil origin is "probable" unless otherwise stated. <sup>(2)</sup>Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Comacchio GEO305  
**METHOD:** AD/T to 5.84m  
**REMARKS:**

**OPERATOR:** Ground Test (LC)

**LOGGED:** L.Lau  
**CASING:** Uncased

Generated with CORE-GS by Geroc - Soil Log

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 10.8 AHD  
**COORDINATE:** E:331765.0, N:6249188.0  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH103  
**PROJECT No:** 229796.00  
**DATE:** 30/08/24  
**SHEET:** 1 of 2

GROUNDWATER		CONDITIONS ENCOUNTERED				SAMPLE			TESTING AND REMARKS							
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL
	0.14		CONCRETE: pale grey; mixed angular aggregate, up to 20mm, 5mm diameter steel reinforcement observed.	[Concrete Symbol]		NA	NA	NA								
	0.25		FILL / Cobby SAND: pale brown; fine to medium; 100mm sandstone cobbles.	[Cobby Sand Symbol]	FILL	(L)					ES	0.50 - 0.60				
	1.0		FILL / Sandy Gravelly CLAY: dark brown; medium plasticity; fine to medium sand; fine to medium, igneous and sandstone gravel.	[Sandy Gravelly Clay Symbol]	FILL	(S)		w=PL			ES	0.90 - 1.00				
	1.40		Continued as rock								SPT	1.23	SPT	4,25/80 (HB)		
	2.0															
	3.0															
	4.0															
	5.0															
	6.0															
	7.0															
	8.0															
	9.0															

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:** Comacchio GEO305 **OPERATOR:** Ground Test (LC) **LOGGED:** L.Lau  
**METHOD:** AD/T to 1.4m, then NMLC to 6.8m **CASING:** HWT to 1.4m  
**REMARKS:** Core barrel dropped under own weight without rotation from 2.51m to 2.88m

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 10.8 AHD  
**COORDINATE:** E:331765.0, N:6249188.0  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH103  
**PROJECT No:** 229796.00  
**DATE:** 30/08/24  
**SHEET:** 2 of 2

GROUNDWATER	CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
30/08/24 NFCWO whilst augering	10		Continued from soil																
	1.55	1.70	SANDSTONE: brown, medium to coarse grained. Hawkesbury sandstone	SW		1.40				1.53m: B, 0°, PR, SN Fe, RF					PLT	PL(D)=0.81MPa PL(A)=1.1MPa			
	2		CORE LOSS: 150 mm	SW		1.70				1.85m: B, 10°, SN Fe, RF					PLT	PL(D)=0.55MPa PL(A)=0.69MPa			
	2.51		SANDSTONE: brown and pale brown, medium to coarse grained, indistinct, bedded, 0 to 10°; unbroken. Hawkesbury sandstone			2.88		78	74										
	2.88		CORE LOSS: 370 mm	SW		2.88				3.03m: B, 10°, PR, SN Fe, RF 3.11m: B, 0°, PR, SN Fe, RF					PLT	PL(D)=0.71MPa PL(A)=1.1MPa			
	3.83		SANDSTONE: pale yellow-brown and red-brown, medium to coarse grained, indistinct, bedded, 10°; slightly fractured to unbroken. Hawkesbury sandstone			3.76				3.44-354m: B x2, 10-20°, CU, SN Fe, RF 3.63m: B, 10°, PR, CN, RF 3.76-3.83m: EW, SN Fe 70mm					PLT	PL(D)=0.91MPa PL(A)=1.2MPa			
	3.96		CORE LOSS: 130 mm	SW		3.96									PLT	PL(A)=0.86MPa PL(D)=0.63MPa			
	5.00		SANDSTONE: pale yellow-brown, medium to coarse grained, indistinct, bedded, 10°; slightly fractured to unbroken. Hawkesbury sandstone			5.00				4.57m: B, 10°, PR, SN Fe, RF 4.91m: B, 10°, PR, SN Fe, RF					PLT	PL(A)=0.90MPa			
	5.48		SANDSTONE: pale grey, fine to medium grained, indistinct, laminated, 0 to 10°, siltstone laminations; slightly fractured to unbroken. Hawkesbury sandstone	FR		5.48		95	93	5.18m CS, Clay 10mm 5.23m: B, 10°, PR, SN Fe, He 5.44m: B, 0°, PR, CN, RF 5.64m: B, 0-10°, IR, CN, RF 5.84m JT, 45°, PR, CN, RF					PLT	PL(D)=1.3MPa PL(A)=2.2MPa			
	6.34					6.34									PLT	PL(A)=0.94MPa			
	6.80		Borehole discontinued at 6.80m depth.												PLT	PL(D)=0.87MPa PL(A)=0.96MPa			

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

**PLANT:** Comacchio GEO305

**OPERATOR:** Ground Test (LC)

**LOGGED:** L.Lau

**METHOD:** AD/T to 1.4m, then NMLC to 6.8m

**CASING:** HWT to 1.4m

**REMARKS:** Core barrel dropped under own weight without rotation from 2.51m to 2.88m

Refer to explanatory notes for symbol and abbreviation definitions



# CORE PHOTO LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 10.8 AHD  
**COORDINATE:** E:331765.0, N:6249188.0  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH103  
**PROJECT No:** 229796.00  
**DATE:** 30/08/24  
**SHEET:** 1 of 1



1.40-5.00 m depth



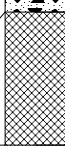

5.00-6.80 m depth

# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 12.6 AHD  
**COORDINATE:** E:331752.6, N:6249236.6  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH201  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	0.06	ASPHALTIC CONCRETE				ND							
		FILL / Gravelly SAND: dark brown; fine to coarse; fine to medium, sub-rounded to sub-angular, igneous and sandstone gravel; with brick fragments.		FILL	ND	D				ES	0.10 - 0.20	PID	<1ppm
										DT	0.40	PID	<1ppm
	12	Borehole discontinued at 0.50m depth. Refusal on inferred sandstone.											

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 0.5m  
**REMARKS:** \*BD3/20240823 sample taken from 0.1-0.2m

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.1 AHD  
**COORDINATE:** E:331731.2, N:6249221.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH202  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	11	0.06	ASPHALTIC CONCRETE				ND						
			FILL / Silty SAND: dark brown; fine to medium; low plasticity silt; trace sandstone and igneous gravel, trace brick gravel.		FILL	ND	D		ES	0.10 - 0.20		PID	<1ppm
									ES	0.30 - 0.40		PID	<1ppm
			Borehole discontinued at 0.45m depth. Refusal on inferred sandstone.										
	10												
	9												
	8												
	7												

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 0.45m  
**REMARKS:**

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.7 AHD  
**COORDINATE:** E:331737.7, N:6249208.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH203  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS				
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (%)	DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	0.06		ASPHALTIC CONCRETE					ND						
	0.10		FILL / Gravelly SAND: dark grey; fine to coarse; igneous and sandstone gravel.		FILL					ES	0.10 - 0.20	PID	<1ppm	
			FILL / Silty CLAY: brown with red mottling; medium to high plasticity.		FILL					ES	0.40 - 0.50	PID	<1ppm	
		1.1			FILL			w<PL						
		1.0			FILL					ES	0.90 - 1.00	PID	<1ppm	
		1.30		FILL / Gravelly SAND: dark grey; fine to coarse; fine to coarse, sub-rounded to sub-angular gravel; sandstone and brick gravel.		FILL				ES	1.40 - 1.50	PID	<1ppm	
		1.0				FILL			ND					
		2.0		From 1.80m: medium to high plasticity clay inclusions		FILL			M		ES	1.90 - 2.00	PID	<1ppm
		2.0				FILL				ES	2.40 - 2.50	PID	<1ppm	
		3.00		SANDSTONE: pale red-yellow; fine to medium grained, inferred low strength					ND		ES	2.80 - 3.00	PID	<1ppm
	3.00								ES	2.90 - 3.10	PID	<1ppm		
	3.50		Borehole discontinued at 3.50m depth. Target depth reached.											

