Douglas PARTNERS

GROUNDED EXPERTISE

Specialist Advice

Report on Geotechnical Investigation

Proposed Development

277 The Grand Parade, Ramsgate NSW

Prepared for Bronxx Pty Ltd

Project 230818.00

16 October 2024

Douglas Partners Pty Ltd
ABN 75 053 980 117
douglaspartners.com.au
96 Hermitage Road, West Ryde, NSW 2114
(02) 9809 0666

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

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Reviewer	16 October 2024

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Douglas Partners Pty Ltd
ABN 75 053 980 117
douglaspartners.com.au
96 Hermitage Road, West Ryde, NSW 2114
(02) 9809 0666

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

Report on Geotechnical Investigation
Proposed Development
277 The Grand Parade, Ramsgate NSW

1. Introduction

This specialist advice report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a geotechnical investigation undertaken for a proposed development at 277 The Grand Parade, Ramsgate NSW (the site). The investigation was commissioned by email instructing to proceed dated 06 September 2024 from Jordan Green of Bronxx Pty Ltd and was undertaken in accordance with Douglas' proposal 230818.00.P.001.Rev3 dated 03 September 2024.

It is understood that the proposed development of the site includes demolition of the existing single-storey commercial development (Coles) and construction of a six-storey development with three basement levels. The site is shown on Drawing 1, Appendix B.

The aim of the investigation was to assess the subsurface geological and hydrogeological conditions across the site in order to provide comments on excavations, shoring, foundations and other geotechnical issues relevant to the proposed development.

The investigation included the drilling of five boreholes, installation of four groundwater monitoring wells, permeability testing and laboratory testing of selected samples.

It is understood that this geotechnical investigation report is required to accompany a Development Application (DA) submission to Bayside Council for the proposed development. This report must be read in conjunction with all appendices including the notes provided in Appendix A.

Concurrently with this report, Douglas are undertaking groundwater monitoring and further permeability testing on site which will be followed by the preparation of a Dewatering Management Plan (DMP) which will include further details on the hydrogeological conditions encountered on site and groundwater management.

2. Site description

The site is located at 277 The Grand Parade, Ramsgate NSW. The locality of the site is shown on Drawing 1 in Appendix B. The site spans across multiple lots, listed below:

- Lot 5 in Deposited Plan 613007;
- Lot 6-11 in Deposited Plan 11037; and
- Lot 8 in Deposited Plan 10747.

The site is roughly rectangular in shape, occupying a total area of approximately 0.43 hectares. The site is generally flat, ranging between approximately RL2.5 mAHD and RL3.5 mAHD. The eastern half (roughly) of the site is currently occupied by a single-storey commercial development (Coles). The western half (roughly) of the site is occupied by an on-grade, hardstand carpark.

The site is surrounded by several single and double storey residential and commercial developments to the south and west. The area north of the site consists of hardstand, council owned car parking and paved footpaths. The Grand Parade, classified as a Transport for NSW State Road, is directly east of the site. Botany Bay is located approximately 70 m east of the site boundary.

3. Previous investigations

Douglas has previously undertaken two geotechnical investigations (Douglas ref. 3371, dated March 1972 and 1965, dated April 1993) on the site comprising six cone penetration tests (CPT) to about 12 m depth and seven boreholes to depths between about 0.70 m and 11.5 m. The results of the investigation indicate the site is underlain by fill up to 1 m depth underlain by sand and silty sand soils. Note, no information was acquired regarding the rock profile in these investigations.

JK Geotechnics completed a geotechnical investigation on the site (ref. 34871PHrpt Rev2, dated 4 January 2024) which comprised three CPTs to depths of between about 15 m and 20 m and seven boreholes to depths of between 2 m and 7 m. The results of this investigation generally agree with those from Douglas' previous investigations.

4. Published data

4.1 Geology

The Sydney 1:100 000 Geological Series map indicates the site is mostly underlain by a Beach Ridge System of the Quaternary period. These soils typically comprise quartz sand with minor shell content and interdune (swale) silt and fine sand. The mapping indicates that a small portion along the eastern side of the site is underlain by marine and estuarine beach soils of the Quaternary period. These soils typically comprise quartz sand with varying amounts of shell fragments.

An extensive area west of the site is mapped as Hawkesbury Sandstone of the Triassic period, which typically comprises medium to coarse grained, quartz sandstone with very minor shale and laminite lenses.

An extract of the geology map is shown in Figure 1.

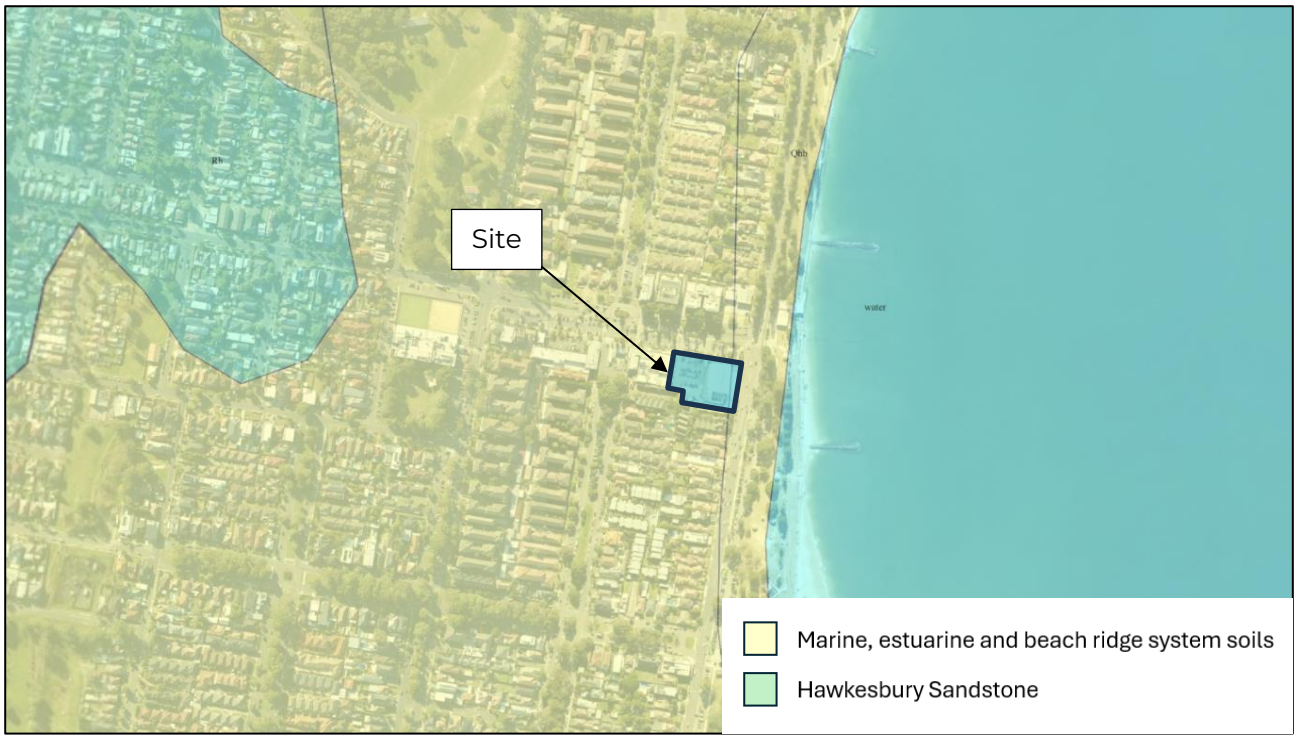

Figure 1: Extract of Sydney 1:100 000 Geological Series map

4.2 Soil landscape

The Sydney 1:100 000 Soil Landscape Series map indicates the eastern half (roughly) of the site is underlain by Narrabeen Beach soils. These soils typically comprise calcareous sand beaches and siliceous sand coastal foredunes over marine sands, with relief up to 20 m and slope gradients up to 45 %. The mapping indicates the western half (roughly) of the site is underlain by Tuggerah Aeolian soils. These soils typically comprise gently undulating to rolling coastal dunefields, with local relief up to 20 m and slope gradients generally 1 – 10 %.

An extract of the soil landscape map is shown in Figure 2.

Figure 2: Extract of Sydney 1:100 000 Soils Landscape map

4.3 Hydrogeology

The proximity of Botany Bay to the site (approximately 70 m east) suggests groundwater levels will be relatively shallow and possibly influenced slightly by tides.

There are several registered groundwater monitoring bores near the site. The groundwater monitoring bores (GW106238, GW107637) indicate a standing groundwater level at about 2.0 m depth. It is noted that most of the monitoring bores do not have recorded standing groundwater levels.

There are also several groundwater spears near the site which are registered for 'domestic use'. Some of these registered spears (GW106419, GW106113) have recorded standing groundwater levels of about 1.8 m to 2.0 m depth.

4.4 Acid sulfate soils

Published Acid Sulfate Soils (ASS) mapping (NSW Department of Environment and Climate Change based on published 1:25,000 Acid Sulfate Soil Risk Mapping, 1994-1998) indicates the site has a low probability for ASS occurrence. ASS are generally not expected in the area, although highly localised occurrences may occur especially near boundaries with environments with a high probability of ASS occurrence. An extract of the ASS mapping is shown in Figure 3.

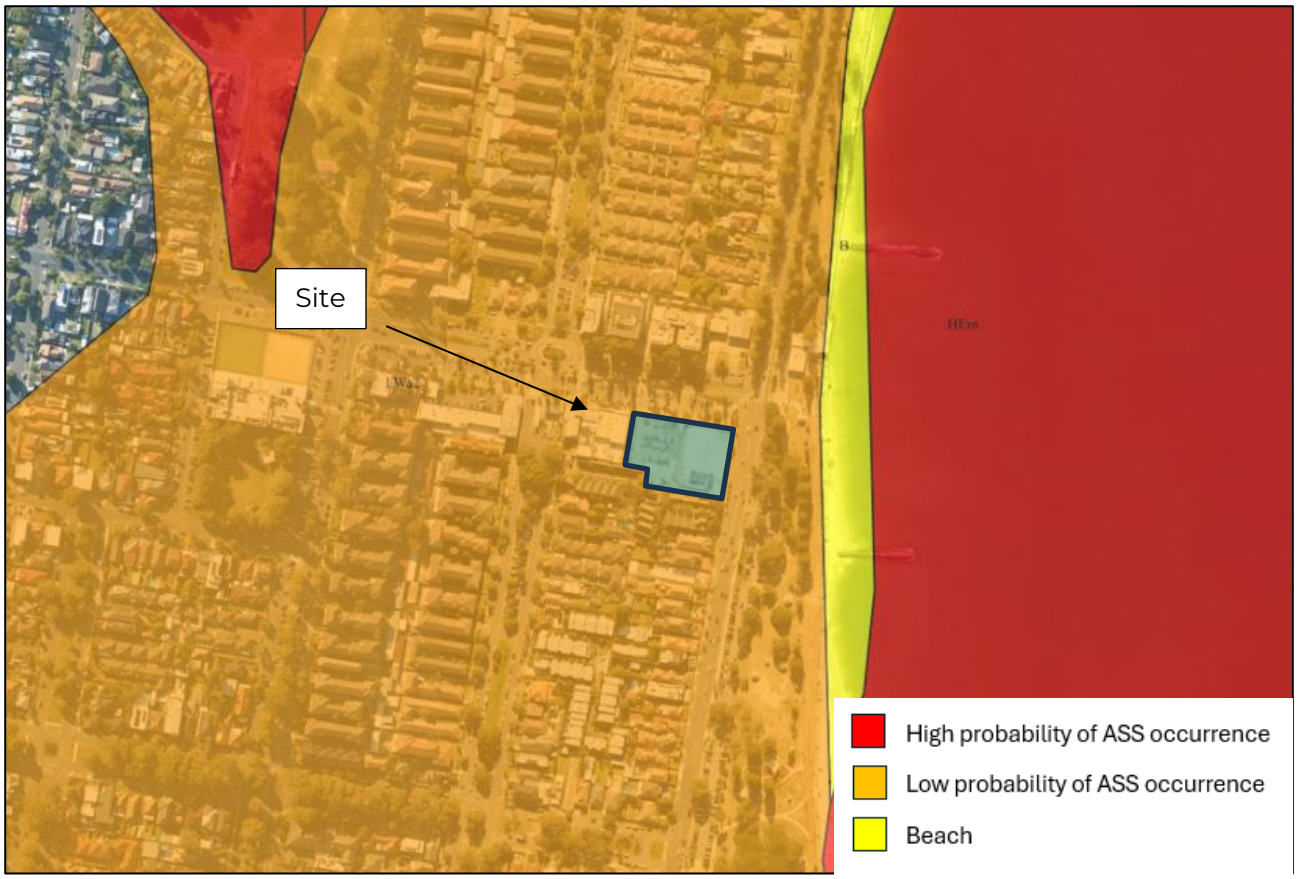

Figure 3: Extract of ASS risk mapping

4.5 Salinity

Dryland salinity risk and hazard mapping was undertaken in 2000 by the former NSW Government Departments of Land and Water Conservation to show the broad distribution of areas considered as having a high salinity risk or hazard. The site is not located within a zone mapped as having a salinity potential.

While outside of the areas of mapped dryland salinity, saline conditions may be present at the site due to the saline water of Botany Bay.

5. Field work

5.1 Field work methods

Field work comprised the drilling of five boreholes (BH01 to BH05) between 19 – 28 September 2024 with Comacchio Geo205 and Comacchio Geo305 tracked drilling rigs. Boreholes were drilled to depths ranging between 23.68 m and 28.20 m.

