Douglas Partners
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Report on
Geotechnical Investigation

Proposed Industrial Estate
813-913 Wallgrove Road, Horsley Park

Prepared for
Gazbuild Pty Ltd

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Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

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1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed industrial estate at 813-913 Wallgrove Road, Horsley Park. The investigation was commissioned in an email dated 30 July 2020 by Tim Sachs of Gazbuild Pty Ltd and was undertaken in accordance with Douglas Partners' proposal SYD200488.P.002.Rev0 dated 27 July 2020.

It is understood that the site is proposed to be developmed into an industrial estate, similar to that located to the north of the site. The current concept plan indicates one road will enter the site along the northern boundary in a westerly direction from Wallgrove Road and will branch into two smaller cul-de-sac roads within the site. The roads will provide access to 14 new industrial lots of varying size that will support warehouses ranging in size from say 5,000 m^2 to more than 43,000 m^2. . Associated road and car parking pavements, offices, subdivisional services and landscaping are also proposed.

The main access road to the site is in alignment with the proposed future Southern Link Road to connect Mamre Road, Kemps Creek to Wallgrove Road, Horsley Park. It is understood however, that the final alignment of the proposed Southern Link Road is yet to be finalised.

The investigation was undertaken to inform the civil and structural aspects of the proposed development and included the drilling of 5 rock cored boreholes, the excavation of 32 test pits and laboratory testing, followed by engineering analysis and reporting. Advice on site preparation and earthworks, foundations, retaining walls and pavements have been included.

2. Previous Investigation

DP has previously carried out a limited geotechnical investigation at the site (Reference 73207.00.R.001.Rev0, dated 19 Nov 2012). The investigation included the drilling of one rock cored borehole (BH1) to a depth of 18 m and laboratory testing of selected rock core samples. Details of the field and laboratory testing for the previous report are included in this report, and a copy of the previous borehole log is given in Appendix E.

3. Site Description

The site is located on the western side of Wallgrove Road immediately south of the Sydney water supply pipelines and opposite the entry to the Austral Bricks site at Horsley Park. An above ground transmission line (Transgrid) is located to the south of the site with part of the easement located within the site. The transmission towers are at about 250 m to 300 m centres and located close to the site boundary with one tower at the western end located within the site boundary.

The site is an irregularly shaped elongated parcel of land that covers approximately 52 hectares with approximate average dimensions of 1200 m east to west and 450 m north to south.

The ground surface within the site is undulating with a prominent hill located at the southern central part of the site. Ground surface levels fall from the crest of the hill to the north, east and west at approximate slopes generally between two and ten degrees, although slightly steeper in places. Ground surface levels fall from reduced levels of RL 96 m, relative to Australian height datum (AHD) at the crest of the hill to about RL 60 m AHD at the eastern and western ends of the site.

At the time of the site investigation, the site was operating as a rural grazing lot for cattle. There were unsealed access tracks along the northern boundary and part of the southern boundary, several sheet metal clad farm sheds mainly located towards the northern central part of the site and rural barbed wire fencing areas for grazing. Two main rural dams were also present, one in the north western corner of the site and one in the central eastern portion of the site.

Substantial vegetation, which generally included groups of mature trees of up to about 20 m in height, is present across the site.

4. Regional Geology

Reference to the Penrith 1:100,000 Geological Series Sheet indicates that the site is underlain by Bringelly Shale, which generally consists of shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff. The weathered portion of this formation typically includes clays and silty clays of medium to high plasticity. An extract from the geological map is shown in Figure 1.

It is also noted that Reedy Creek, which runs along the western boundary of lot, is underlain by, an alluvial profile of often deep layered fine grained sand, silt and clay over bedrock.

The field work confirmed the presence of predominantly shale and siltstone bedrock, with sandstone bands also present within the rock profile. Overlying soils comprised shallow topsoil and silty clay.