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:** Drillman GT10

**OPERATOR:** Groundtest

**LOGGED:** SAF

**METHOD:** 250mm diameter SFA to 1.0m, 100mm diameter SFA to 3.5m

**CASING:** Uncased

**REMARKS:**

Refer to explanatory notes for symbol and abbreviation definitions





# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 12.3 AHD  
**COORDINATE:** E:331757.3, N:6249218.9  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH204  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	0.06	ASPHALTIC CONCRETE			ND	ND					0.10	PID	<1ppm
	12	FILL / Gravelly SAND: dark grey; fine to coarse; fine to medium, sub-rounded to sub-angular, igneous and sandstone gravel; with brick fragments, trace glass fragments.  Borehole discontinued at 0.30m depth. Refusal on inferred sandstone.		FILL	ND	D			ES	0.20			
	1												
	11												
	2												
	10												
	3												
	9												
	4												
	8												

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 0.3m  
**REMARKS:**

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.3 AHD  
**COORDINATE:** E:331795.9, N:6249171.9  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH205  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	0.06		ASPHALTIC CONCRETE				ND						
	11	0.06 - 0.20	FILL / Gravelly SAND: brown-dark brown; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous and concrete gravel.		FILL		D		ES	0.10 - 0.20		PID	<1ppm
	0.40	0.20 - 0.50	FILL / Gravelly SAND: dark grey; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; concrete and sandstone gravel.		FILL	ND	M		* ES	0.40 - 0.50		PID	<1ppm
	0.80	0.50 - 0.80	SANDSTONE: red-brown; fine to medium grained, inferred low strength				ND		ES	0.70 - 0.80		PID	<1ppm
	1	Borehole discontinued at 0.85m depth. Refusal on inferred sandstone.											

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 0.85m  
**REMARKS:** \*BD1/20240823 sample taken from 0.4-0.5m

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.8 AHD  
**COORDINATE:** E:331772.9, N:6249199.6  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH206  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	0.06		ASPHALTIC CONCRETE				ND						
	0.20		FILL / Gravelly SAND: brown; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous and sandstone gravel.		FILL		D		ES	0.10 - 0.20		PID	<1ppm
			FILL / Silty SAND: dark brown; fine to medium; low plasticity silt; trace sandstone gravel.		FILL		M		ES	0.30 - 0.40		PID	<1ppm
	1				FILL	ND			ES	0.90 - 1.00		PID	<1ppm
		Borehole discontinued at 1.10m depth. Refusal on inferred sandstone.											

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 1.1m  
**REMARKS:**

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 12.4 AHD  
**COORDINATE:** E:331800.7, N:6249184.2  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH207  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	0.06	0.06	ASPHALTIC CONCRETE				ND						
	12	0.10	FILL / Gravelly SAND: brown; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous, concrete and sandstone gravel.		FILL		ND	D		ES	0.10 - 0.20	PID	<1ppm
		0.60	FILL / Gravelly SAND: dark grey; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous, concrete, sandstone and brick gravel, trace tile, plastic, ballast, metal pipe.		FILL			M		ES	0.40 - 0.50	PID	<1ppm
	1	0.60	Borehole discontinued at 0.80m depth. Refusal on inferred sandstone.										
	11												
	2												
	10												
	3												
	9												
	4												
	8												

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 0.8m  
**REMARKS:** \*BD2/20240823 sample taken from 0.1-0.2m

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions




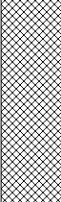



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 10.3 AHD  
**COORDINATE:** E:331777.8, N:6249171.8  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH208  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
	0.06	ASPHALTIC CONCRETE					ND						
	1.0	FILL / Gravelly SAND: dark grey; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous, sandstone and concrete gravel, broken brick cobbles and fragments.		FILL			M		ES	0.10 - 0.20	PID	<1ppm	
	0.80	FILL / Gravelly CLAY: dark grey; low to medium plasticity; fine to coarse, sub-rounded to sub-angular gravel; brick and sandstone gravel.		FILL			ND		ES	0.40 - 0.50	PID	<1ppm	
	1			FILL			w=PL		ES	0.90 - 1.00	PID	<1ppm	
	2			FILL			w>PL		ES	1.40 - 1.50	PID	<1ppm	
	2	Borehole discontinued at 2.00m depth. Refusal on inferred sandstone bedrock.											

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 2m  
**REMARKS:** Groundwater observed at 1.4 m

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.9 AHD  
**COORDINATE:** E:331807.0, N:6249169.8  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH209  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	0.06		ASPHALTIC CONCRETE				ND						
		0.30	FILL / Gravelly SAND: dark brown-brown ; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous, sandstone and brick gravel.		FILL		D		ES	0.10 - 0.20	PID	<1ppm	
		0.60	FILL / Gravelly SAND: dark grey; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; sandstone and brick gravel.		FILL		M		ES	0.40 - 0.50	PID	<1ppm	
		1.00	FILL / SAND: brown; fine to coarse; with sandstone and brick gravel.		FILL	ND			ES	0.70 - 0.80	PID	<1ppm	
		1.10	SANDSTONE: pale red-yellow; fine to medium grained, inferred low strength				ND		ES	1.00 - 1.10	PID	<1ppm	
Borehole discontinued at 1.50m depth. Target depth reached.													

Generated with CORE-GS by Geroc - Soil Log

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

**PLANT:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 1.5m  
**REMARKS:**

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.1 AHD  
**COORDINATE:** E:331799.7, N:6249163.5  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH210  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	11	0.06	ASPHALTIC CONCRETE				ND						
		0.30	FILL / Gravelly SAND: brown-dark brown; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous and concrete gravel.		FILL		D		ES	0.10 - 0.20	PID	<1ppm	
			FILL / Clayey Gravelly SAND: brown; fine to coarse; medium to high plasticity clay; fine to medium, sub-rounded to sub-angular gravel; sandstone and brick gravel, clayey zones.		FILL	ND	M		ES	0.40 - 0.50	PID	<1ppm	
		1	0.80m: becoming dark grey		FILL				ES	0.90	PID	<1ppm	
	10	Borehole discontinued at 1.00m depth. Refusal on inferred sandstone .											

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:** Drillman GT10  
**METHOD:** 250mm diameter SFA to 0.8m, 100mm SFA to 1.0m  
**REMARKS:**

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions

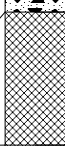
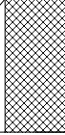


# BOREHOLE LOG

**CLIENT:** Corio Projects Pty Ltd  
**PROJECT:** Proposed Seniors Housing  
**LOCATION:** 2-32 Junction Street, Forest Lodge, NSW 2037

**SURFACE LEVEL:** 11.1 AHD  
**COORDINATE:** E:331720.8, N:6249210.1  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH211  
**PROJECT No:** 229796.01  
**DATE:** 23/08/24  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS				
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%)	DENSITY. (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/08/24 No free groundwater observed whilst drilling	11	0.06	ASPHALTIC CONCRETE					ND						
			FILL / Gravelly SAND: dark brown; fine to coarse; fine to medium, sub-rounded to sub-angular gravel; igneous, concrete and sandstone gravel.		FILL		ND	D		ES	0.10 - 0.20		PID	<1ppm
										ES	0.40		PID	<1ppm
			Borehole discontinued at 0.50m depth. Target depth reached.											
	10													
	9													
	8													
	7													

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:** Drillman GT10 and hand tools  
**METHOD:** 250mm diameter SFA to 0.1m, hand auger to 0.5m  
**REMARKS:**

**OPERATOR:** Groundtest

**LOGGED:** SAF  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



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## **Appendix D**

### Laboratory Results

# Material Test Report

**Report Number:** 229796.00-1  
**Issue Number:** 1  
**Date Issued:** 05/09/2024  
**Client:** Corio Projects Pty Ltd  
 22-24 Junction Street, Forest Lodge NSW  
**Contact:** Chris West  
**Project Number:** 229796.00  
**Project Name:** Proposed Seniors Housing  
**Project Location:** 2-32 Junction Street, Forest Lodge NSW  
**Work Request:** 11755  
**Sample Number:** SY-11755A  
**Date Sampled:** 03/09/2024  
**Dates Tested:** 03/09/2024 - 05/09/2024  
**Sampling Method:** Sampled by Engineering Department  
*The results apply to the sample as received*  
**Sample Location:** BH101 (0.9-1.0m)  
**Material:** FILL/Silty Clay