Drilling was undertaken using 110 mm diameter, solid flight augers followed by rotary wash boring techniques to the top of weathered rock. Disturbed samples were collected from the augers to assist with soil identification. Standard penetration tests (SPTs) were carried out to assess the *in-situ* soil strength and to collect disturbed samples from each borehole. SPT's were typically undertaken at 1.5 m depth intervals then 3 m intervals below 15 m depth. Boreholes were then extended into the rock profile using NMLC rock coring techniques to obtain continuous rock core samples. Point load strength index (I_{s50}) tests were typically undertaken on the recovered core at 1 m depth intervals.

Supervision of the drilling and logging of the boreholes was completed by an experienced geotechnical engineer from Douglas. Logging was undertaken in general accordance with AS 1726:2017.

At the completion of drilling (termination depth), a "packer" permeability test was undertaken within the rock profile in boreholes BH01, BH02 and BH05. Note, the results of packer testing will be presented separately within the DMP.

At the completion of drilling and testing, a groundwater monitoring well was installed within boreholes BH01, BH02, BH03 and BH05.

Table 1 summarises the borehole spatial and termination depth information. Borehole locations are shown on Drawing 1 in Appendix B.

Table 1: Borehole summary

Borehole	Easting (m)[1]	Northing (m)[1]	Surface RL (mAHD)	Termination Depth (m bgl)[2]
BH01	328773.5	6237869.3	2.8	23.68
BH02	328775.7	6237797.0	3.3	28.19
BH03	328853.1	6237843.4	2.6	25.00
BH04	328769.2	6237820.9	3.0	24.59
BH05	328847.7	6237789.1	2.5	28.20

Notes: 1 – MGA2020 Zone 56
2 – 'bgl' denotes below ground level

Coordinates and surface levels for all borehole locations were recorded using a differential Global Positioning System (dGPS) receiver, which typically has an accuracy of 0.1 m. Coordinates are in GDA2020/MGA Zone 56 format (Geocentric Datum of Australia 2020 base with Map Grid of Australia projection) and levels are relative to Australian Height Datum (AHD).

5.2 Field work results

The subsurface conditions encountered in the boreholes are presented on the engineering logs in Appendix C, along with standard notes defining the descriptive terms and the classification methods used. Groundwater monitoring well installation details are provided on each respective log. The general subsurface profile encountered at the borehole locations may be summarised as follows:

Pavement:	Asphaltic concrete pavement, 100 mm thick, was encountered at borehole BH04;
Fill:	Poorly to moderately compacted gravelly sand, silty sand and sand to depths between 0.6 m and 1.8 m, with varying proportions of other inclusions such as silt, roots, brick and concrete fragments; overlying
Aeolian soils:	Very loose to very dense sands and clayey sands; overlying
Estuarine soils:	Very soft to stiff clays and loose to medium dense clayey sands, encountered in boreholes BH02, BH03, BH04 and BH05 at depths of between 16.2 m and 18.5 m; overlying
Weathered Sandstone:	Inferred extremely weathered sandstone, encountered in boreholes BH03 and BH05 at depths of between 20.5 m and 21 m; overlying
Sandstone:	Medium to coarse grained Hawkesbury Sandstone, encountered at depths of between 17.8 m and 22.25 m.

An organic / sulfurous odour was noted at varying depths, below about 5 m to 10 m in some boreholes.

Groundwater was observed between 2.3 m and 2.5 m depth during auger drilling of the boreholes. It is noted that groundwater levels fluctuate with seasonal influences and other factors such as soil and rock permeability and ground disturbing work nearby to the site. Groundwater levels may also be slightly affected by tidal influence.

A summary of the surface levels and depths at which various strata were encountered during the investigation is presented in Table 2.

Table 2: Approximate Surface levels and Summary of Subsurface Profile at Test Locations

Borehole	Surface RL (mAHD)	Fill thickness (m)	Top of Aeolian Soil		Top Estuarine Soil		Top of Rock	
			Depth (m)	RL (mAHD)	Depth (m)	RL (mAHD)	Depth (m)	RL (mAHD)
BH01	2.8	0.80	0.80	2.00	ne	ne	17.80	-15.00
BH02	3.3	1.80	1.80	1.50	17.30	-14.00	22.05	-18.75
BH03	2.6	0.60	0.60	2.00	18.00	-15.40	21.30	-18.70
BH04	3.0	0.80	0.80	2.20	18.50	-15.50	19.51	-16.51
BH05	2.5	0.80	0.80	1.70	16.20	-13.70	22.25	-19.75

Notes: 1 – 'ne' denotes the material was not encountered

6. Laboratory testing

6.1 Aggressivity

Soil aggressivity laboratory testing was performed on nine selected soil samples at a NATA registered laboratory in Sydney. The results of the laboratory testing are provided in detail in the test report sheets in Appendix D and are summarised in Table 3.

Table 3: Summary of aggressivity test results

Borehole	Depth (m)	Material	pH	Sulfate (mg/kg)	Chloride (mg/kg)	Electrical Conductivity (µS/cm)
BH01	2.50-2.95	Sand	8.3	20	10	34
BH01	13.00-13.41	Sand	8.6	190	10	200
BH02	6.80-7.25	Sand	8.6	170	<10	160
BH02	9.80-10.25	Sand	9.0	90	<10	130
BH03	8.50-8.95	Sandy Clay	8.5	800	25	500
BH03	19.00-19.45	Clay	7.8	460	2200	1800
BH04	4.00-4.45	Sand	9.3	20	10	52
BH04	14.50-14.95	Sand	9.1	10	10	40
BH05	11.50-11.95	Sand	8.0	70	10	200

Notes: Samples were tested as a 1:5 mixture of soil to water.

6.2 Acid Sulfate Soils

ASS screening tests were performed on forty selected soil samples at a NATA registered laboratory in Sydney. The results of the laboratory testing are provided in detail in the test report sheets in Appendix D and are summarised in Table 4.

Table 4: Summary of ASS screening test results

Borehole	Depth (m)	Material	pH_F	pH_{FOX}	Reaction Rate
BH01	2.00-2.10	Sand	7.8	5.5	Medium
BH01	3.00-3.10	Sand	8.3	5.5	Medium
BH01	4.00-4.10	Sand	9.1	6.6	Medium
BH01	5.50-5.60	Sand	8.8	6.4	Medium
BH01	7.00-7.10	Sand	8.8	6.7	High
BH01	8.50-8.60	Sandy Clay	8.8	7.3	Volcanic
BH01	10.00-10.10	Sandy Clay	8.4	6.2	Medium
BH02	6.80-6.90	Sand	8.7	6.6	High

Borehole	Depth (m)	Material	pH_F	pH_{FOX}	Reaction Rate
BH02	8.30-8.40	Sand	8.5	5.9	High
BH02	9.80-9.90	Sand	9.6	4.5	High
BH02	11.30-11.40	Sand	8.8	4.7	Medium
BH02	12.80-12.90	Sand	8.8	6.3	Medium
BH02	17.50-17.60	Clayey Sand	8.4	2.6	Medium
BH02	20.50-20.60	Clayey Sand	7.6	3.9	Medium
BH03	1.00-1.45	Sand	7.1	4.9	Medium
BH03	2.50-2.95	Sand	8.8	6.0	Medium
BH03	4.00-4.45	Sand	9.3	6.5	Medium
BH03	5.50-5.95	Sand	8.8	6.5	Medium
BH03	7.00-7.45	Sand	8.4	6.8	High
BH03	10.00-10.45	Sand	9.5	6.1	High
BH03	11.50-11.95	Sand	8.8	3.3	Medium
BH03	16.00-16.45	Sand	8.6	2.5	Medium
BH03	19.00-19.45	Clay	8.0	6.6	Extreme
BH04	2.50-2.60	Sand	8.0	5.7	Medium
BH04	4.00-4.10	Sand	8.4	6.7	Medium
BH04	5.50-5.60	Sand	8.7	6.5	Medium
BH04	7.00-7.10	Sand	8.4	6.4	High
BH04	8.50-8.60	Sand	8.5	6.5	Medium
BH04	10.00-10.10	Sand	8.8	6.1	Medium
BH04	11.50-11.60	Sand	8.7	5.2	Medium
BH04	13.00-13.10	Sand	8.8	6.9	Medium
BH04	14.50-14.95	Sand	7.7	5.5	Medium
BH05	4.00-4.10	Sand	8.3	6.1	Medium
BH05	5.50-5.60	Sand	8.3	6.1	Medium
BH05	8.50-8.60	Sand	9.5	6.5	Medium
BH05	10.00-10.10	Sand	9.5	4.8	Medium
BH05	11.50-11.60	Sand	8.1	5.1	Medium
BH05	13.00-13.10	Sand	8.3	5.4	Medium
BH05	16.30-16.40	Sandy Clay	8.1	1.8	Volcanic
BH05	19.00-19.10	Sandy Clay	7.4	2.9	Medium

No actual acid sulfate soils (AASS) were detected from the screening. Chromium Reducible Sulphur (SCR) laboratory testing is being undertaken on four selected soil samples that showed signs of potential acid sulfate soils (PASS) at a NATA accredited laboratory, summarised in Table 5. At the time of this report, the results are not yet available and will be provided in subsequent revisions.

Table 5: Summary of ASS test results

Borehole	Depths (m)	Material	pH_{KCl}	SCR (%w/w)
BH02	9.80-9.90	Sand		
BH02	17.50-17.60	Clayey Sand		
BH03	11.50-11.95	Sand		
BH05	16.30-16.40	Sandy Clay		

7. Proposed development

It is understood that the proposed development of the site includes demolition of the existing single-storey commercial development (Coles) and construction of a six-storey development, consisting of two stories for commercial use and four stories of apartments. It is further understood that the development will include three basement levels, which will likely require excavation of about 11 m (or more). A section from the concept drawings for the proposed development is shown in Figure 4 below.

It is also understood that the basement excavation will be "tanked" with a "cut-off" diaphragm wall proposed to be founded in the underlying bedrock.

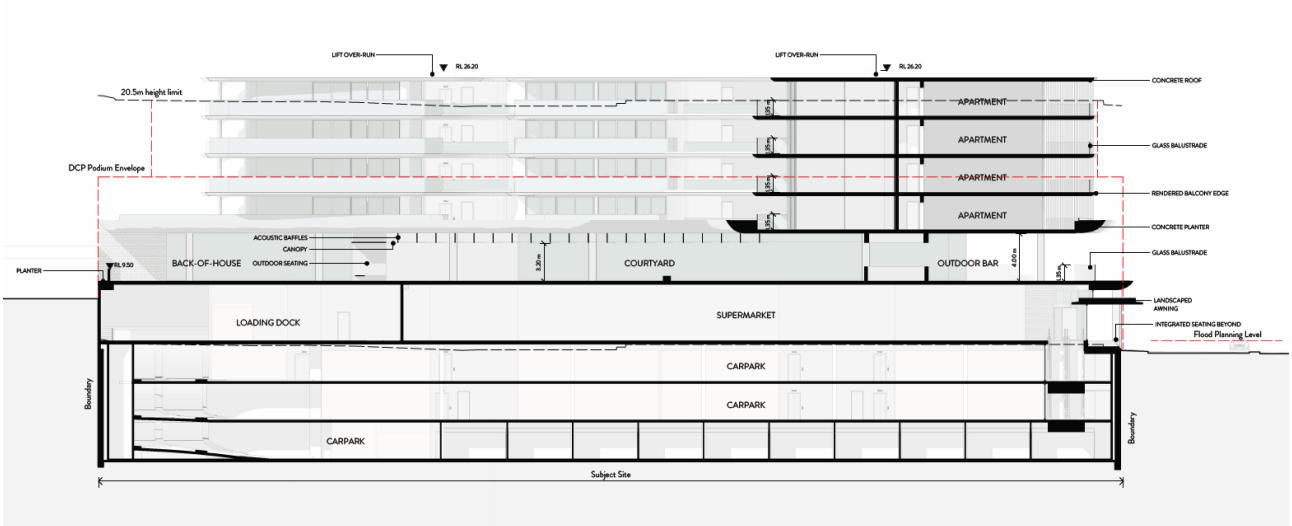

Figure 4: Concept section of proposed development

8. Geotechnical Model

The site appears to be underlain by a variable depth of sandy fill and natural sand overlying sandstone bedrock at depths of between 17.80 m (RL-15.00 mAHD) and 22.25 m (RL-19.75 mAHD). The natural aeolian sands range from very loose to very dense. A variable composition estuarine soil layer was encountered in boreholes BH02, BH03, BH04 and BH05 at depths of between 16.20 m (RL-13.70 mAHD) and 18.50 m (RL-15.50 mAHD). This layer comprised very soft to stiff clays and loose to medium dense clayey sands. The sandstone surface appears to fall towards the southeast. The rock encountered on the western side of the site appears to be generally medium strength or better with minor zones of weaker rock and weathered seams. The rock encountered on the eastern side of the site generally appears to be very low, low and low to medium strength grading to medium strength or better.

Groundwater was generally encountered between about RL0.1 mAHD and RL0.8 mAHD. The measured groundwater levels indicate a flow direction on the site to the east. Groundwater levels will fluctuate with weather, rainfall, possibly tides and other factors.

9. Comments

9.1 Dilapidation surveys

Dilapidation (building condition) reports should be undertaken on surrounding properties prior to commencing work on the site to document any existing defects so that any claims for damage due to construction related activities can be accurately assessed. As a minimum this should include the adjacent buildings to the south and west of the site, and road pavements and infrastructure to the north and east.

9.2 Site preparation

Trafficability of the site soils during bulk earthworks is likely to be difficult and will generally require the use of tracked plant and machinery.

It is expected that the exposed material at bulk excavation level will comprise very loose to very dense sand. To improve trafficability, the material at bulk excavation level could be covered with a layer of granular filling (e.g., crushed concrete, or similar) to act as a temporary working surface and / or a permanent subbase below the basement floor slab. The thickness of the gravel layer / working platform should be based on an assessment of the ground conditions following bulk excavation and the type of plant that is proposed to be used on the site.