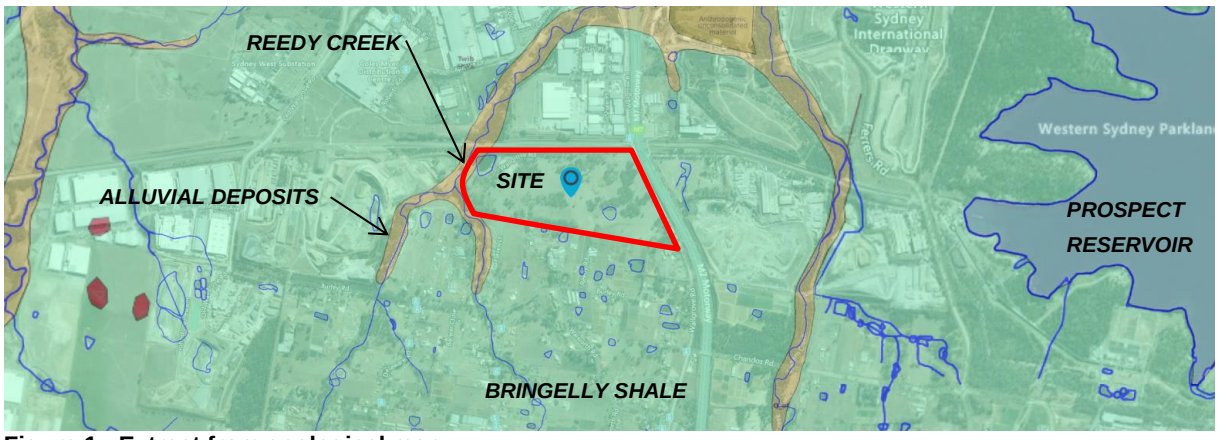

Figure 1: Extract from geological map

5. Field Work Methods

The field work was conducted over six days between 10 and 17 August 2020 and followed a period of heavy rainfall in Sydney. The geotechnical investigation included:

- A walkover inspection of the site by a geotechnical engineer;
- Drilling of five borehole (BH101-BH105) using a truck-mounted drill rig. Initially the bores were drilled using solid flight augers fitted with a Tungsten-Carbide (TC) bit until practical refusal on rock occurred at depths of between 2.5 m and 3.5 m. Drilling was then advanced to depths of between 12 m and 20.6 m within the better-quality rock using NMLC diamond core methods. Boreholes BH101-BH105 was positioned within the main areas of the proposed cuts in the southern central part of the site;
- Standard penetration tests (SPT) within the boreholes at 1.5 m depth intervals in the overburden materials where silty clay was intersected;
- Excavation of 32 test pits (TP201 to TP232) using a 5 tonne excavator fitted with a 450 mm wide toothed bucket. The test pits were generally excavated to a maximum depth of 2 m or prior refusal on bedrock to identify and allow more detailed inspection and sampling of the near-surface soils.
- Dynamic cone penetrometer (DCP) tests adjacent to selected locations to assess in situ soil strength to a maximum depth of 2.4 m or prior refusal on bedrock or hard clay.
- Collection of soil and rock core samples from the boreholes and test pits for examination, logging and to provide test specimens for laboratory testing.

The field work was supervised by a geotechnical engineer. The test locations are shown on Drawing GI - 1 in Appendix B. The ground surface levels and coordinates at the boreholes and test pits were measured to GDA94 and AHD using a high precision differential global positioning system (dGPS).

6. Field Work Results

Details of the subsurface conditions encountered are given on the borehole and test pit logs presented in Appendix C, together with photographs of the rock core, DCP test results and notes defining classification methods and descriptive terms.

A summary of the typical sequence of subsurface conditions encountered at the site is presented below:

Topsoil:	Comprising between 0.1 m and 0.4 m thickness of brown, low to medium plasticity silty clay with some grass rootlets. The topsoil was generally soft to firm and moist.
Fill	Encountered at the surface in TP206, TP207, TP213 and TP232 only to depths of between 0.3 m and 1.1 m. TP206 was terminated within the fill due to the presence of groundwater filling the test pit and the collapse of the gravelly fill material. Generally consisting of gravel or gravelly/silty clay and varying proportions of rootlets and building rubble including concrete, tile, plastic, glass fragments.