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



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Lujia Wu  
 Soil Technician

Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	6	
Soil Description	FILL/Silty Clay	
Nature of Water	Demineralised	
Temperature of Water (°C)	22	

# Material Test Report

**Report Number:** 229796.00-1  
**Issue Number:** 1  
**Date Issued:** 05/09/2024  
**Client:** Corio Projects Pty Ltd  
22-24 Junction Street, Forest Lodge NSW  
**Contact:** Chris West  
**Project Number:** 229796.00  
**Project Name:** Proposed Seniors Housing  
**Project Location:** 2-32 Junction Street, Forest Lodge NSW  
**Work Request:** 11755  
**Sample Number:** SY-11755B  
**Date Sampled:** 03/09/2024  
**Dates Tested:** 03/09/2024 - 05/09/2024  
**Sampling Method:** Sampled by Engineering Department  
*The results apply to the sample as received*  
**Sample Location:** BH101 (3.9-4.0m)  
**Material:** FILL/Sandy Clay



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Approved Signatory: Lujia Wu  
Soil Technician

Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	6	
Soil Description	FILL/Sandy Clay	
Nature of Water	Demineralised	
Temperature of Water (°C)	22	

# Material Test Report

**Report Number:** 229796.00-1  
**Issue Number:** 1  
**Date Issued:** 05/09/2024  
**Client:** Corio Projects Pty Ltd  
 22-24 Junction Street, Forest Lodge NSW  
**Contact:** Chris West  
**Project Number:** 229796.00  
**Project Name:** Proposed Seniors Housing  
**Project Location:** 2-32 Junction Street, Forest Lodge NSW  
**Work Request:** 11755  
**Sample Number:** SY-11755C  
**Date Sampled:** 03/09/2024  
**Dates Tested:** 03/09/2024 - 05/09/2024  
**Sampling Method:** Sampled by Engineering Department  
*The results apply to the sample as received*  
**Sample Location:** BH101 (5-5.1m)  
**Material:** Clayey SAND



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Accredited for compliance with ISO/IEC 17025 - Testing

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

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	6	
Soil Description	Clayey SAND	
Nature of Water	Demineralised	
Temperature of Water (°C)	22	

# Material Test Report

**Report Number:** 229796.00-1  
**Issue Number:** 1  
**Date Issued:** 05/09/2024  
**Client:** Corio Projects Pty Ltd  
22-24 Junction Street, Forest Lodge NSW  
**Contact:** Chris West  
**Project Number:** 229796.00  
**Project Name:** Proposed Seniors Housing  
**Project Location:** 2-32 Junction Street, Forest Lodge NSW  
**Work Request:** 11755  
**Sample Number:** SY-11755D  
**Date Sampled:** 03/09/2024  
**Dates Tested:** 03/09/2024 - 05/09/2024  
**Sampling Method:** Sampled by Engineering Department  
*The results apply to the sample as received*  
**Sample Location:** BH101 (6-6.1m)  
**Material:** Clayey SAND



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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Lujia Wu  
Soil Technician

Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)	Min	Max
Emerson Class	5	
Soil Description	Clayey SAND	
Nature of Water	Demineralised	
Temperature of Water (°C)	22	

## CERTIFICATE OF ANALYSIS 360804

### Client Details

<b>Client</b>	Douglas Partners Pty Ltd
<b>Attention</b>	Rhys McMillan
<b>Address</b>	96 Hermitage Rd, West Ryde, NSW, 2114

### Sample Details

<b>Your Reference</b>	<b><u>229796.00 Forest Lodge</u></b>
<b>Number of Samples</b>	26 Soil
<b>Date samples received</b>	03/09/2024
<b>Date completed instructions received</b>	03/09/2024

### 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

<b>Date results requested by</b>	10/09/2024
<b>Date of Issue</b>	09/09/2024
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b>	

#### **Results Approved By**

Diego Bigolin, Inorganics Supervisor  
 Giovanni Agosti, Group Technical Manager  
 Jenny He, Senior Chemist

#### **Authorised By**

Nancy Zhang, Laboratory Manager

Client Reference: 229796.00 Forest Lodge

ESP/CEC					
Our Reference		360804-1	360804-2	360804-3	360804-4
Your Reference	UNITS	BH01	BH01	BH01	BH01
Depth		0.9-1	3.9-4	5-5.1	6-6.1
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	05/09/2024	05/09/2024	05/09/2024	05/09/2024
Date analysed	-	05/09/2024	05/09/2024	05/09/2024	05/09/2024
Exchangeable Ca	meq/100g	4.9	7.6	1.5	0.9
Exchangeable K	meq/100g	0.2	0.4	0.1	0.2
Exchangeable Mg	meq/100g	1.1	0.8	0.2	0.7
Exchangeable Na	meq/100g	0.4	<0.1	<0.1	<0.1
Cation Exchange Capacity	meq/100g	6.5	8.8	1.9	1.8
ESP	%	6	[NT]	[NT]	[NT]

Client Reference: 229796.00 Forest Lodge

Texture and Salinity*						
Our Reference		360804-1	360804-2	360804-3	360804-4	360804-5
Your Reference	UNITS	BH01	BH01	BH01	BH01	BH03
Depth		0.9-1	3.9-4	5-5.1	6-6.1	0.9-1
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/09/2024	04/09/2024	04/09/2024	04/09/2024	04/09/2024
Date analysed	-	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024
Electrical Conductivity 1:5 soil:water	µS/cm	290	110	53	33	32
Texture Value	-	8.5	9.0	8.0	8.0	[NA]
Texture	-	LIGHT CLAY	CLAY LOAM	LIGHT MEDIUM CLAY	LIGHT MEDIUM CLAY	[NA]
ECe	dS/m	2.4	<2	<2	<2	[NA]
Class	-	SLIGHTLY SALINE	NON SALINE	NON SALINE	NON SALINE	[NA]

Texture and Salinity*		
Our Reference		360804-24
Your Reference	UNITS	BH02
Depth		4.5-4.6
Date Sampled		30/08/2024
Type of sample		Soil
Date prepared	-	04/09/2024
Date analysed	-	05/09/2024
Electrical Conductivity 1:5 soil:water	µS/cm	170

**Client Reference: 229796.00 Forest Lodge**

<b>Misc Inorg - Soil</b>				
Our Reference		360804-4	360804-5	360804-24
Your Reference	UNITS	BH01	BH03	BH02
Depth		6-6.1	0.9-1	4.5-4.6
Date Sampled		30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	04/09/2024	04/09/2024	04/09/2024
Date analysed	-	04/09/2024	04/09/2024	04/09/2024
pH 1:5 soil:water	pH Units	6.0	7.1	7.4
Chloride, Cl 1:5 soil:water	mg/kg	28	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	10	86

**Client Reference: 229796.00 Forest Lodge**

sPOCAS field test						
Our Reference		360804-1	360804-2	360804-3	360804-4	360804-5
Your Reference	UNITS	BH01	BH01	BH01	BH01	BH03
Depth		0.9-1	3.9-4	5-5.1	6-6.1	0.9-1
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024
pH <sub>F</sub> (field pH test)	pH Units	5.9	6.9	7.1	7.6	7.4
pH <sub>FOX</sub> (field peroxide test)	pH Units	4.5	3.2	2.6	4.0	5.0
Reaction Rate*	-	Medium reaction	Extreme reaction	Medium reaction	Medium reaction	Medium reaction

sPOCAS field test						
Our Reference		360804-6	360804-7	360804-8	360804-9	360804-10
Your Reference	UNITS	BH01	BH01	BH01	BH01	BH01
Depth		0.5-0.6	1.5-1.6	2-2.1	2.5-2.6	3-3.1
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024
pH <sub>F</sub> (field pH test)	pH Units	7.9	6.2	7.8	7.6	7.6
pH <sub>FOX</sub> (field peroxide test)	pH Units	5.4	4.2	6.1	5.9	5.6
Reaction Rate*	-	Medium reaction	Medium reaction	Medium reaction	Medium reaction	High reaction

sPOCAS field test						
Our Reference		360804-11	360804-12	360804-13	360804-14	360804-15
Your Reference	UNITS	BH01	BH01	BH02	BH02	BH02
Depth		3.5-3.6	4.5-4.6	0.5-0.6	0.9-1	1.5-1.6
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024
pH <sub>F</sub> (field pH test)	pH Units	7.7	7.7	8.1	8.8	8.4
pH <sub>FOX</sub> (field peroxide test)	pH Units	5.7	4.2	5.3	6.5	6.2
Reaction Rate*	-	High reaction	Extreme reaction	Medium reaction	Medium reaction	Medium reaction