The material exposed at bulk excavation level should be compacted using an appropriately sized smooth drum roller prior to placement of the working platform. It may be beneficial to place a layer of fine crushed rock to confine the sand during compaction. The compaction should be inspected by a geotechnical engineer (proof roll) to help identify any soft or heaving areas. Further specification on the compaction (i.e. roller weight, number of passes) should be outlined as part of the working platform assessment.

9.3 Excavations

It is anticipated that excavations of about 11 m (to RL-8 mAHD) will be required for the proposed development. Excavation through the fill and natural soils should be readily undertaken using conventional earthmoving equipment such as tracked hydraulic excavators.

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the Waste Classification Guidelines (EPA 2014) and in accordance with any recommendations provided in contamination reports produced for the site.

9.4 Groundwater and dewatering

9.4.1 Dewatering and tanking requirements

Based on the anticipated depth of excavation and measured groundwater levels, bulk excavation level will be approximately 9 m below the groundwater table. Temporary dewatering will be required to remove water already beneath the site and that which flows under the perimeter shoring wall as the excavation proceeds. It should be noted that that groundwater levels fluctuate with seasonal influences, prolonged periods of rainfall and other factors such as soil and rock permeability and ground disturbing works nearby to the site. Groundwater levels may also be slightly affected by tidal influence.

Temporary dewatering will be required to control and temporarily lower the groundwater table to allow construction of the tanked basement. Generally the groundwater level should be lowered to at least 1 m below the bulk excavation to allow machinery to operate and traverse the site. On this basis, the groundwater level may need to be temporarily lowered by approximately 10 m (to RL-9 mAHD).

Given the depth that the groundwater level is required to be lowered, it is suggested that the use of a relatively impermeable shoring system should be adopted, with the shoring walls socketed below the bulk excavation and at least 2 m into consistent bedrock. This would be expected to reduce groundwater inflows into basement excavations below the groundwater table and also reduce drawdown of groundwater levels on adjacent properties to more acceptable levels.

The sandy soils are expected to be highly permeable, and a water-tight or 'tanked' basement will therefore be required on the site. It is not possible to accurately predict future groundwater levels and response to extreme rainfall events, climate change, damming due to the cut off walls and tanked basements on the site and adjacent sites, and other factors. An allowance for a potential rise in groundwater levels of at least 1.5 m above maximum measured levels, should be made in the design. If it is necessary to eliminate the risk of buoyancy issues for tanked structures then the design could incorporate hydrostatic relief 'valves' or 'portals' at the adopted design water level to prevent structural damage, in the event that water levels rise to above the adopted design level.

Additional monitoring of groundwater levels is being undertaken to obtain more detailed information on likely fluctuations in groundwater levels.

9.4.2 Methods of dewatering

Dewatering should be undertaken with spears installed at regular spacings within the confines of the excavation. The spears (slotted PVC pipes) should be installed below the groundwater table and generally spaced at about 1 m to 2 m centres around the perimeter of the excavation. Due to the size of the site intermediate spears or larger diameter wells will be required across the site. The spears should be connected by a series of pumps and hoses which collect and transport the groundwater to a sedimentation tank, prior to treatment (if required) and discharge off-site. Sump and pump dewatering methods are unlikely to be practical nor effective for the high permeability sandy soils.

The dewatering system design should give due consideration to drawdown effects on adjacent properties and dewatering of the site should be carried out by a contractor with demonstrated experience in similar conditions.

9.4.3 Groundwater disposal

Groundwater that is removed from the site will require disposal. Generally, groundwater should be suitable for disposal by pumping to stormwater drains, subject to confirmation testing, treatment if necessary, and approval from Council. Testing and reporting will be required to determine appropriate disposal options, together with approval from relevant authorities (i.e., Bayside Council and / or Water NSW).

9.5 Shoring

Vertical excavations in fill and natural soils will not be self-supporting and will need to be temporarily and permanently supported by shoring walls.

Although not expected for this site, if battering is required within the shored excavation, then the soils above the groundwater table should be temporarily battered at no steeper than 1.5H : 1V. Excavations below the ground water surface will collapse immediately on excavation, irrespective of the batter grade, and are not possible. Surcharge loads should be kept well back from the crest of any batters.

9.5.1 Suitable shoring wall systems

Due to the depth of excavation proposed it is suggested that a diaphragm wall may provide the most appropriate solution for this site and may be used as the permanent basement wall. These walls are associated with lower risk but are relatively slow to construct and consequently more expensive. Diaphragm walls are constructed using a large grab, which excavates the soil and rock in panels which are supported by bentonite fluid. Each panel is then cast using concrete tremmied into the bentonite supported excavation, with reinforcement cages installed prior to the concrete being tremmied. The joints between the panels are sealed with a waterstop so that a completely water-tight wall is achieved.

A secant pile wall may be considered comprising interlocking Continuous Flight Auger (CFA) piles or CFA piles with jet grouted columns between the piles. This shoring system can generally provide an effective seal to minimise sand loss and water inflow from behind the wall, and if adequately supported, minimise lateral deflections. The hard (reinforced) piles can be incorporated into the vertical load carrying footing system and can generally form part of the basement structure. The depth of the wall to rock however may result in some misalignment and gaps in the wall which should be discussed with the specialist contractor. Cased secant piles may be required to improve alignment and also to help reduce risks associated with decompression of the soils.

For CFA piles, care will be required to avoid 'decompression' of the sandy soils during augering, which can lead to the loosening of the foundations and settlement and consequent damage to adjacent structures. This is worse where drilling into rock is required, and it becomes more difficult to control the penetration and rotation of the augers to avoid drawing in sand. It may be necessary to adopt temporary segmental casing to reduce the risk of decompression.

Soil mixed wall systems may also be considered as an alternative to the more conventional secant pile wall. These walls are constructed using specialised equipment to blend cement with the in-situ soils to create a soil-cement mix. Universal Column sections are usually installed into the wet soil-cement mix at regular intervals along the wall to provide additional stiffness and to act as load-bearing columns. There are several different systems available and further advice should be obtained from the specialist piling contractor regarding the suitability of the wall system to this site. In particular, confirmation should be sought in relation to the consistency/strength of the soil mixed wall and its long-term durability. The wall may have higher permeability and less effective mixing in clayey soils and rock.

9.5.2 Retaining wall design

Suggested parameters for the design of shoring walls are provided in Table 6. Details of adjacent building footings and basements should be confirmed for detailed design of the shoring walls.

Table 6: Recommended design parameters for shoring system

Material	Unit Weight (kN/m³)	Earth Pressure Coefficient K_a (Active)	Effective Cohesion c' (kPa)	Effective Friction Angle (°)	Young's Modulus E (MPa)
Sand: very loose – loose	17	0.4	0	27	10
Sand: medium dense	20	0.35	0	32	40
Sand: dense	20	0.25	0	35	60
Sand: very dense	20	0.25	0	38	80
Sandstone: very low - low strength	22	0.15	50	38	300
Sandstone: medium strength	23	0	500	45	2000

To minimise ground (and wall) movements, the Active Earth Pressure coefficient (Ka) should generally be increased by 50% where retaining walls are close to existing structures and services. Where small movements of retaining walls are acceptable, away from buildings, roads and services, they may be designed for the 'active' (Ka) condition.

It is expected that the shoring wall will be socketed into rock below the bulk excavation level. For sockets in rock below bulk excavation level an allowable passive pressure of 500 kPa in low strength rock and 1000 kPa in medium strength rock may be adopted.

It is suggested that a groundwater level to at least RL 2.5 mAHD should be adopted for long term shoring design. This must be reviewed following longer term monitoring of groundwater levels.

In design of the retaining walls due allowance should be made for surcharge loads including adjacent footings and plant operating above the excavation during construction.

Detailed design of shoring should preferably be carried out using PLAXIS or other widely used computer analysis programs capable of modelling progressive excavation and anchoring and predicting potential lateral movements, stresses and bending moments.

9.5.3 Ground anchors

It is presumed that temporary anchors or stiff propping will be used to restrict wall movements during the construction phase, with permanent support of walls provided by the final basement structure. The preliminary design of temporary ground anchors for the support of shoring / retaining systems may be carried out on the basis of the parameters given in Table 7.

Table 7: Recommended parameters for anchor design

Material	Soil Friction Angle
Loose sand	27°
Medium dense sand	32°
Dense sand	35°
Very Dense Sand	38°

The parameters given in Table 7 assume that the drilled holes are clean and adequately flushed. The anchors should be bonded behind a line drawn up at 45 degrees from the base of the bulk excavation, and 'lift-off' tests should be carried out to confirm the anchor capacities. It is suggested that ground anchors should be proof loaded to 125% of the design working load and locked-off at no higher than 80% of the working load. Post-grouting techniques may be used to achieve higher capacities. Installation of ground anchors should be undertaken under the supervision of a geotechnical engineer.

The anchors will need to be carefully positioned and possibly inclined at steeper angles to avoid adjacent services and footings for adjacent buildings. It is noted that permission from adjacent property owners will be required prior to installing soil anchors beneath their land.

It is recommended that only reputable, specialist anchor contractors be engaged to design and / or install temporary anchors on this site due to the complexities involved with penetrations within the shoring wall and installation of ground anchors in sands.

As a guide, well designed and properly restrained shoring walls in sand supported by anchors may experience lateral wall movements in the order of 1 mm to 2 mm for each metre of excavation height. The extent of movement will depend on the final design and construction methods used. A programme of precise survey monitoring should be adopted to assess shoring wall and adjacent building movement progressively during the excavation to ensure that tolerable limits are not exceeded and to provide an early indication of whether additional support is required.

9.5.4 Adjacent foundations

Consideration may be given to stabilising and / or underpinning the foundations beneath neighbouring properties, which may comprise shallow strip and pad footings. This would improve the strength of the sands and also help to reduce, but not eliminate, differential movements. This may be achieved through grout injection or chemical stabilisation. Further advice should be obtained from specialist contractors regarding the suitability of stabilisation / underpinning at this site.

9.6 Foundations

It is expected that the exposed material at bulk excavation level will comprise very loose to very dense sand with weathered rock about 7 – 12 m below bulk excavation level. It is recommended that the building is uniformly supported on rock to provide consistent foundation strata and to avoid potential issues with excessive differential settlements. Individual pad and strip footings on the sand at bulk level are not recommended for this site due to the potential for excessive and unpredictable differential settlement. A raft slab may be considered however this will require very careful design and consideration of differential settlements between shallow to deep soil profiles with variable strength. The raft slab would likely be tied into the shoring wall which will be founded uniformly on rock. A piled raft system would most likely need to be considered for this site due the variable soil profile and limited capacity of very loose to loose sand.

9.6.1 Pile foundations

Structural loads could be transferred into the underlying bedrock by the use of CFA piles. These piles should be socketed into very low to low strength or stronger rock. Recommended design pressures for piles founded in rock are presented in Table 8.

Table 8: Recommended design parameters for pile foundation design

Material	Maximum Allowable Pressure		Maximum Ultimate Pressure		Young's Modulus E' (MPa)
	End Bearing (kPa)	Shaft Adhesion (kPa)[1]	End Bearing (kPa)	Shaft Adhesion (kPa)[1]	
Very low to low strength sandstone	1 000	100	3 000	150	100
Medium strength sandstone	3 500	350	20 000	800	350

Notes: 1 – Shaft adhesion parameters provided for compression loading. Values should be halved for tension loads

Standard bored piles socketed within bedrock could be considered but would require temporary casing to rock, and dewatering of piles holes or tremmie pouring of concrete to the bottom of the pile. This method can be problematic if the casing is not sealed into rock, or if sandy layers are encountered in the rock.

It should be noted that the serviceability limit-state is likely to govern the design of the piles and the ultimate bearing pressures provided in Table 8 are unlikely to be achieved within the limits of serviceability. A geotechnical strength reduction factor (ϕ_g) should be applied to the ultimate values provided in Table 8 if the limit-state design process is undertaken to design the piles. Australian Standard AS2159–2009 "Piling – Design and Installation" provides information on how to determine an appropriate value of ϕ_g which is based on a risk assessment. The pile designer will need to confirm a ϕ_g value when the piling contractor is selected.

Settlement of a pile is dependent on the loads applied to the pile and the foundation conditions in the socket zone and below the pile toe. The total settlement of a footing designed using the 'allowable' parameters provided in Table 8 would be expected to experience total settlements of less than 1% of the footing width/pile diameter under the applied working load. Serviceability analysis should be undertaken if the ultimate bearing pressures (incorporating a suitable reduction factor) are used to proportion the piles.

All footing / pile excavations should be inspected by a geotechnical engineer to confirm that foundation conditions are suitable for the design parameters.

9.6.2 Raft slab

Consideration may be given to the use of a raft slab footing system; however, this will be subject to detailed review and analysis of bearing pressures and settlements. Further investigation using cone penetration tests (CPTs) should be carried out to provide more detailed information on soil strength and design parameters if a raft slab is to be considered and when more specific details of the founding level, column layout and slab loadings have been confirmed. As the bedrock surface beneath the site is not uniform, particular care will be needed in designing a raft slab, as potential settlements will be greater where the depth to rock increases. Additionally, the presence of weak soils below the raft slab should be carefully considered for concentrated column and shear core loadings.

A piled raft foundation would most likely be required to reduce differential settlements, if required.

9.7 Seismic loading

In accordance with AS1170-2007 "Structural Design Actions, Part 4: Earthquake Actions in Australia" a hazard design factor (Z) of 0.08 and a site subsoil Class Ce or De is considered to be appropriate for the site. Further review of the average profile will be required to try and justify a Ce due the presence of very loose and soft clay.