Client Reference: 229796.00 Forest Lodge

sPOCAS field test						
Our Reference		360804-16	360804-17	360804-18	360804-19	360804-20
Your Reference	UNITS	BH02	BH02	BH02	BH02	BH02
Depth		2-2.1	2.4-2.5	3-3.1	3.5-3.6	3.9-4
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	05/09/2024	05/09/2024	05/09/2024	05/09/2024	05/09/2024
pH <sub>F</sub> (field pH test)	pH Units	8.4	8.4	7.7	7.0	7.8
pH <sub>FOX</sub> (field peroxide test)	pH Units	5.7	5.4	3.2	2.0	2.4
Reaction Rate*	-	Medium reaction	Medium reaction	Extreme reaction	Medium reaction	Medium reaction

sPOCAS field test		
Our Reference		360804-21
Your Reference	UNITS	BH03
Depth		0.5-0.6
Date Sampled		30/08/2024
Type of sample		Soil
Date prepared	-	03/09/2024
Date analysed	-	05/09/2024
pH <sub>F</sub> (field pH test)	pH Units	7.9
pH <sub>FOX</sub> (field peroxide test)	pH Units	5.5
Reaction Rate*	-	Medium reaction

**Client Reference: 229796.00 Forest Lodge**

<b>Method ID</b>	<b>Methodology Summary</b>
<b>Inorg-001</b>	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.
<b>Inorg-002</b>	Conductivity and Salinity - measured using a conductivity cell.
<b>Inorg-063</b>	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.
<b>Inorg-081</b>	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.
<b>INORG-123</b>	Determined using a "Texture by Feel" method.
<b>Metals-020</b>	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

**Client Reference: 229796.00 Forest Lodge**

QUALITY CONTROL: ESP/CEC					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			05/09/2024	[NT]	[NT]	[NT]	[NT]	05/09/2024	[NT]
Date analysed	-			05/09/2024	[NT]	[NT]	[NT]	[NT]	05/09/2024	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]

**Client Reference: 229796.00 Forest Lodge**

QUALITY CONTROL: Texture and Salinity*				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/09/2024	[NT]	[NT]	[NT]	[NT]	04/09/2024	[NT]
Date analysed	-			05/09/2024	[NT]	[NT]	[NT]	[NT]	05/09/2024	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]

**Client Reference: 229796.00 Forest Lodge**

QUALITY CONTROL: Misc Inorg - Soil				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/09/2024	[NT]	[NT]	[NT]	[NT]	04/09/2024	[NT]
Date analysed	-			04/09/2024	[NT]	[NT]	[NT]	[NT]	04/09/2024	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	106	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	107	[NT]

**Client Reference: 229796.00 Forest Lodge**

QUALITY CONTROL: sPOCAS field test							Duplicate		Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			03/09/2024	[NT]	[NT]	[NT]	[NT]	03/09/2024	[NT]
Date analysed	-			05/09/2024	[NT]	[NT]	[NT]	[NT]	05/09/2024	[NT]
pH <sub>F</sub> (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH <sub>Fox</sub> (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: sPOCAS field test							Duplicate		Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	03/09/2024	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	05/09/2024	[NT]
pH <sub>F</sub> (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
pH <sub>Fox</sub> (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]

## Result Definitions

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

## Quality Control Definitions

<b>Blank</b>	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.
<b>Duplicate</b>	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.
<b>Matrix Spike</b>	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.
<b>LCS (Laboratory Control Sample)</b>	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.
<b>Surrogate Spike</b>	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

ESP: Where the exchangeable Sodium is less than the PQL and CEC is less than 10meq/100g, the ESP cannot be calculated.

## CERTIFICATE OF ANALYSIS 360804-A

### Client Details

<b>Client</b>	Douglas Partners Pty Ltd
<b>Attention</b>	Rhys McMillan
<b>Address</b>	96 Hermitage Rd, West Ryde, NSW, 2114

### Sample Details

<b>Your Reference</b>	<b><u>229796.00 Forest Lodge</u></b>
<b>Number of Samples</b>	26 Soil
<b>Date samples received</b>	03/09/2024
<b>Date completed instructions received</b>	10/09/2024

### 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

<b>Date results requested by</b>	17/09/2024
<b>Date of Issue</b>	17/09/2024
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Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b>	

**Results Approved By**  
 Jenny He, Senior Chemist

**Authorised By**  
 Nancy Zhang, Laboratory Manager

Client Reference: 229796.00 Forest Lodge

sPOCAS + %S w/w						
Our Reference		360804-A-2	360804-A-3	360804-A-10	360804-A-11	360804-A-12
Your Reference	UNITS	BH01	BH01	BH01	BH01	BH01
Depth		3.9-4	5-5.1	3-3.1	3.5-3.6	4.5-4.6
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
pH <sub>kcl</sub>	pH units	7.2	7.0	8.4	8.4	7.3
TAA pH 6.5	moles H <sup>+</sup> /t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH <sub>ox</sub>	pH units	4.5	7.0	7.1	6.8	6.7
TPA pH 6.5	moles H <sup>+</sup> /t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H <sup>+</sup> /t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC <sub>E</sub>	% CaCO <sub>3</sub>	[NT]	0.12	0.38	0.25	0.12
a-ANC <sub>E</sub>	moles H <sup>+</sup> /t	[NT]	25	75	50	25
s-ANC <sub>E</sub>	%w/w S	[NT]	<0.05	0.12	0.08	<0.05
S <sub>KCl</sub>	%w/w S	0.02	0.01	0.04	0.06	0.02
S <sub>P</sub>	%w/w	0.05	0.05	0.06	0.10	0.09
S <sub>POS</sub>	%w/w	0.03	0.04	0.03	0.04	0.06
a-S <sub>POS</sub>	moles H <sup>+</sup> /t	20	22	17	23	38
Ca <sub>KCl</sub>	%w/w	0.19	0.11	0.44	0.50	0.21
Ca <sub>P</sub>	%w/w	0.23	0.16	0.46	0.42	0.27
Ca <sub>A</sub>	%w/w	0.034	0.051	0.015	<0.005	0.061
Mg <sub>KCl</sub>	%w/w	0.015	0.009	0.024	0.024	0.015
Mg <sub>P</sub>	%w/w	0.016	0.010	0.035	0.037	0.015
Mg <sub>A</sub>	%w/w	<0.005	<0.005	0.011	0.012	<0.005
S <sub>HCl</sub>	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S <sub>NAS</sub>	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
a-S <sub>NAS</sub>	moles H <sup>+</sup> /t	[NT]	[NT]	[NT]	[NT]	[NT]
s-S <sub>NAS</sub>	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H <sup>+</sup> /t	20	<5	<5	<5	<5
s-Net Acidity	%w/w S	0.03	<0.01	<0.01	<0.01	<0.01
Liming rate	kg CaCO <sub>3</sub> /t	1.5	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without -ANCE	%w/w S	0.03	0.04	0.03	0.04	0.06
a-Net Acidity without ANCE	moles H <sup>+</sup> /t	20	22	17	23	38
Liming rate without ANCE	kg CaCO <sub>3</sub> /t	1.5	1.7	1.3	1.8	2.9

Client Reference: 229796.00 Forest Lodge

sPOCAS + %S w/w				
Our Reference		360804-A-18	360804-A-19	360804-A-20
Your Reference	UNITS	BH02	BH02	BH02
Depth		3-3.1	3.5-3.6	3.9-4
Date Sampled		30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	11/09/2024	11/09/2024	11/09/2024
pH <sub>kcl</sub>	pH units	6.6	6.0	7.2
TAA pH 6.5	moles H <sup>+</sup> /t	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01
pH <sub>ox</sub>	pH units	6.0	4.3	6.6
TPA pH 6.5	moles H <sup>+</sup> /t	<5	37	<5
s-TPA pH 6.5	%w/w S	<0.01	0.06	<0.01
TSA pH 6.5	moles H <sup>+</sup> /t	<5	36	<5
s-TSA pH 6.5	%w/w S	<0.01	0.06	<0.01
ANC <sub>E</sub>	% CaCO <sub>3</sub>	[NT]	[NT]	0.25
a-ANC <sub>E</sub>	moles H <sup>+</sup> /t	[NT]	[NT]	50
s-ANC <sub>E</sub>	%w/w S	[NT]	[NT]	0.08
S <sub>KCl</sub>	%w/w S	0.02	0.02	0.02
S <sub>P</sub>	%w/w	0.07	0.17	0.04
S <sub>POS</sub>	%w/w	0.05	0.15	0.02
a-S <sub>POS</sub>	moles H <sup>+</sup> /t	32	93	14
Ca <sub>KCl</sub>	%w/w	0.28	0.26	0.31
Ca <sub>P</sub>	%w/w	0.26	0.26	0.03
Ca <sub>A</sub>	%w/w	<0.005	<0.005	<0.005
Mg <sub>KCl</sub>	%w/w	0.022	0.011	0.017
Mg <sub>P</sub>	%w/w	0.022	0.012	<0.005
Mg <sub>A</sub>	%w/w	<0.005	<0.005	<0.005
S <sub>HCl</sub>	%w/w S	[NT]	[NT]	[NT]
S <sub>NAS</sub>	%w/w S	[NT]	[NT]	[NT]
a-S <sub>NAS</sub>	moles H <sup>+</sup> /t	[NT]	[NT]	[NT]
s-S <sub>NAS</sub>	%w/w S	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	1.5	1.5
a-Net Acidity	moles H <sup>+</sup> /t	32	93	<5
s-Net Acidity	%w/w S	0.05	0.15	<0.01
Liming rate	kg CaCO <sub>3</sub> /t	2.4	7.0	<0.75
s-Net Acidity without -ANCE	%w/w S	0.05	0.15	0.02
a-Net Acidity without ANCE	moles H <sup>+</sup> /t	32	93	14
Liming rate without ANCE	kg CaCO <sub>3</sub> /t	2.4	7.0	1.0

Client Reference: 229796.00 Forest Lodge

SCr						
Our Reference		360804-A-2	360804-A-3	360804-A-10	360804-A-11	360804-A-12
Your Reference	UNITS	BH01	BH01	BH01	BH01	BH01
Depth		3.9-4	5-5.1	3-3.1	3.5-3.6	4.5-4.6
Date Sampled		30/08/2024	30/08/2024	30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
Chromium Reducible Sulfur	%w/w	0.02	0.03	0.008	0.01	0.06
a-Chromium Reducible Sulfur	moles H <sup>+</sup> /t	12	17	5	6	37

SCr				
Our Reference		360804-A-18	360804-A-19	360804-A-20
Your Reference	UNITS	BH02	BH02	BH02
Depth		3-3.1	3.5-3.6	3.9-4
Date Sampled		30/08/2024	30/08/2024	30/08/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	03/09/2024	03/09/2024	03/09/2024
Date analysed	-	11/09/2024	11/09/2024	11/09/2024
Chromium Reducible Sulfur	%w/w	0.04	0.12	0.1
a-Chromium Reducible Sulfur	moles H <sup>+</sup> /t	28	74	61

Method ID	Methodology Summary
<p><b>Inorg-064</b></p>	<p>sPOCAS determined using titrimetric and ICP-AES techniques.</p> <p>Ideally samples should be received in the laboratory at &lt;6oC. Please refer to SRA for sample temperature on receipt.</p> <p>Net acidity including ANC has a safety factor of 1.5 applied.                      Neutralising value (NV) of 100% is assumed for liming rate                      The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL result.                      However, it has been applied in the SNAS calculation:                      SNAS % = (SHCL-SKCL)x2</p>
<p><b>Inorg-068</b></p>	<p>Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity.</p> <p>Net acidity including ANC has a safety factor of 1.5 applied.</p> <p>Neutralising value (NV) of 100% is assumed for liming rate.</p> <p>The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL result.                      However, it has been applied in the SNAS calculation:                      SNAS % = (SHCL-SKCL)x2</p>

Client Reference: 229796.00 Forest Lodge

QUALITY CONTROL: sPOCAS + %S w/w				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			03/09/2024	2	03/09/2024	03/09/2024		03/09/2024	[NT]
Date analysed	-			11/09/2024	2	11/09/2024	11/09/2024		11/09/2024	[NT]
pH <sub>KCl</sub>	pH units		Inorg-064	[NT]	2	7.2	7.2	0	99	[NT]
TAA pH 6.5	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	<5	<5	0	93	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	2	<0.01	<0.01	0	[NT]	[NT]
pH <sub>Ox</sub>	pH units		Inorg-064	[NT]	2	4.5	4.6	2	100	[NT]
TPA pH 6.5	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	<5	<5	0	98	[NT]
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	2	<0.01	<0.01	0	[NT]	[NT]
TSA pH 6.5	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	<5	<5	0	[NT]	[NT]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	2	<0.01	<0.01	0	[NT]	[NT]
ANC <sub>E</sub>	% CaCO <sub>3</sub>	0.05	Inorg-064	<0.05	2	[NT]	[NT]		[NT]	[NT]
a-ANC <sub>E</sub>	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	[NT]	[NT]		[NT]	[NT]
s-ANC <sub>E</sub>	%w/w S	0.05	Inorg-064	<0.05	2	[NT]	[NT]		[NT]	[NT]
S <sub>KCl</sub>	%w/w S	0.005	Inorg-064	<0.005	2	0.02	0.02	0	[NT]	[NT]
S <sub>P</sub>	%w/w	0.005	Inorg-064	<0.005	2	0.05	0.05	0	[NT]	[NT]
S <sub>POS</sub>	%w/w	0.005	Inorg-064	<0.005	2	0.03	0.04	29	[NT]	[NT]
a-S <sub>POS</sub>	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	20	22	10	[NT]	[NT]
Ca <sub>KCl</sub>	%w/w	0.005	Inorg-064	<0.005	2	0.19	0.20	5	[NT]	[NT]
Ca <sub>P</sub>	%w/w	0.005	Inorg-064	<0.005	2	0.23	0.23	0	[NT]	[NT]
Ca <sub>A</sub>	%w/w	0.005	Inorg-064	<0.005	2	0.034	0.022	43	[NT]	[NT]
Mg <sub>KCl</sub>	%w/w	0.005	Inorg-064	<0.005	2	0.015	0.016	6	[NT]	[NT]
Mg <sub>P</sub>	%w/w	0.005	Inorg-064	<0.005	2	0.016	0.016	0	[NT]	[NT]
Mg <sub>A</sub>	%w/w	0.005	Inorg-064	<0.005	2	<0.005	<0.005	0	[NT]	[NT]
S <sub>HCl</sub>	%w/w S	0.005	Inorg-064	<0.005	2	[NT]	[NT]		[NT]	[NT]
S <sub>NAS</sub>	%w/w S	0.005	Inorg-064	<0.005	2	[NT]	[NT]		[NT]	[NT]
a-S <sub>NAS</sub>	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	[NT]	[NT]		[NT]	[NT]
s-S <sub>NAS</sub>	%w/w S	0.01	Inorg-064	<0.01	2	[NT]	[NT]		[NT]	[NT]
Fineness Factor	-	1.5	Inorg-064	<1.5	2	1.5	1.5	0	[NT]	[NT]
a-Net Acidity	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	20	22	10	[NT]	[NT]
s-Net Acidity	%w/w S	0.01	Inorg-064	<0.01	2	0.03	0.04	29	[NT]	[NT]
Liming rate	kg CaCO <sub>3</sub> /t	0.75	Inorg-064	<0.75	2	1.5	1.6	6	[NT]	[NT]
s-Net Acidity without -ANCE	%w/w S	0.01	Inorg-064	<0.01	2	0.03	0.04	29	[NT]	[NT]