9.8 Aggressivity

The laboratory test results indicate that the soil samples tested are non-aggressive to mildly aggressive to buried concrete and non-aggressive to buried steel elements in accordance with the provisions of Australian Standard AS 2159 – 2009 *Piling – Design and installation*.

9.9 Acid sulfate soils

The ASS screening have been compared with the assessment criteria in the following guidelines:

- Acid Sulphate Soils Management Advisory Committee (ASSMAC) *Acid Sulphate Soils Management Guidelines* (1998) (ASSMAC, 1998); and
- QASSIT/Qld NRM&E/SCU/NatCASS/QASSMAC/ASSMAC *Acid Sulphate Soils Laboratory Methods Guidelines Version 2.1 – June 2004*. Published by Department of Natural Resources, Mines and Energy, Indooroopilly, Queensland, Australia (Qld NRM&E, 2004) (this guideline supersedes the laboratory section of ASSMAC, 1998).

This assessment criteria for ASS screening may be summarised below:

- pH_F (pH in water)
  - $pH_F \leq 4$ indicates actual acid sulfate soils are present; and
  - $4 < pH_F < 5.5$ indicates the soil is acidic. This may be as a result of limited oxidation of sulfides but may also be as a consequence of the presence of organic acids.
- pH_{Fox} (pH in hydrogen peroxide)
  - $pH_{Fox} < 3$, plus a strong reaction with peroxide, plus a pH_{Fox} value of at least one pH unit below pH_F, strongly indicates a potential acid sulfate soil (PASS). The higher the reaction, the lower the drop between pH_F and pH_{Fox}, and the lower the pH_{Fox} value, the higher the potential for PASS;
  - $3 < pH_{Fox} < 4$ is less positive. Laboratory results (POCAS with or without S_{CR}) are recommended for confirmation of sulfides;
  - $4 < pH_{Fox} < 5$ is neither positive nor negative, as some sulfides may be present in small quantities. Some laboratory testing is recommended; and
  - $pH_{Fox} > 5$ and little or no drop from pH_F to pH_{Fox} indicate little net acid generating ability. Acid generation can be buffered, however, by carbonate material in the samples (such as shell fragments). Again, some laboratory testing should be performed.

Some pHFox results were less than 4 pH units and more than one pH unit below the respective pHF results. These screening test results were considered to be possibly indicative of potential acid sulphate soils (PASS). The results of SCR testing are not yet available and will be provided in subsequent revisions of this report.

Further confirmation testing for ASS / PASS should be carried out across the site during future site investigations as the extent of PASS can vary vertically and laterally within short distances.

10. **Conclusion**

The subsurface profile encountered within the current investigation is generally consistent with the subsurface profile encountered during the previous investigations undertaken on site (refer Section 3).

The following further investigations / assessments will be required for detailed design:

- A geotechnical assessment of the impacts of the proposed development on nearby Sydney Water assets and The Grand Parade which is a TfNSW asset;
- Additional boreholes generally extending at least 4 - 5 m into bedrock will be required across the site post demolition of the existing development to supplement the information from this investigation. The additional boreholes along the eastern boundary (adjacent to The Grand Parade) should consider the requirements of TfNSW Technical Direction Geotechnology GTD 2020/001 Version No.01 – 2 July 2020;
- Additional CPT's extending to the top of bedrock (or prior refusal) will be required post demolition of the existing development to supplement the information from this investigation;
- A geotechnical assessment of the impacts of the proposed development on neighbouring developments / structures; and
- Ongoing groundwater monitoring from wells and inflow assessment and Dewatering Management Plan.

A Geotechnical Hydrogeological and Vibration Monitoring Plan (GHVMP) will also be required.

Douglas was provided with a report prepared by Morrow titled "Geotechnical Review of Updated Documentation, 277 The Grand Parade, Ramsgate Beach NSW, Ref P3052_02, dated 23/02/2024. The report was prepared for the Owners' Corporation of Strata Plan 46143 at 86-88 Alfred Street, Sans Souci Beach NSW. The following comments are provided in response to the conclusions of the Morrow report in corresponding order:

- Two deep rock cored boreholes (BH03, BH05) have been drilled adjacent to The Grand Parade. An additional borehole will be required along the boundary when access permits (post demolition) to satisfy the TfNSW Technical Direction GTD 2020/001 borehole spacing requirement (30 m). The investigation information will then be used to inform detailed design and impact assessment for The Grand Parade;
- Geotechnical assessment for Sydney Water assets will be undertaken as part of the detailed design. The additional investigations will inform this analysis;

- Four groundwater monitoring wells have now been installed on site and long term monitoring is underway to comply with Water NSW Minimum Requirements;
- Five rock cored boreholes have been drilled which is sufficient for the current stage of development planning. Additional boreholes will be drilled post demolition to inform detailed design and planning;
- Additional CPTs will be undertaken post demolition to inform detailed design and planning. Note, the current site access would require a small CPT rig which is likely unable to penetrate to rock;
- Assessment of neighbouring footings will be carried out for detailed design and until then conservative assumptions on the footings will be made to inform preliminary design;
- The vibration limit will be assessed once a review of the surrounding buildings is undertaken. A vibration limit of 3 mm/s is not unreasonable for sensitive buildings founded at high level on loose sand;
- A Geotechnical Monitoring Plan will be prepared prior to CC withhold points as noted; and
- The design will adhere to the requirements of the Design and Building Practitioners Act 2020 where required.

11. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 277 The Grand Parade, Ramsgate NSW in line with Douglas' proposal dated 03 September 2024 and acceptance received from Jordan Green of Bronxx Pty Ltd dated 06 September 2024. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Bronxx Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and / or their agents.

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

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

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

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

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

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

Appendix A

About This Report

About this Report

October 2024

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas 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, Douglas 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, Douglas will be pleased to assist with investigations or advice to resolve the matter.

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, Douglas 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. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

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

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Appendix B

Drawings

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	11.10.2024	EC

SCALE: 0 6 12 18 24 30 m
1:600 @ A3

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

CLIENT: **Bronxx Pty Ltd**

NOTE:
1: Basemap from Metromap (Dated 14.07.2024)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME: **Proposed Development**

PROJECT ADDRESS: **277 The Grand Parade, Ramsgate Beach**

DRAWING TITLE: **Test Location Plan**

PROJECT NO: **230818.00**

DRAWING NO: **1**

REVISION: **0**

Appendix C

Terminology, Symbols and Abbreviations

Soil and Rock Descriptions (optional)

Sampling, Testing and Excavation Methodology

Borehole Logs

Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

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

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

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

Abbreviation Codes

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

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

Data Integrity Codes

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

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

Graphic Symbols

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

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Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

Introduction

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

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

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

Particle size designation and Behaviour Model

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

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

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

[1] – refer grain size subdivision descriptions below

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

Component proportions

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

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

[1] As defined in AS1726-2017 6.1.4.4

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

Composite Materials

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

Soil Descriptions

Classification

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

Soil Name

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

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

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

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

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

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

Identification of minor components

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

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

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

Soil Composition

Plasticity

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

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

Grain Size

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

Grading

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

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

Soil Condition

Moisture

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

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

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

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

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

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

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

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

Consistency (fine grained soils)

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

Relative Density (coarse grained soils)

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

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

Compaction (anthropogenically modified soil)

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

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

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

Soil Origin

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

Cobbles and Boulders

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

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

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Rock Strength

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

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

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

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

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

Degree of Alteration

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

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

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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.

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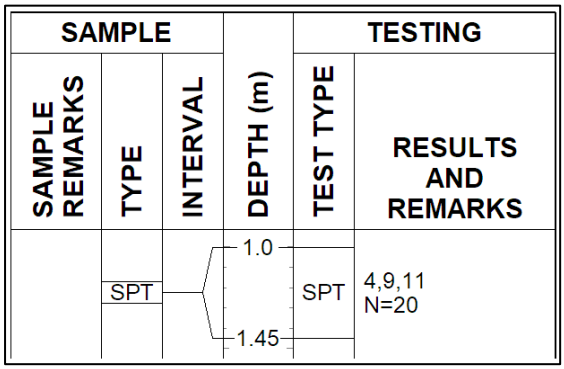
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

October 2024

Sampling and Testing

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



Sampling

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

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

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

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

Field and Laboratory Testing

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

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

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP9/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

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

Drilling or Excavation Methods/Tools

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

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

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

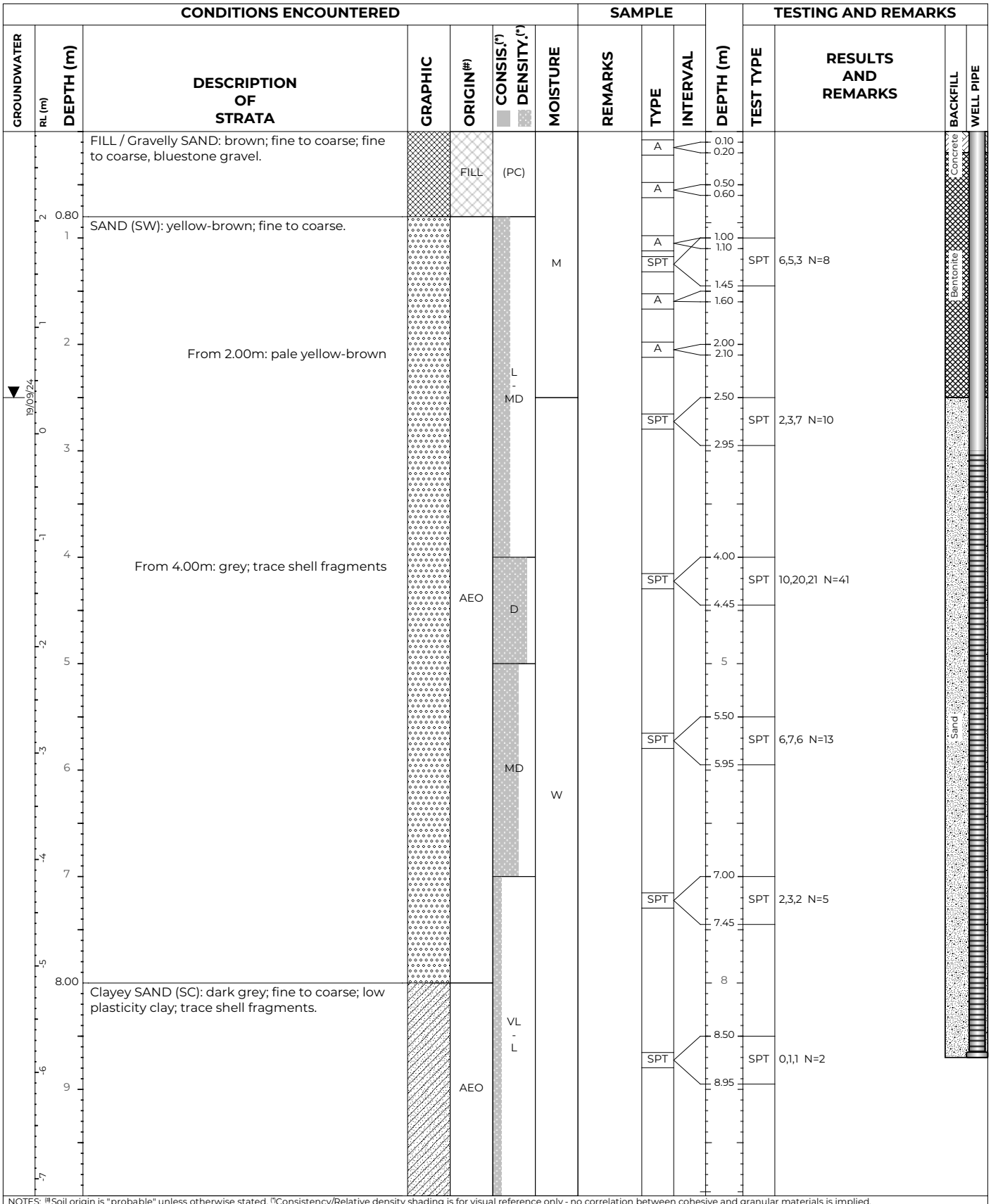
Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.8 AHD
COORDINATE: E:328773.5, N:6237869.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 230818.00
DATE: 19/09/24 - 23/09/24
SHEET: 1 of 4



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.

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

PLANT: Comacchio Geo205
METHOD: AD/T to 2.5m, then WB to 17.8m, then NMLC to 23.68m
REMARKS:

OPERATOR: Groundtest (JJ/CS)

LOGGED: AG
CASING: HW to 3m, then HQ to 17.8m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.8 AHD
COORDINATE: E:328773.5, N:6237869.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 230818.00
DATE: 19/09/24 - 23/09/24
SHEET: 2 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-8	10.70	[CONT] Clayey SAND (SC): dark grey; fine to coarse; low plasticity clay; trace shell fragments. From 10.00m: organic odour (sulfurous)		AEO	VL - L			SPT		10.00 10.45	SPT	1,1,5 N=6		
	-9	11	SAND (SP): grey; fine to medium.								11				
	-9	12							SPT		11.50 11.91	SPT	14,28,22/110		
	-10	13							SPT		13.00 13.26	SPT	25,25/110		
	-11	14			AEO	VD	W				14				
	-12	15							SPT		14.50 14.75	SPT	25,25/100		
	-13	16									15 16				
	-14	17							SPT		16.90 17.00	SPT	25/100 (HB)		
	-15	17.80	Continued as rock								18				
	-16	19									19				
	-17														

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 Geo205
METHOD: AD/T to 2.5m, then WB to 17.8m, then NMLC to 23.68m
REMARKS:

OPERATOR: Groundtest (JJ/CS)

LOGGED: AG
CASING: HW to 3m, then HQ to 17.8m

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.8 AHD
COORDINATE: E:328773.5, N:6237869.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 230818.00
DATE: 19/09/24 - 23/09/24
SHEET: 3 of 4

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, MW, SW, FR; DW)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, 2.00, >2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-8 / 11														11				
	-9 / 12														12				
	-10 / 13														13				
	-11 / 14														14				
	-12 / 15														15				
	-13 / 16														16				
	-14 / 17														17				
	-15 / 18		Continued from soil												18				
			SANDSTONE: pale grey and red-brown, medium to coarse grained; indistinctly bedded at 0-10°. Hawkesbury Sandstone		MW - SW	17.80	M - H									PLT	PL(A)=1.1MPa		
	-16 / 19.00				HW	18.64	VL												
	19.16				XW	18.71	SEAM				18.63m: B, 5°, PR Clay 1mm, RF								
					HW	18.80	VL	94	79	SEAM	18.71m: DS, 90mm					PLT	PL(A)=0.40MPa		
						19.16					19.16m: EW, 340mm				19				
					XW		SEAM			SEAM									
	-17				MW	19.50	M												
					SW	19.85										PLT	PL(A)=0.51MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

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

PLANT: Comacchio Geo205
METHOD: AD/T to 2.5m, then WB to 17.8m, then NMLC to 23.68m
REMARKS:

OPERATOR: Groundtest (JJ/CS)

LOGGED: AG
CASING: HW to 3m, then HQ to 17.8m

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.8 AHD
COORDINATE: E:328773.5, N:6237869.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 230818.00
DATE: 19/09/24 - 23/09/24
SHEET: 4 of 4

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (DW: PS, XW, HW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	20.00 / -18 / 21	SANDSTONE: pale grey and red-brown, medium to coarse grained; indistinctly bedded at 0-10°. Hawkesbury Sandstone		SW	21.10	M	94	79		20.25m: B, 5°, PR, INF Clay 2mm, RF 20.44m: JT, 20°, SN Fe, RF 20.59m: DS 10mm 21.06m: EW, 10mm				21	PLT	PL(A)=0.38MPa		
	-19 / 22				21.90					21.78m: B, 5°, PR, SN Fe, RF 21.85m: JT, 70°, PR, SN Fe, RF 21.91m: B, 0°, PR, SN Fe, RF 22.13m: EW, 10mm				22	PLT	PL(A)=1.2MPa		
	-20 / 23			MW		H	100	95		23.00m: B, 0°, PR Clay 2mm, RF 23.50m: B, 5°, PR, SN Fe, RF				23	PLT	PL(A)=1.7MPa		
	-21 / 24	Borehole discontinued at 23.68m depth. Target depth reached.													PLT	PL(A)=2.7MPa		
	-22 / 25																	
	-23 / 26																	
	-24 / 27																	
	-25 / 28																	
	-26 / 29																	
	-27																	

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo205
METHOD: AD/T to 2.5m, then WB to 17.8m, then NMLC to 23.68m
REMARKS:

OPERATOR: Groundtest (JJ/CS)

LOGGED: AG
CASING: HW to 3m, then HQ to 17.8m

Refer to explanatory notes for symbol and abbreviation definitions

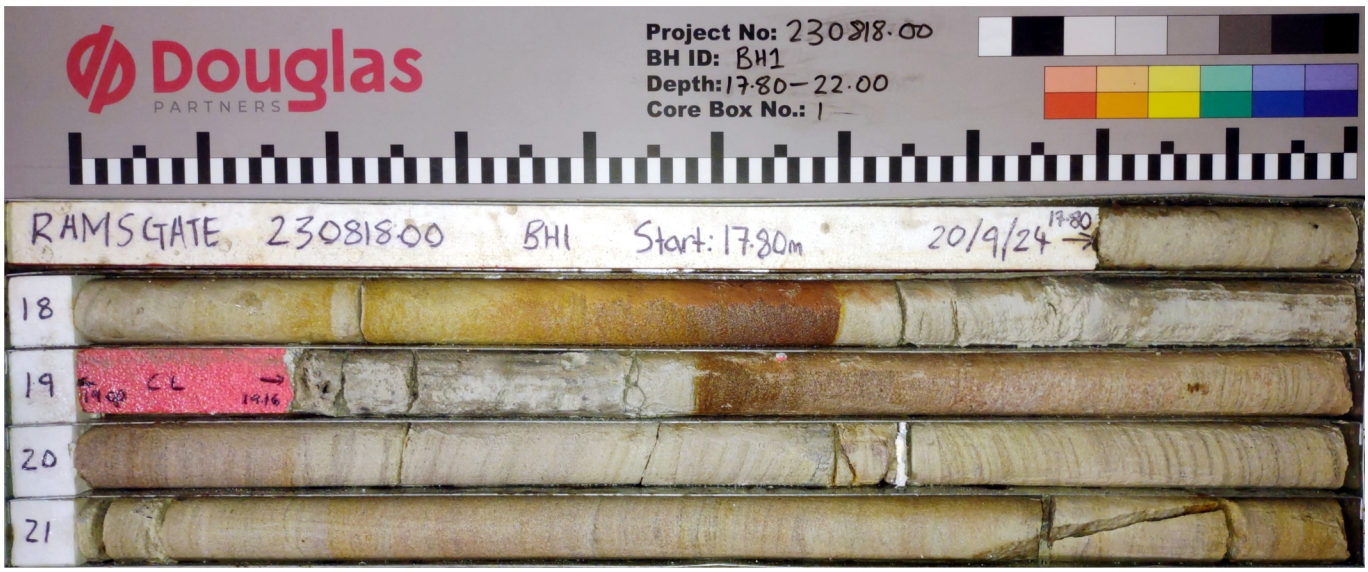
Douglas PARTNERS

CORE PHOTO LOG

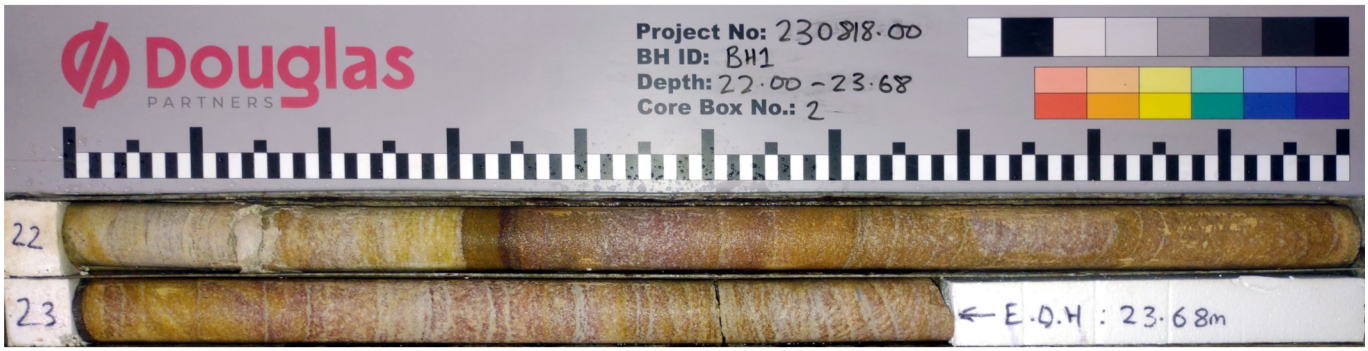
CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.8 AHD
COORDINATE: E:328773.5, N:6237869.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 230818.00
DATE: 19/09/24 - 23/09/24
SHEET: 1 of 1



17.80-22.00 m depth



22.00-23.68 m depth

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.3 AHD
COORDINATE: E:328779.4, N:6237791.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 230818.00
DATE: 23/09/24 - 25/09/24
SHEET: 1 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL	WELL PIPE
	3	0.20	FILL / MULCH			NA	NA		A		0.10 0.20			Concrete	
			FILL / Gravelly SAND: brown and grey; fine to coarse; fine to coarse, bluestone gravel; trace rootlets.		FILL				A		0.40 0.50				
	1					(PC)	D		A		0.90 1.00			Bentonite	
	2	1.30	FILL / Gravelly SAND: brown; fine to coarse; fine to coarse gravel; trace building rubble (brick fragments).		FILL				A		1.40 1.50				
		1.80	SAND (SW): yellow-brown; fine to coarse.				M		A		1.90 2.00				
▼ 23/09/24	1								A		2.40 2.50				
									SPT			SPT	2,2,12 N=14		
	0	3				MD					2.95				
		4							SPT		4.00	SPT	8,25,26/130		
	-1										4.43				
		5			AEO	D - VD					5			Sand	
	-2								SPT		5.30	SPT	13,16,17 N=33		
		6	From 6.00m: grey, slight organic odour (sulfurous)				W				5.75 6				
	-3										6.80				
		7				L			SPT		7	SPT	4,5,2 N=7		
	-4										7.25				
		8									8				
	-5	8.00	Clayey SAND (SC): dark grey; fine to coarse; low plasticity clay. Slight organic odour (sulfurous).						SPT		8.30	SPT	0,0,0 N=0		
											8.75				
	9				AEO	VL					9				
	-6										9.80	SPT			

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 Geo205
OPERATOR: Groundtest (JJ)
LOGGED: RD
METHOD: HA to 0.5m, then AD/T to 2.5m, then WB to 22.05m, then NMLC to 28.19m
CASING: HW to 3.5m, then HQ to 22.05m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

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

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.3 AHD
COORDINATE: E:328779.4, N:6237791.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 230818.00
DATE: 23/09/24 - 25/09/24
SHEET: 2 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS	BACKFILL / WELL PIPE
	-7		[CONT] Clayey SAND (SC): dark grey; fine to coarse; low plasticity clay. Slight organic odour (sulfurous).		AEO	VL			SPT		10.25	SPT	1,0,2 N=2	Sand
		11.00									11			
	-8		SAND (SP): grey; fine to medium.						SPT		11.30	SPT	14,26,25/130	
											11.73			
		12									12			
	-9										12.80			
		13							SPT		13	SPT	16,24,28 N=52	
	-10										13.25			
		14			AEO	VD					14			
	-11										14.30			
									SPT		14.68	SPT	16,31,25/80	
		15					W				15			
	-12													
		16									16			
	-13													
		17									17			
	-14	17.30												
			Clayey SAND (SC): grey; fine to coarse; medium plasticity clay.								17.50			
		18							SPT			SPT	2,4,4 N=8	
	-15				EST	L - MD					17.95			
		19									19			
	-16													

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 Geo205
OPERATOR: Groundtest (JJ)
LOGGED: RD
METHOD: HA to 0.5m, then AD/T to 2.5m, then WB to 22.05m, then NMLC to 28.19m
CASING: HW to 3.5m, then HQ to 22.05m
REMARKS:

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

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.3 AHD
COORDINATE: E:328779.4, N:6237791.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 230818.00
DATE: 23/09/24 - 25/09/24
SHEET: 3 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-17	21	[CONT] Clayey SAND (SC): grey; fine to coarse; medium plasticity clay.		EST	L - MD	W		SPT	20.50 - 20.95	20.50	SPT	3,6,9 N=15		
	-18														
	-19	22.05	Continued as rock												
	-20	23									23				
	-21	24									24				
	-22	25									25				
	-23	26									26				
	-24	27									27				
	-25	28									28				
	-26	29									29				

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 Geo205
OPERATOR: Groundtest (JJ)
LOGGED: RD
METHOD: HA to 0.5m, then AD/T to 2.5m, then WB to 22.05m, then NMLC to 28.19m
CASING: HW to 3.5m, then HQ to 22.05m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.3 AHD
COORDINATE: E:328779.4, N:6237791.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 230818.00
DATE: 23/09/24 - 25/09/24
SHEET: 4 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-17	21													21				
	-18																		
		22	Continued from soil												22				
	-19		SANDSTONE: pale grey, orange-brown and pale red-brown, medium to coarse grained; distinctly and indistinctly bedded at 0-20°. Hawkesbury Sandstone		MW	22.05					22.32m: B, 5°, PR, Clay 1 mm 22.48m: B, 10°, PR, SN Fe, RF								
		23													23	PLT	PL(A)=2.1MPa		
	-20							100	100										
		24			FR	23.85					23.85m: B, 5°, PR, Clay 1 mm				24	PLT	PL(A)=1.9MPa		
	-21					24.75													
		25			MW - SW		H				25.10m: B, 0°, UN, SN Fe, RF 25.40m: EW, 20mm 25.45m: DS, 10mm				25	PLT	PL(A)=2.9MPa		
	-22					25.35													
		26			FR										26	PLT	PL(A)=1.6MPa		
	-23					26.62		100	96		26.55m: B, 5°, PR, SN Fe, RF 26.81m: B, 10°, PR, VNR Clay, RF 26.93m: B, 10°, PR, VNR Clay, RF 27.16m: EW, 35mm								
		27			MW - SW										27	PLT	PL(A)=1.9MPa		
	-24																		
		28													28	PLT	PL(A)=2.7MPa		
	-25																		
		29	Borehole discontinued at 28.19m depth. Target depth reached.																
	-26																		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo205
OPERATOR: Groundtest (JJ)
LOGGED: RD
METHOD: HA to 0.5m, then AD/T to 2.5m, then WB to 22.05m, then NMLC to 28.19m
CASING: HW to 3.5m, then HQ to 22.05m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

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

CORE PHOTO LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.3 AHD
COORDINATE: E:328779.4, N:6237791.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 230818.00
DATE: 23/09/24 - 25/09/24
SHEET: 1 of 1