**Client Reference: 229796.00 Forest Lodge**

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
a-Net Acidity without ANCE	moles H <sup>+</sup> /t	5	Inorg-064	<5	2	20	22	10	[NT]	[NT]
Liming rate without ANCE	kg CaCO <sub>3</sub> /t	0.75	Inorg-064	<0.75	2	1.5	1.6	6	[NT]	[NT]

**Client Reference: 229796.00 Forest Lodge**

QUALITY CONTROL: SCr				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			03/09/2024	2	03/09/2024	03/09/2024		03/09/2024	[NT]
Date analysed	-			11/09/2024	2	11/09/2024	11/09/2024		11/09/2024	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	2	0.02	0.02	0	98	[NT]
a-Chromium Reducible Sulfur	moles H <sup>+</sup> /t	3	Inorg-068	<3	2	12	12	0	[NT]	[NT]

**Result Definitions**

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

## Quality Control Definitions

<b>Blank</b>	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.
<b>Duplicate</b>	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.
<b>Matrix Spike</b>	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.
<b>LCS (Laboratory Control Sample)</b>	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.
<b>Surrogate Spike</b>	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

Sample 360804-A-20 has been observed a-Chromium Reducible Sulfur>a-SPOS and CaKCl>CaP, this may be considered acceptable due to inhomogeneous nature of the sample matrix.

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## **Appendix E**

### Historical Investigation Results

# TEST BORE REPORT

**CLIENT:** CICI HOUR PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**DATE:** 17 MARCH 98  
**PROJECT No.:** 27259  
**SURFACE LEVEL:**

**BORE No. 1**  
**SHEET 1 OF 1**

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0 0.05 0.15  1  1.6  2  3  4  5  6  7  8  9  10	BITUMEN FILLING - roadbase (sand and gravel) FILLING - yellow brown sand, clay, crushed sandstone, dolerite and ironstone gravel filling TEST BORE DISCONTINUED AT 1.6 METRES - auger refusal		1.5 1.0	15/100mm ref	

**RIG:** B40

**DRILLER:** CHITTLEBURGH **LOGGED:** PARMAR

**CASING:**

**TYPE OF BORING:** SFA TO 1.6m

**GROUND WATER OBSERVATIONS:** NO FREE GROUNDWATER OBSERVED

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:
Initials: <i>NSP</i>
Date: <i>23-4-98</i>



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# TEST BORE REPORT

**CLIENT:** CICI HOUR PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**DATE:** 17 MARCH 98  
**PROJECT No.:** 27259  
**SURFACE LEVEL:**

**BORE No. 2**  
**SHEET 1 OF 1**

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0					
0.05	BITUMEN				
0.15					
0.3	FILLING - roadbase (sand and gravel)				
	FILLING - crushed sandstone and black sandy clay filling				
0.95	SANDY CLAY - light brown sandy clay				
1	- 0.8m - auger refusal				
2	TEST BORE DISCONTINUED AT 0.95 METRES - auger refusal on sandstone				
3					
4					
5					
6					
7					
8					
9					
10					

**RIG:** B40

**DRILLER:** CHITTLEBURGH **LOGGED:** PARMAR

**CASING:**

**TYPE OF BORING:** SFA TO 0.95m

**GROUND WATER OBSERVATIONS:** NO FREE GROUNDWATER OBSERVED

**REMARKS:**

### SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:

Initials:

Date:



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# TEST BORE REPORT

**CLIENT:** CICI HOUR PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**DATE:** 18 MARCH 98  
**PROJECT No.:** 27259  
**SURFACE LEVEL:**

**BORE No. 3**  
**SHEET 1 OF 1**

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0	BITUMEN				
0.05					
0.15	FILLING - roadbase (sand and gravel)				
	FILLING - light and dark grey black clay, sand, ash and gravel filling				
1					
2		S	1.5	1,0,2 N=2	
			1.95		
3		S	3.0	1,0,0 N=0	
			3.45		
4					
4.65	TEST BORE DISCONTINUED AT 4.65 METRES - auger refusal				
5					
6					
7					
8					
9					
10					

**RIG:** B40

**DRILLER:** CHITTLEBURGH **LOGGED:** PARMAR

**CASING:**

**TYPE OF BORING:** SFA TO 4.65m

**GROUND WATER OBSERVATIONS:** NO FREE GROUNDWATER OBSERVED

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:
Initials: <i>WSE</i>
Date: <i>23.4.98</i>



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# TEST BORE REPORT

CLIENT: CICI HOUR PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

DATE: 17-18 MARCH 98  
 PROJECT No.: 27259  
 SURFACE LEVEL:

BORE No. 4  
 SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing		
		Type	Depth (m)	Test Results Core Recovery %
0	BITUMEN			
0.05				
0.15	FILLING - roadbase (sand and gravel)			
	FILLING - black clay, sand and dolerite gravel filling			
1				
1.0	CLAYEY SAND - dark grey clayey sand			
1.3				
	CLAYEY SAND - light grey, fine to medium grained clayey sand	S	1.5 1.74	1,15/90mm ref
1.8	TEST BORE DISCONTINUED AT 1.8 METRES - auger refusal on sandstone			
2				
3				
4				
5				
6				
7				
8				
9				
10				

RIG: B40

DRILLER: CHITTLEBURGH LOGGED: PARMAR

CASING:

TYPE OF BORING: SFA TO 1.8m

GROUND WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 1.5m

REMARKS:

### SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:

Initials: *NSR*

Date: *23.4.98*



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# TEST BORE REPORT

CLIENT: CICI HOUR PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

DATE: 18 MARCH 98  
 PROJECT No.: 27259  
 SURFACE LEVEL:

BORE No. 5  
 SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0					
0.05	BITUMEN				
0.15	FILLING - roadbase (sand and gravel)				
0.8	FILLING - black sand and cobble filling				
1	CLAYEY SAND - brown clayey sand				
1.05	TEST BORE DISCONTINUED AT 1.05 METRES - auger refusal				
2					
3					
4					
5					
6					
7					
8					
9					
10					

RIG: B40

DRILLER: CHITTLEBURGH LOGGED: PARMAR

CASING:

TYPE OF BORING: SFA TO 1.05m

GROUND WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS:

### SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:

Initials: *DL*

Date: *23.4.98*



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# TEST BORE REPORT

CLIENT: CICI HOUR PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

DATE: 17 MARCH 98  
 PROJECT No.: 27259  
 SURFACE LEVEL:

BORE No. 6  
 SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing		
		Type	Depth (m)	Test Results Core Recovery %
0	BITUMEN			
0.05				
0.15	FILLING - roadbase (sand and gravel)			
	FILLING - dark grey black sand, clay glass, and dolerite gravel filling			
1				
2		S	1.5	1,0,1 N=1
			1.95	
2.2	TEST BORE DISCONTINUED AT 2.2 METRES - auger refusal on sandstone			
3				
4				
5				
6				
7				
8				
9				
10				

RIG: B40

DRILLER: CHITTLEBURGH LOGGED: PARMAR

CASING:

TYPE OF BORING: SFA TO 2.2m

GROUND WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS:

### SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:

Initials: *NSL*

Date: 23.4.98



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# TEST BORE REPORT

**CLIENT:** CICI HOUR PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**DATE:** 18 MARCH 98  
**PROJECT No.:** 27259  
**SURFACE LEVEL:**

**BORE No. 7**  
**SHEET 1 OF 1**

Depth m	Description of Strata	Sampling & In Situ Testing		
		Type	Depth (m)	Test Results Core Recovery %
0	CONCRETE			
0.075	FILLING - bricks, sand and clay filling			
0.6	FILLING - red brown clayey sand			
1.5	FILLING - dark grey black sandy clay, sandstone gravel and slag filling	S	1.5	1,0,2 N=2
1.95				
3.0	SANDY CLAY - stiff, light yellow grey sandy clay (extremely weathered sandstone)	S	3.0	1,0,2 N=2
3.45				
4.5	TEST BORE DISCONTINUED AT 5.3 METRES - auger refusal	S	4.5	3,4,8 N=12
4.95				
5.3				
6				
7				
8				
9				
10				

**RIG:** B40

**DRILLER:** CHITTLEBURGH **LOGGED:** PARMAR

**CASING:**

**TYPE OF BORING:** SFA TO 5.3m

**GROUND WATER OBSERVATIONS:** FREE GROUNDWATER OBSERVED AT 3.8m

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

**CHECKED:**

Initials: *KSL*

Date: *23-4-98*



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# TEST BORE REPORT

**CLIENT:** CICI HOUR PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**DATE:** 18 MARCH 98  
**PROJECT No.:** 27259  
**SURFACE LEVEL:**

**BORE No. 8**  
**SHEET 1 OF 1**

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0 0.05 0.15  1 0.9  1.6  2  3  4  5  6  7  8  9  10	BITUMEN FILLING - roadbase (sand and gravel) FILLING - black sand filling CLAYEY SAND - light yellow grey, fine to medium grained clayey sand TEST BORE DISCONTINUED AT 1.6 METRES - auger refusal		1.5 1.55	15/50mm ref	

**RIG:** B40

**DRILLER:** CHITTLEBURGH **LOGGED:** PARMAR

**CASING:**

**TYPE OF BORING:** SFA TO 1.6m

**GROUND WATER OBSERVATIONS:** NO FREE GROUNDWATER OBSERVED

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

- |                    |                             |
|--------------------|-----------------------------|
| A Auger sample     | M Moisture content (%)      |
| B Bulk sample      | pp Pocket Penetration (kPa) |
| D Disturbed sample | Ux x mm dia. tube           |
| HV Hand Vane       | Wp Plastic limit (%)        |

**CHECKED:**

**Initials:** *PSL*

**Date:** 23-4-98



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# TEST BORE REPORT

**CLIENT:** CICI HOUR PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**DATE:** 18 MARCH 98  
**PROJECT No.:** 27259  
**SURFACE LEVEL:**

**BORE No. 9**  
**SHEET 1 OF 7**

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0 0.05 0.15 0.7 1 2 3 4 5 6 7 8 9 10	BITUMEN FILLING - roadbase (sand and gravel) FILLING - black sand, bricks and timber filling TEST BORE DISCONTINUED AT 0.7 METRES - auger refusal				

**RIG:** B40

**DRILLER:** CHITTLEBURGH **LOGGED:** PARMAR

**CASING:**

**TYPE OF BORING:** SFA TO 0.7m

**GROUND WATER OBSERVATIONS:** NO FREE GROUNDWATER OBSERVED

**REMARKS:**

**SAMPLING & IN SITU TESTING LEGEND**

A Auger sample B Bulk sample □ Disturbed sample HV Hand Vane	M Moisture content (%) pp Pocket Penetration (kPa) Ux x mm dia. tube Wp Plastic limit (%)
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CHECKED:

Initials: *NSL*

Date: *23.4.98*



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# TEST BORE REPORT

**CLIENT:** CICI HOUR PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**DATE:** 18 MARCH 98  
**PROJECT No.:** 27259  
**SURFACE LEVEL:**

**BORE No. 10**  
**SHEET 1 OF 1**

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0	BITUMEN				
0.05					
0.15	FILLING - roadbase (sand and gravel)				
	FILLING - black clay, bricks and cobble filling				
1					
1.3	CLAYEY SAND - medium dense, light brown yellow, fine to medium grained clayey sand	S	1.5	1,7,13 N=20	
2			1.95		
2.15	TEST BORE DISCONTINUED AT 2.15 METRES - auger refusal				
3					
4					
5					
6					
7					
8					
9					
10					

**RIG:** B40

**DRILLER:** CHITTLEBURGH **LOGGED:** PARMAR

**CASING:**

**TYPE OF BORING:** SFA TO 2.15m

**GROUND WATER OBSERVATIONS:** NO FREE GROUNDWATER OBSERVED

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:
Initials: <i>NSL</i>
Date: <i>23.4.98</i>



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# TEST BORE REPORT

CLIENT: CICI HOUR PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

DATE: 18 MARCH 98  
 PROJECT No.: 27259  
 SURFACE LEVEL:

BORE No. 11  
 SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0					
0.05	BITUMEN				
0.15					
0.3	FILLING - roadbase (sand and gravel)				
	FILLING - black clay and cobble filling				
1	FILLING - brown and dark grey gravelly clay and sand filling				
		S	1.5	1,0,0 N=0	
2			1.95		
2.2	SILTY CLAY - stiff, light orange brown silty clay with sandstone gravel and sand				
3		S	3.0	2,3,11 N=14	
3.3			3.45		
3.6	SANDSTONE - very low to low strength, moderately weathered, light orange brown sandstone				
4	TEST BORE DISCONTINUED AT 3.6 METRES - auger refusal				
5					
6					
7					
8					
9					
10					

RIG: B40

DRILLER: CHITTLEBURGH LOGGED: PARMAR

CASING:

TYPE OF BORING: SFA TO 3.6m

GROUND WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 2.8m

REMARKS:

### SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
□ Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:

Initials: *NSL*

Date: *23-4-98*



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# TEST BORE REPORT

CLIENT: CICI HOUR PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

DATE: 18 MARCH 98  
 PROJECT No.: 27259  
 SURFACE LEVEL:

BORE No. 12  
 SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0					
0.05	BITUMEN				
0.15	FILLING - roadbase (sand and gravel)				
0.5	FILLING - black clay and cobble filling				
1	CLAYEY SAND - light brown, fine to medium grained clayey sand (sandstone cobbles and boulders being crushed by auger - possible filling)	A	1.5		
2					
2.5	SANDY CLAY - light grey mottled red brown, sandy clay	A	3.0		
3					
4					
4.8	TEST BORE DISCONTINUED AT 4.8 METRES - auger refusal	A	4.5		
5					
6					
7					
8					
9					
10					

RIG: B40

DRILLER: CHITTLEBURGH LOGGED: PARMAR

CASING:

TYPE OF BORING: SFA TO 4.8m

GROUND WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 2.8m

REMARKS:

### SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:

Initials:

Date:



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# TEST BORE REPORT

CLIENT: CICI HOUR PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

DATE: 18 MARCH 98  
 PROJECT No.: 27259  
 SURFACE LEVEL:

BORE No. 13  
 SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Test Results	Core Recovery %
0	BITUMEN				
0.05	FILLING - roadbase (sand and gravel)				
0.15	FILLING - black clay and cobble filling				
1					
1.1	CLAYEY SAND - yellow brown clayey sand				
1.2	TEST BORE DISCONTINUED AT 1.2 METRES - auger refusal				
2					
3					
4					
5					
6					
7					
8					
9					
10					

RIG: B40

DRILLER: CHITTLEBURGH LOGGED: PARMAR

CASING:

TYPE OF BORING: SFA TO 1.2m

GROUND WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS:

### SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plastic limit (%)

CHECKED:

Initials: *NSL*  
 Date: *23.4.98*



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# TEST BORE REPORT

CLIENT: FDC CONSTRUCTION & FITOUT PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

PROJECT No: 27259B  
 SURFACE LEVEL: RL 13.26  
 DIP OF HOLE: 90°

BORE No: 14  
 DATE: 18 MARCH 99  
 SHEET 1 OF 1  
 AZIMUTH:

Depth (m)	Description of Strata	Degree of weathering					Graphic Log	Rock Strength					Discontinuities B - Bedding J - Joint S - Shear D - Drill Break	Fracture Spacing (m)				Sampling & In Situ Testing								
		EW	PM	NM	SM	FS		FR	Ex. Low	Very Low	Low	Medium		High	Very High	Ex. Hgt	0.01	0.05	0.10	0.50	1.00	Sample Type	Core Rec. %	RQD %	Test Results & Comments	
0	FILLING - roadbase, brown clay and bricks (Drillers' description)																									
1.4	CLAY - grey brown and red brown clay with ironstone bands (Drillers' description)																									
1.6	SANDSTONE - medium then high strength, moderately to slightly weathered, slightly fractured and unbroken, grey brown and red brown, fine to medium grained, micaceous sandstone																						C	100	100	PL (A)=0.9MPa PL (A)=1.0MPa
2.52																										
3.82																										
4.3	TEST BORE DISCONTINUED AT 4.3 METRES																									PL (A)=2.1MPa
5																										
6																										
7																										
8																										
9																										
10																										

RIG: SCOUT DRILLER: COOPER LOGGED: HOLY CASING: GL TO 1.5m  
 TYPE OF BORING: SFA TO 1.6m, NMLC CORING TO 4.3m  
 WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED WHILST AUGERING  
 REMARKS:

A auger sample	PL point load strength $I_s$ (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:
Initials: <i>GH</i>
Date: 4.9.99



# TEST BORE REPORT

CLIENT: FDC CONSTRUCTION & FITOUT PTY LTD  
 PROJECT: INDUSTRIAL DEVELOPMENT  
 LOCATION: 2-32 JUNCTION ST, CAMPERDOWN

PROJECT No: 27259B  
 SURFACE LEVEL: RL 11.00  
 DIP OF HOLE: 90°

BORE No: 15C  
 DATE: 18 MARCH 99  
 SHEET 1 OF 1  
 AZIMUTH:

Depth (m)	Description of Strata	Degree of Weathering EW, TH, SW, LS, FC	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Discontinuities B - Bedding, J - Joint, S - Shear, D - Drill Break	Fracture Spacing (m) 0.01, 0.05, 0.10, 0.50, 1.00	Sampling & In Situ Testing			
							Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	ASPHALT AND ROADBASE									
0.3	FILLING - clay, brick and sandstone (Drillers' description)									
1.2	FILLING - brown clay (Drillers' description)									
3.8	SANDY CLAY - dark grey sandy clay (Drillers' description)									
5.3	SANDY CLAY - light brown sandy clay (Drillers' description)									
6.4	SANDSTONE - medium strength, moderately and slightly weathered, fractured to slightly fractured, grey brown and red brown, fine grained, micaceous sandstone with very low strength bands									
8.28	SANDSTONE - high strength, slightly weathered, slightly fractured, grey brown, fine to medium grained, micaceous sandstone									
9.5	TEST BORE DISCONTINUED AT 9.5 METRES									

Note: fractures along the bedding caused by drilling are not recorded

RIG: SCOUT

DRILLER: COOPER

LOGGED: HOLY

CASING: GL TO 4.5m

TYPE OF BORING: SFA TO 4.5m, ROTARY TO 6.4m, NMLC TO 9.5m

WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED WHILST AUGERING

REMARKS:

### SAMPLING & IN SITU TESTING LEGEND

A auger sample  
 B bulk sample  
 C core drilling  
 pp pocket penetrometer (kPa)  
 PL point load strength  $I_s$  (50)MPa  
 S standard penetration test  
 Ux x mm dia. tube  
 V Shear Vane (kPa)

CHECKED:

Initials: *GH*

Date: 4-99



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# TEST BORE REPORT

**CLIENT:** FDC CONSTRUCTION & FITOUT PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**PROJECT No:** 27259B  
**SURFACE LEVEL:** RL 10.74  
**DIP OF HOLE:** 90°

**BORE No:** 16A  
**DATE:** 19 MARCH 99  
**SHEET 1 OF 1**  
**AZIMUTH:**

Depth (m)	Description of Strata	Degree of Weathering EW, LM, MW, SW, FS, FR	Graphic Log	Rock Strength Ex. Low, Very Low, Low, Medium, High, Very High, Ex. High	Discontinuities B - Bedding, J - Joint, S - Shear, D - Drill Break	Fracture Spacing (m) 0.01, 0.05, 0.10, 0.50, 1.00	Sampling & In Situ Testing				
							Sample Type	Core Rec. %	RQD %	Test Results & Comments	
0	ASPHALT AND ROADBASE										
0.2	FILLING - brown sand and bricks (Drillers' description)										
1.3	FILLING - grey brown and red brown clay (Drillers' description)										
2.1	CLAY - dark brown clay (Drillers' description)										
3.3	CLAY - soft, dark grey clay (Drillers' description)										
3.9	CLAY - grey brown and red brown clay with ironstone bands (Drillers' description)										
5.6	SANDSTONE - low to medium strength, highly weathered, highly fractured to fractured, yellow brown, fine to medium grained sandstone										
6.03	SANDSTONE - high strength, moderately and slightly weathered, slightly fractured, grey brown and red brown, fine grained, micaceous sandstone with very low to low and medium strength bands										
6.07											
7											PL (A)=1.8MPa
8	- medium to high strength below 8.03m										PL (A)=1.1MPa
8.8	TEST BORE DISCONTINUED AT 8.8 METRES										PL (A)=1.0MPa

Note: fractures along the bedding due to drilling are not recorded

Core loss 230mm  
 6.07m: B 15' planar smooth  
 6.19m: B 0' clayey sand veneer  
 6.21m: B 5' 1-2mm clayey sand  
 6.84m: B 20' 3mm clayey sand  
 7.75m: B 5' 2-3mm sandy clay  
 7.95m: B 15' 1-2mm sandy clay  
 8.05m: B 5' sandy clay veneer  
 8.15m: J 45' undulating smooth

**CASING:** GL TO 4.5m

**RIG:** SCOUT **DRILLER:** COOPER **LOGGED:** HOLY

**TYPE OF BORING:** SFA TO 4.5m, ROTARY TO 5.8m, NMLC TO 8.8m

**WATER OBSERVATIONS:** FREE GROUNDWATER OBSERVED AT 3.8m WHILST AUGERING

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A auger sample	PL point load strength $I_s$ (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

<b>CHECKED:</b>
Initials: <i>GH</i>
Date: <i>4/7/99</i>



# TEST BORE REPORT

**CLIENT:** FDC CONSTRUCTION & FITOUT PTY LTD  
**PROJECT:** INDUSTRIAL DEVELOPMENT  
**LOCATION:** 2-32 JUNCTION ST, CAMPERDOWN

**PROJECT No:** 27259B  
**SURFACE LEVEL:** RL 12.29  
**DIP OF HOLE:** 90°

**BORE No:** 17  
**DATE:** 19 MARCH 99  
**SHEET 1 OF 1**  
**AZIMUTH:**

Depth (m)	Description of Strata	Degree of weathering					Graphic Log	Rock Strength					Discontinuities				Fracture Spacing (m)	Sampling & In Situ Testing			
		EX	LM	SW	FS	FC		EX	LM	SW	FS	FC	B - Bedding	J - Joint	S - Shear	D - Drill Break		Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	ASPHALT AND ROADBASE						B														
0.2	SAND - brown sand (Drillers' description)																				
0.9	SANDSTONE - low to medium strength, moderately weathered, slightly fractured, grey brown, fine grained sandstone																				
1.44							X														PL (A)=0.3MPa
1.84							X														
1.84	SANDSTONE - high strength, moderately and slightly weathered, slightly fractured and unbroken, grey brown and red brown, fine to medium grained, micaceous sandstone																				PL (A)=1.5MPa
2.28																					
2.32																					
2.75																					
2.77																					
3.0																					
3.8	TEST BORE DISCONTINUED AT 3.8 METRES																				PL (A)=1.8MPa

**RIG:** SCOUT                      **DRILLER:** COOPER                      **LOGGED:** HOLY                      **CASING:** GL TO 1.0m

**TYPE OF BORING:** SFA TO 1.0m, THEN NMLC TO 3.8m

**WATER OBSERVATIONS:** NO FREE GROUNDWATER OBSERVED WHILST AUGERING

**REMARKS:**

SAMPLING & IN SITU TESTING LEGEND	
A auger sample	PL point load strength $I_s$ (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

<b>CHECKED:</b>
Initials: <i>GH</i>
Date: <i>4.99</i>