22.05-26.00 m depth

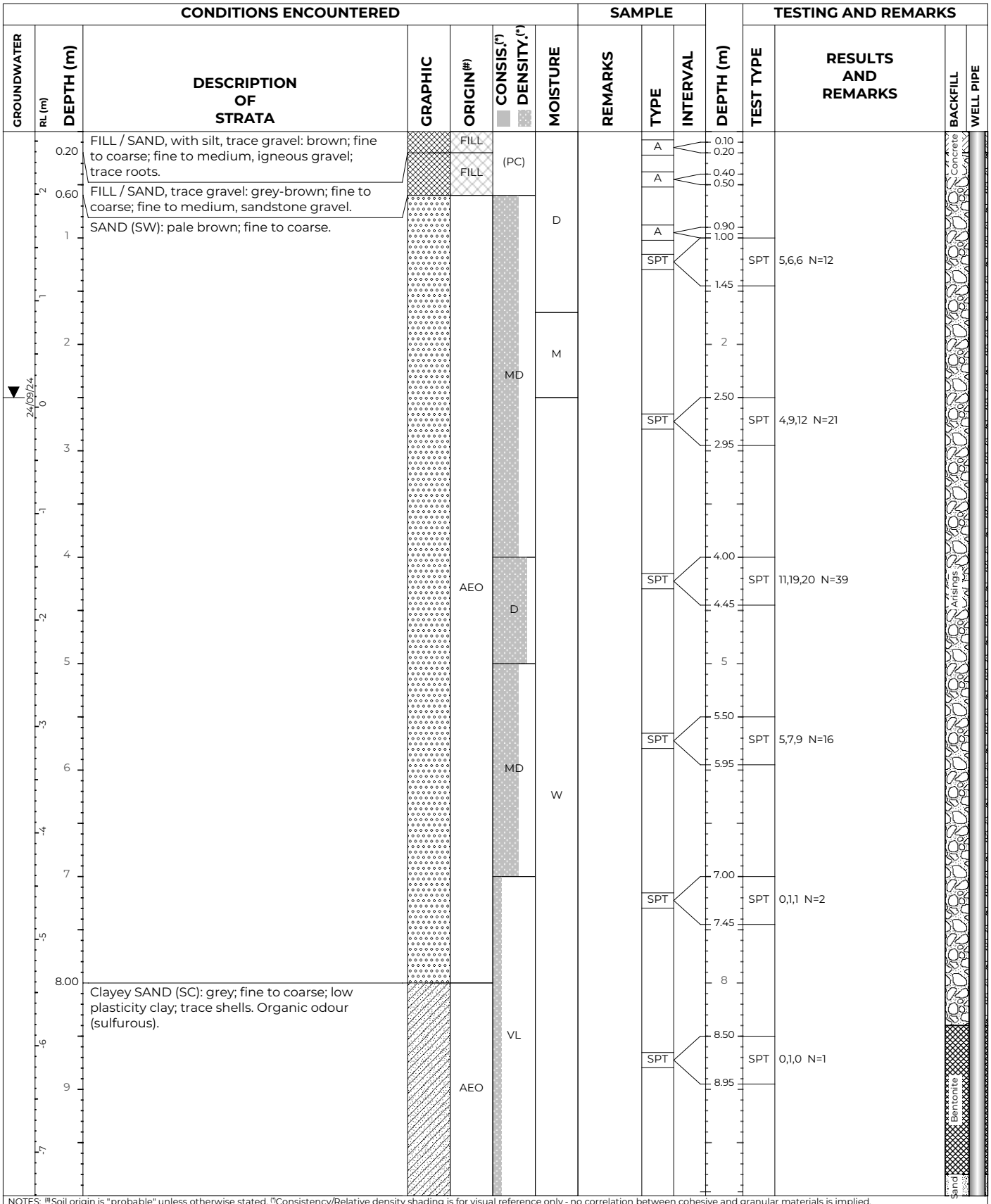
26.00-28.19 m depth

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.6 AHD
COORDINATE: E:328853.1, N:6237843.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 230818.00
DATE: 24/09/24
SHEET: 1 of 4



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.

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

PLANT: Comacchio Geo205
METHOD: AD/T to 2.5m, then WB to 21.3m, then NMLC to 25m
REMARKS:

OPERATOR: Groundtest (LC)

LOGGED: LHS
CASING: HW to 3m, then HQ to 21.3m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.6 AHD
COORDINATE: E:328853.1, N:6237843.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 230818.00
DATE: 24/09/24
SHEET: 2 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
		10.10	[CONT] Clayey SAND (SC): grey; fine to coarse; low plasticity clay; trace shells. Organic odour (sulfurous).		AEO	VL			SPT		10.00	SPT	0,1,5 N=6		
	-8		SAND (SW), trace silt: grey; fine to coarse. Organic odour (sulfurous).			L					10.45				
		11									11				
	-9								SPT		11.50	SPT	6,12,18 N=30		
		12				MD - D					11.95				
	-10														
		13							SPT		13.00	SPT	13,27,25/100	Sand	
	-11										13.40				
		14			AEO		W				14				
	-12														
		15				VD					15				
	-13														
		16							SPT		16.00	SPT	14,28,25/100		
	-14										16.40				
		17									17				
	-15														
		18.00	CLAY (CI-CH), with sand: grey mottled brown; medium to high plasticity; fine sand.								18				
	-16														
		19			EST	VS	w>PL		SPT		19.00	SPT	0,0,0 N=0		
	-17										19.45				

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 Geo205
METHOD: AD/T to 2.5m, then WB to 21.3m, then NMLC to 25m
REMARKS:

OPERATOR: Groundtest (LC)

LOGGED: LHS
CASING: HW to 3m, then HQ to 21.3m

Refer to explanatory notes for symbol and abbreviation definitions

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

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.6 AHD
COORDINATE: E:328853.1, N:6237843.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 230818.00
DATE: 24/09/24
SHEET: 3 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-18 / 20.50	[CONT] CLAY (CI-CH), with sand: grey mottled brown; medium to high plasticity; fine sand.		EST	VS									
	-19 / 21.30	Sandy CLAY (CL-CI): pale grey; low to medium plasticity; fine to coarse sand.		XWM	(St) - (VSt)	w>PL								
		Continued as rock												

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 Geo205
METHOD: AD/T to 2.5m, then WB to 21.3m, then NMLC to 25m
REMARKS:

OPERATOR: Groundtest (LC)

LOGGED: LHS
CASING: HW to 3m, then HQ to 21.3m

Refer to explanatory notes for symbol and abbreviation definitions

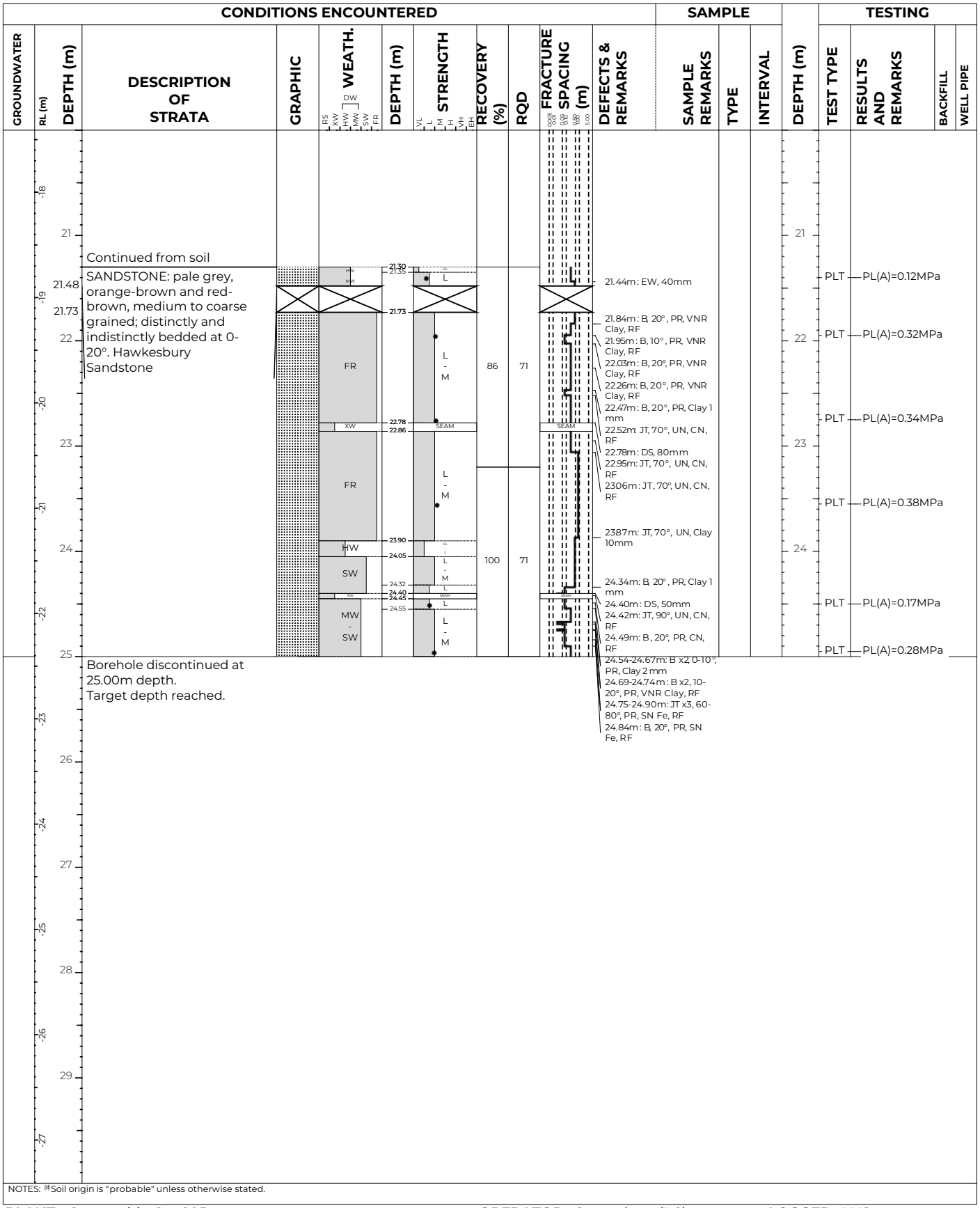
Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.6 AHD
COORDINATE: E:328853.1, N:6237843.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 230818.00
DATE: 24/09/24
SHEET: 4 of 4



NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo205
METHOD: AD/T to 2.5m, then WB to 21.3m, then NMLC to 25m
REMARKS:

OPERATOR: Groundtest (LC)

LOGGED: LHS
CASING: HW to 3m, then HQ to 21.3m

Refer to explanatory notes for symbol and abbreviation definitions

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

CORE PHOTO LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.6 AHD
COORDINATE: E:328853.1, N:6237843.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 230818.00
DATE: 24/09/24
SHEET: 1 of 1

21.30-25.00 m depth

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.0 AHD
COORDINATE: E:328769.2, N:6237819.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 230818.00
DATE: 26/09/24
SHEET: 1 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*]	DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.10	ASPHALTIC CONCRETE			NA		NA		A		0.10 0.20		
			FILL / Gravelly SAND: brown; fine to coarse; fine to coarse, sandstone gravel; trace building rubble (brick and concrete fragments).		FILL	(MC)		M		A		0.50 0.60		
		0.80	SAND (SP): brown; fine to medium.							A		0.90 1.00		
	2 1	1					L	M		SPT		1.45	SPT	3,3,5 N=8
▼ 25/09/24	1 0	2	From 2.50m: pale yellow-brown							SPT		2.50 2.95	SPT	2,4,8 N=12
	0 -1	3					MD							
	-1 -2	4	From 4.00m: pale yellow-brown and pale grey		AEO		D			SPT		4.00 4.45	SPT	11,19,21 N=40
	-2 -3	5										5		
	-3 -4	6					MD	W		SPT		5.50 5.95	SPT	7,9,12 N=21
	-4 -5	7	From 6.70m: dark grey, trace clay and shell fragments							SPT		7.00 7.45	SPT	1,0,1 N=1
	-5 -6	8					VL					8		
	-6 -7	8.50 9	Clayey SAND (SC): dark grey; fine to medium; low plasticity clay. Slight organic odour (sulfurous).		AEO					SPT		8.50 8.95	SPT	0,0,0 N=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
METHOD: AD/T to 3m, then WB to 19.51m, then NMLC to 24.59m
REMARKS:

OPERATOR: Groundtest (LC)

LOGGED: AG/LHS
CASING: HW to 3m, then HQ to 19.51m

Refer to explanatory notes for symbol and abbreviation definitions

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

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.0 AHD
COORDINATE: E:328769.2, N:6237819.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 230818.00
DATE: 26/09/24
SHEET: 2 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	-8 / 11	[CONT] Clayey SAND (SC): dark grey; fine to medium; low plasticity clay. Slight organic odour (sulfurous).		AEO	VL			SPT		10.00 10.45	SPT	0,0,1 N=1
	-9 / 12	SAND (SP): brown and pale grey; fine to medium.						SPT		11.50 11.91	SPT	12,24,25/110
	-10 / 13							SPT		13.00 13.39	SPT	17,27,25/90
	-11 / 14					W				14.50		
	-12 / 15			AEO	VD			SPT		14.90	SPT	17,28,23/100
	-13 / 16											
	-14 / 17									17.50		
	-15 / 18							SPT		17.90	SPT	20,33,25/100
	18.50	CLAY (CI-CH), with sand: grey mottled brown; medium to high plasticity; fine sand.										
	-16 / 19			EST	(VS)	w>PL				19		
	19.51	Continued as rock										

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 3m, then WB to 19.51m, then NMLC to 24.59m
REMARKS:

OPERATOR: Groundtest (LC)

LOGGED: AG/LHS
CASING: HW to 3m, then HQ to 19.51m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.0 AHD
COORDINATE: E:328769.2, N:6237819.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 230818.00
DATE: 26/09/24
SHEET: 3 of 4

CONDITIONS ENCOUNTERED												SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, DW [HW, MW], SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, 2.00, >2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-8	11													11				
	-9	12													12				
	-10	13													13				
	-11	14													14				
	-12	15													15				
	-13	16													16				
	-14	17													17				
	-15	18													18				
	-16	19													19				
			Continued from soil																
			SANDSTONE: see below		MW	19.51	M	100	91							PLT	PL(A)=0.50MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo305
METHOD: AD/T to 3m, then WB to 19.51m, then NMLC to 24.59m
REMARKS:

OPERATOR: Groundtest (LC)

LOGGED: AG/LHS
CASING: HW to 3m, then HQ to 19.51m

Refer to explanatory notes for symbol and abbreviation definitions

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

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.0 AHD
COORDINATE: E:328769.2, N:6237819.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 230818.00
DATE: 26/09/24
SHEET: 4 of 4

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-17	20.00	SANDSTONE: pale grey, orange-brown and red-brown, medium to coarse grained; distinctly and indistinctly bedded at 0-20°. Hawkesbury Sandstone		MW XW	20.06 20.14 20.24	M SEAM	100	91	SEAM	20.06m: DS, 5°, 5mm 20.14m: EW, 100mm								
	-18	21									21.22m: B, 20°, PR, SN Fe, RF				21	PLT	PL(A)=1.4MPa		
											21.61m: EW, 10mm								
	-19	22			MW - SW		H				22.00m: B, 5°, PR, Clay 1 mm				22	PLT	PL(A)=1.7MPa		
											22.39m: B, 20°, PR, VNR Clay, RF 22.46m: B, 0°, PR, VNR Clay, RF								
	-20	23						100	93		22.95m: B, 20°, PR, CN, RF 23.01m: B, 20°, PR, Clay 1 mm 23.06m: JT, 70°, UN, SN Fe, RF				23	PLT	PL(A)=1.5MPa		
	-21	24									24.04m: B, 5°, UN, CN, RF				24	PLT	PL(A)=1.6MPa		
																PLT	PL(A)=1.4MPa		
	-22	25	Borehole discontinued at 24.59m depth. Target depth reached.																
	-23	26																	
	-24	27																	
	-25	28																	
	-26	29																	

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo305
OPERATOR: Groundtest (LC)
LOGGED: AG/LHS
METHOD: AD/T to 3m, then WB to 19.51m, then NMLC to 24.59m
CASING: HW to 3m, then HQ to 19.51m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

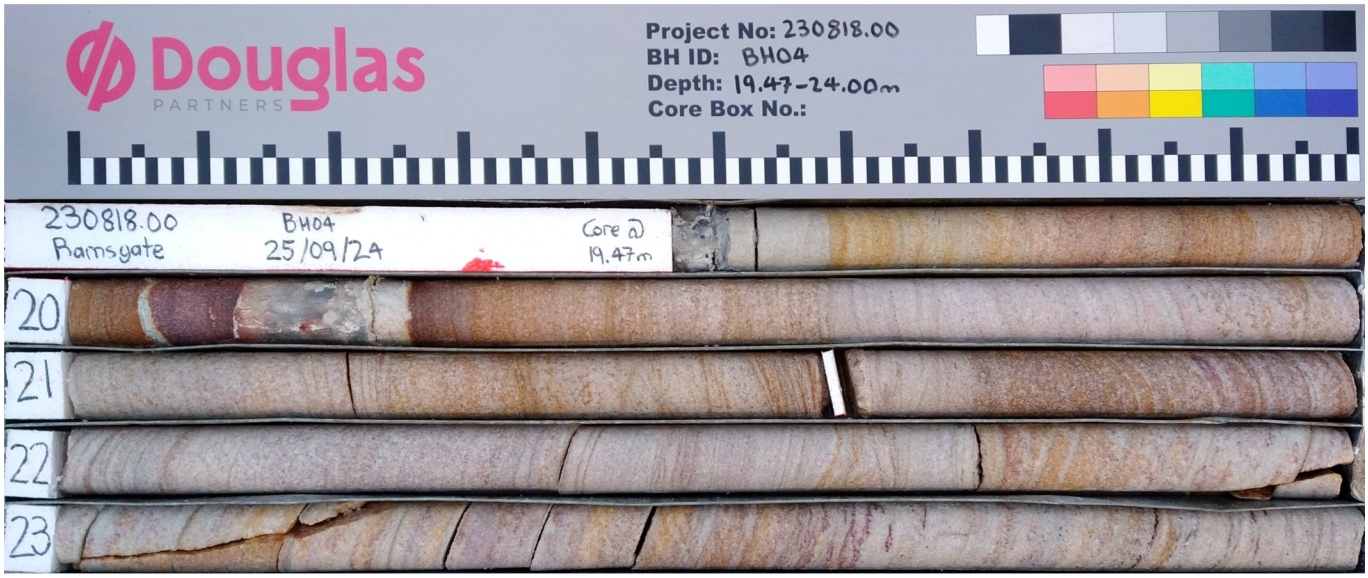
Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

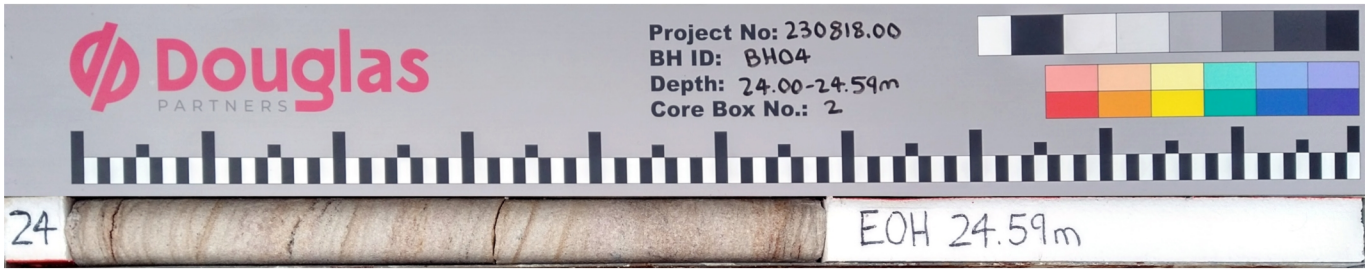
CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 3.0 AHD
COORDINATE: E:328769.2, N:6237819.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 230818.00
DATE: 26/09/24
SHEET: 1 of 1



19.47-24.00 m depth



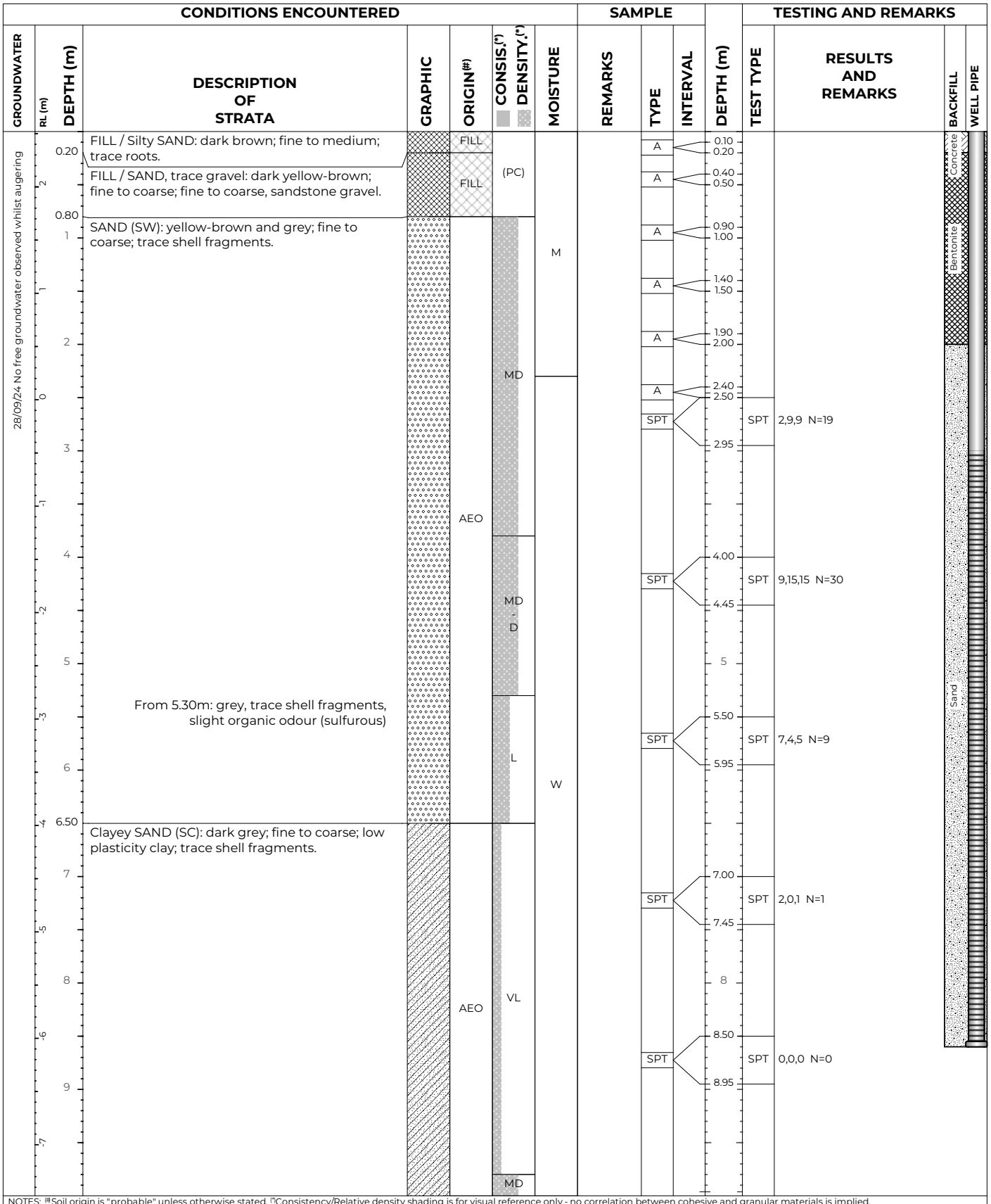
24.00-24.59 m depth

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.5 AHD
COORDINATE: E:328847.7, N:6237789.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 230818.00
DATE: 26/09/24 - 28/09/24
SHEET: 1 of 4



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 Geo205
METHOD: AD/T to 2.5m, WB to 22.25m, NMLC to 28.2m
REMARKS:

OPERATOR: Ground Test (JJ/CS)

LOGGED: RD/SI
CASING: HW to 2.5m, then HQ to 22.25m

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

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.5 AHD
COORDINATE: E:328847.7, N:6237789.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 230818.00
DATE: 26/09/24 - 28/09/24
SHEET: 2 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	10.00	SAND (SP), with clay: dark grey; fine to medium; trace shell fragments.			MD			SPT		10.00	SPT	2,8,5 N=13		
	10.45									10.45				
	11.50				D			SPT		11.50	SPT	5,15,21 N=36		
	11.95									11.95				
	13.00	From 13.00m: pale grey, clay absent		AEO	VD	W		SPT		13.00	SPT	16,26,25/120		
	13.42									13.42				
	14.50							SPT		14.50	SPT	20,25/110		
	14.76									14.76				
	16.00							SPT		16.00	SPT	8,6,6 N=12		
	16.20	CLAY (CH), with sand: dark grey; high plasticity; fine sand. Organic odour (sulfurous).			St					16.45				
	17			EST		w>PL				17				
	18	From 18.50m: pale grey								18				
	19				S			SPT		19.00	SPT	2,1,2 N=3		
										19.45				

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 Geo205
METHOD: AD/T to 2.5m, WB to 22.25m, NMLC to 28.2m
REMARKS:

OPERATOR: Ground Test (JJ/CS)

LOGGED: RD/SI
CASING: HW to 2.5m, then HQ to 22.25m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.5 AHD
COORDINATE: E:328847.7, N:6237789.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 230818.00
DATE: 26/09/24 - 28/09/24
SHEET: 3 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-18 / 21.00	[CONT] CLAY (CH), with sand: dark grey; high plasticity; fine sand. Organic odour (sulfurous).		EST	S					21				
	-19 / 22	Sandy CLAY (CL-CI): pale grey; low to medium plasticity; medium to coarse sand.		XWM	(St) - (VSt)	w>PL				22				
	-20 / 22.20													
	-21 / 23									23				
	-22 / 24									24				
	-23 / 25									25				
	-24 / 26									26				
	-25 / 27									27				
	-26 / 28									28				
	-27 / 29									29				

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 Geo205
METHOD: AD/T to 2.5m, WB to 22.25m, NMLC to 28.2m
REMARKS:

OPERATOR: Ground Test (JJ/CS)

LOGGED: RD/SI
CASING: HW to 2.5m, then HQ to 22.25m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.5 AHD
COORDINATE: E:328847.7, N:6237789.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 230818.00
DATE: 26/09/24 - 28/09/24
SHEET: 4 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
			Continued from soil																
			SANDSTONE: pale grey, red-brown and orange-brown, medium to coarse grained; distinctly and indistinctly bedded at 0-20°. Hawkesbury Sandstone		HW - MW	22.25	L												
						22.40					22.40m: DS, 20mm					PLT	PL(A)=0.26MPa		
						22.43	L												
						22.70	SEAM				22.70m: DS, 60mm								
					HW	22.76	L	100	68										
						22.85					22.88m: EW, 70mm								
						22.88	SEAM												
					MW	22.95	M												
						23.30	SEAM				23.30m: DS, 80mm								
					HW	23.38	VL to L				23.43m: DS, 30mm								
						23.70	SEAM				23.65m: JT, 70°, PR, Clay, RF								
					HW	23.77	VL - L				23.70m: EW, 70mm								
						24.00					23.95m: DS, 10mm					PLT	PL(A)=0.19MPa		
					MW	24.30	M				24.30m: JT, 70°, UN, Clay 50mm, RF, Qz gravel								
						24.35	VL												
					MW	25.00	M	100	80		24.50-25.20m: B x7, 10°, VNR Clay					PLT	PL(A)=0.72MPa		
					MW - SW	25.45					25.45m: B, 10°, PR, VNR Clay, RF					PLT	PL(A)=0.71MPa		
						26.32	SEAM				26.32m: EW, 50mm								
					SW	26.37	M				26.52m: B, 10°, CT Clay 2 mm					PLT	PL(A)=0.46MPa		
						27.01	SEAM				27.01m: DS 50mm								
					SW	27.06	H	100	86		27.42m: B, 5°, PR, VNR Clay, RF					PLT	PL(A)=1.0MPa		
						27.65	SEAM				27.65m: DS, 50mm								
					HW to MW	27.70	H				27.80m: JT, 35°, PR, SN Fe, RF								
						28.12	SEAM				27.83m: B, 20°, PR, SN Fe, RF					PLT	PL(A)=1.2MPa		
											27.95m: JT, 45°, PR, SN Fe, RF								
											28.12m: EW, 80mm								
			Borehole discontinued at 28.20m depth. Target depth reached.																

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo205
METHOD: AD/T to 2.5m, WB to 22.25m, NMLC to 28.2m
REMARKS:

OPERATOR: Ground Test (JJ/CS)

LOGGED: RD/SI
CASING: HW to 2.5m, then HQ to 22.25m

Refer to explanatory notes for symbol and abbreviation definitions

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

CORE PHOTO LOG

CLIENT: Bronxx Pty Ltd
PROJECT: Proposed Development
LOCATION: 277 The Grand Parade, Ramsgate Beach, NSW

SURFACE LEVEL: 2.5 AHD
COORDINATE: E:328847.7, N:6237789.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 230818.00
DATE: 26/09/24 - 28/09/24
SHEET: 1 of 1

22.25-26.00 m depth

26.00-28.20 m depth

Douglas PARTNERS

Appendix D

Laboratory Test Results

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

CERTIFICATE OF ANALYSIS 362850

Client Details

Client	Douglas Partners Pty Ltd
Attention	Lachlan Straney
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**230818.00, Ramsgate**
Number of Samples	39 Soil
Date samples received	27/09/2024
Date completed instructions received	27/09/2024

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

Date results requested by	04/10/2024
Date of Issue	02/10/2024

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

Results Approved By
Diego Bigolin, Inorganics Supervisor

Authorised By
Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		362850-2	362850-9	362850-10	362850-13	362850-24
Your Reference	UNITS	BH01	BH01	BH02	BH02	BH03
Depth		2.5-2.95	13-13.41	6.8-7.25	9.8-10.25	8.5-8.95
Date Sampled		16/09/2024	16/09/2024	23/09/2024	23/09/2024	24/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	30/09/2024	30/09/2024	30/09/2024	30/09/2024	30/09/2024
Date analysed	-	30/09/2024	30/09/2024	30/09/2024	30/09/2024	30/09/2024
pH 1:5 soil:water	pH Units	8.3	8.6	8.6	9.0	8.5
Electrical Conductivity 1:5 soil:water	µS/cm	34	200	160	130	500
Chloride, Cl 1:5 soil:water	mg/kg	10	10	<10	<10	25
Sulphate, SO4 1:5 soil:water	mg/kg	20	190	170	90	800

Misc Inorg - Soil				
Our Reference		362850-28	362850-31	362850-38
Your Reference	UNITS	BH03	BH04	BH04
Depth		19-19.45	4-4.45	14.5-14.95
Date Sampled		24/09/2024	25/09/2024	25/09/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	30/09/2024	30/09/2024	30/09/2024
Date analysed	-	30/09/2024	30/09/2024	30/09/2024
pH 1:5 soil:water	pH Units	7.8	9.3	9.1
Electrical Conductivity 1:5 soil:water	µS/cm	1,800	52	40
Chloride, Cl 1:5 soil:water	mg/kg	2,200	10	10
Sulphate, SO4 1:5 soil:water	mg/kg	460	20	10

sPOCAS field test						
Our Reference		362850-1	362850-3	362850-4	362850-5	362850-6
Your Reference	UNITS	BH01	BH01	BH01	BH01	BH01
Depth		2-2.1	3-3.1	4-4.1	5.5-5.6	7-7.1
Date Sampled		16/09/2024	16/09/2024	16/09/2024	16/09/2024	16/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2024	27/09/2024	27/09/2024	27/09/2024	27/09/2024
Date analysed	-	01/10/2024	01/10/2024	01/10/2024	01/10/2024	01/10/2024
pH_F (field pH test)	pH Units	7.8	8.3	9.1	8.8	8.8
pH_{FOX} (field peroxide test)	pH Units	5.5	5.5	6.6	6.4	6.7
Reaction Rate*	-	Medium reaction	Medium reaction	Medium reaction	Medium reaction	High reaction

sPOCAS field test						
Our Reference		362850-7	362850-8	362850-11	362850-12	362850-14
Your Reference	UNITS	BH01	BH01	BH02	BH02	BH02
Depth		8.5-8.6	10-10.1	6.8-6.9	8.3-8.4	9.8-9.9
Date Sampled		16/09/2024	16/09/2024	23/09/2024	23/09/2024	23/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2024	27/09/2024	27/09/2024	27/09/2024	27/09/2024
Date analysed	-	01/10/2024	01/10/2024	01/10/2024	01/10/2024	01/10/2024
pH_F (field pH test)	pH Units	8.8	8.4	8.7	8.5	9.6
pH_{FOX} (field peroxide test)	pH Units	7.3	6.2	6.6	5.9	4.5
Reaction Rate*	-	Volcanic reaction	Medium reaction	High reaction	High reaction	High reaction

sPOCAS field test						
Our Reference		362850-15	362850-16	362850-17	362850-18	362850-19
Your Reference	UNITS	BH02	BH02	BH02	BH02	BH03
Depth		11.3-11.4	12.8-12.9	17.5-17.6	20.5-20.6	1-1.45
Date Sampled		23/09/2024	23/09/2024	23/09/2024	23/09/2024	24/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2024	27/09/2024	27/09/2024	27/09/2024	27/09/2024
Date analysed	-	01/10/2024	01/10/2024	01/10/2024	01/10/2024	01/10/2024
pH_F (field pH test)	pH Units	8.8	8.8	8.4	7.6	7.1
pH_{FOX} (field peroxide test)	pH Units	4.7	6.3	2.6	3.9	4.9
Reaction Rate*	-	Medium reaction	Medium reaction	Medium reaction	Medium reaction	Medium reaction

sPOCAS field test						
Our Reference		362850-20	362850-21	362850-22	362850-23	362850-25
Your Reference	UNITS	BH03	BH03	BH03	BH03	BH03
Depth		2.5-2.95	4-4.45	5.5-5.95	7-7.45	10-10.45
Date Sampled		24/09/2024	24/09/2024	24/09/2024	24/09/2024	24/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2024	27/09/2024	27/09/2024	27/09/2024	27/09/2024
Date analysed	-	01/10/2024	01/10/2024	01/10/2024	01/10/2024	01/10/2024
pH_F (field pH test)	pH Units	8.8	9.3	8.8	8.4	9.5
pH_{FOX} (field peroxide test)	pH Units	6.0	6.5	6.5	6.8	6.1
Reaction Rate*	-	Medium reaction	Medium reaction	Medium reaction	High reaction	High reaction

sPOCAS field test						
Our Reference		362850-26	362850-27	362850-28	362850-29	362850-30
Your Reference	UNITS	BH03	BH03	BH03	BH04	BH04
Depth		11.5-11.95	16-16.45	19-19.45	2.5-2.6	4-4.1
Date Sampled		24/09/2024	24/09/2024	24/09/2024	25/09/2024	25/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2024	27/09/2024	27/09/2024	27/09/2024	27/09/2024
Date analysed	-	01/10/2024	01/10/2024	01/10/2024	01/10/2024	01/10/2024
pH_F (field pH test)	pH Units	8.8	8.6	8.0	8.0	8.4
pH_{FOX} (field peroxide test)	pH Units	3.3	2.5	6.6	5.7	6.7
Reaction Rate*	-	Medium reaction	Medium reaction	Extreme reaction	Medium reaction	Medium reaction

sPOCAS field test						
Our Reference		362850-32	362850-33	362850-34	362850-35	362850-36
Your Reference	UNITS	BH04	BH04	BH04	BH04	BH04
Depth		5.5-5.6	7-7.1	8.5-8.6	10-10.1	11.5-11.6
Date Sampled		25/09/2024	25/09/2024	25/09/2024	25/09/2024	25/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	27/09/2024	27/09/2024	27/09/2024	27/09/2024	27/09/2024
Date analysed	-	01/10/2024	01/10/2024	01/10/2024	01/10/2024	01/10/2024
pH_F (field pH test)	pH Units	8.7	8.4	8.5	8.8	8.7
pH_{FOX} (field peroxide test)	pH Units	6.5	6.4	6.5	6.1	5.2
Reaction Rate*	-	Medium reaction	High reaction	Medium reaction	Medium reaction	Medium reaction

sPOCAS field test			
Our Reference		362850-37	362850-38
Your Reference	UNITS	BH04	BH04
Depth		13-13.1	14.5-14.95
Date Sampled		25/09/2024	25/09/2024
Type of sample		Soil	Soil
Date prepared	-	27/09/2024	27/09/2024
Date analysed	-	01/10/2024	01/10/2024
pH_F (field pH test)	pH Units	8.8	7.7
pH_{FOX} (field peroxide test)	pH Units	6.9	5.5
Reaction Rate*	-	Medium reaction	Medium reaction

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-063	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.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	362850-9
Date prepared	-			30/09/2024	2	30/09/2024	30/09/2024		30/09/2024	30/09/2024
Date analysed	-			30/09/2024	2	30/09/2024	30/09/2024		30/09/2024	30/09/2024
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	8.3	8.2	1	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	34	36	6	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	10	20	67	107	90
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	20	20	0	113	#

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			27/09/2024	[NT]	[NT]	[NT]	[NT]	27/09/2024	[NT]
Date analysed	-			01/10/2024	[NT]	[NT]	[NT]	[NT]	01/10/2024	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH_{FOX} (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]	27/09/2024	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	01/10/2024	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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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

Samples received in good order: Holding time exceedance

MISC_INORG_DRY: # Percent recovery is not applicable due to the high concentration of the analyte/s in the sample/s. However an acceptable recovery was obtained for the LCS.

RPD is accepted as <5*PQL

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

CERTIFICATE OF ANALYSIS 363239

Client Details

Client	Douglas Partners Pty Ltd
Attention	Lachlan Straney
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**230818.00 Ramsgate**
Number of Samples	9 Soil
Date samples received	03/10/2024
Date completed instructions received	03/10/2024

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.

Report Details

Date results requested by	11/10/2024
Date of Issue	11/10/2024

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

Results Approved By
Diego Bigolin, Inorganics Supervisor
Jenny He, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Misc Inorg - Soil		
Our Reference		363239-9
Your Reference	UNITS	BH05
Depth		11.5-11.95
Date Sampled		26/09/2024
Type of sample		Soil
Date prepared	-	03/10/2024
Date analysed	-	08/10/2024
pH 1:5 soil:water	pH Units	8.0
Electrical Conductivity 1:5 soil:water	µS/cm	200
Chloride, Cl 1:5 soil:water	mg/kg	10
Sulphate, SO4 1:5 soil:water	mg/kg	70

sPOCAS field test						
Our Reference		363239-1	363239-2	363239-3	363239-4	363239-5
Your Reference	UNITS	BH05	BH05	BH05	BH05	BH05
Depth		4-4.1	5.5-5.6	8.5-8.6	10-10.1	11.5-11.6
Date Sampled		26/09/2024	26/09/2024	26/09/2024	26/09/2024	26/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/10/2024	03/10/2024	03/10/2024	03/10/2024	03/10/2024
Date analysed	-	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024
pH_F (field pH test)	pH Units	8.3	8.3	9.5	9.5	8.1
pH_{FOX} (field peroxide test)	pH Units	6.1	6.1	6.5	4.8	5.1
Reaction Rate*	-	Medium reaction	Medium reaction	Medium reaction	Medium reaction	Medium reaction

sPOCAS field test				
Our Reference		363239-6	363239-7	363239-8
Your Reference	UNITS	BH05	BH05	BH05
Depth		13-13.1	16.3-16.4	19-19.1
Date Sampled		26/09/2024	26/09/2024	26/09/2024
Type of sample		Soil	Soil	Soil
Date prepared	-	03/10/2024	03/10/2024	03/10/2024
Date analysed	-	04/10/2024	04/10/2024	04/10/2024
pH_F (field pH test)	pH Units	8.3	8.1	7.4
pH_{FOX} (field peroxide test)	pH Units	5.4	1.8	2.9
Reaction Rate*	-	Medium reaction	Volcanic reaction	Medium reaction

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-063	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.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			03/10/2024	[NT]	[NT]	[NT]	[NT]	03/10/2024	[NT]
Date analysed	-			08/10/2024	[NT]	[NT]	[NT]	[NT]	08/10/2024	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	105	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	108	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			03/10/2024	[NT]	[NT]	[NT]	[NT]	03/10/2024	[NT]
Date analysed	-			04/10/2024	[NT]	[NT]	[NT]	[NT]	04/10/2024	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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

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