Residual Clay: (Natural)	Intersected below the topsoil or fill and extending to depths of between 0.8 m and greater than 3.0 m. Consisting of orange brown and pale grey, silty clay with varying proportions of ironstone gravel. The clay was generally firm to stiff becoming very stiff to hard and grading into weathered bedrock with depth.
Weathered Rock:	Intersected from depths of between 0.8 m and 3.0 m consisting mainly of siltstone with some sandstone bands. The rock was initially of typically very low strength (with medium strength bands) to depths of between 2.5 m to greater than 12 m increasing to low to medium strength then becoming medium strength (with high strength bands) below depths of between 5.6 m and 10 m. Boreholes BH104 and BH105 were terminated within low to medium strength and very low strength siltstone respectively. The degree of fracturing varied considerably within the very low and low to medium strength siltstone. The rock was slightly fractured to unbroken within the medium strength siltstone and sandstone bands. Bedding was essentially near horizontal and joints ranged from 30 to 40 degrees in sandstone to 30 to 90 degrees in siltstone. Thin clay seams and clay smears were identified in the rock core sample, generally along bedding separations.

No free groundwater was encountered during auger drilling. Once water was introduced into the borehole to facilitate rotary and NMLC drilling, further observation of groundwater seepage flows, and levels was precluded. Groundwater seepage was observed near the termination depths of TP206 and TP219 within the lower lying north eastern and south western corners of the site. No long term/ongoing groundwater monitoring was completed as a part of this investigation.

It should be noted that groundwater levels are potentially transient and that fluctuations may occur in response to climatic and seasonal conditions.

7. Laboratory Testing

7.1 Geotechnical Laboratory Testing

Laboratory testing was carried out on representative soil samples collected during the field investigation including:

- Seven soil samples were subjected to Atterberg limits; and
- Six soil samples were subjected to four-day soaked California bearing ratio (CBR), standard compaction and field moisture content test;

The results of the geotechnical laboratory testing are summarised in Table 1. The detailed laboratory test reports are given in Appendix D.

Table 1: Summary of Geotechnical Laboratory Test Results

ID	Depth (m)	Material	Atterberg Limits (%)			MDD (t/m^3)	OMC (%)	FMC (%)	CBR (%)	Swell (%)
			LL	PL	PI					
TP204	0.2-0.5	Silty CLAY	-	-	-	1.72	20.0	22.4	4.0	1.0
TP215	0.8-1.3	SILTSTONE	32	17	15	1.87	14.5	10.3	6.0	1.0
TP217	0.5-1.0	Silty CLAY	63	20	43	1.67	21.0	22.8	1.5	3.5
TP219	2.5-3.0	Gravelly Silty CLAY	64	21	43	-	-	-	-	-
TP222	1.6-2.0	Shaly Clay	57	23	34	1.69	20.5	18.3	1.5	4.0
TP223	0.2-0.8	Silty CLAY	59	21	38	1.65	22.5	24.5	5.0	1.0
TP225	0.6-1.4	Silty CLAY	52	17	35	1.72	20.5	23.2	4.5	1.0
TP227	1.8-2.0	SILTSTONE	54	22	32	1.81	17.5	15.0	3.5	2.0
TP231	0.2-0.7	Silty CLAY	-	-	-	1.9	17.5	18.3	7.0	0.0

Note: LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index; MMD = Maximum Dry Density; OMC = Optimum Moisture Content; FMC = Field Moisture Content.

The above results indicate that the residual clay is typically of high plasticity and is likely to exhibit a high propensity for shrink and swell movements with changes in moisture content (i.e. highly reactive).

Rock core samples were collected from boreholes BH101 to BH105 during the field investigation. Several sub-samples of the core were subjected to point load strength index testing in their axial direction for classification according to rock strength. The test results are presented on the log sheets in Appendix C, at the relevant depth.

7.2 Aggressivity Laboratory Testing

Selected soil samples were analysed for aggressivity (electrical conductivity, pH, chloride and sulphate). The results are summarised in Table 2. The detailed results are included in Appendix D.

Table 2: Summary of Laboratory Test Results for Aggressivity

Sample/ Depth (m)	Description	pH*	EC (µS/cm)*	Chloride (mg/kg)*	Sulphate (mg/kg)*
TP209/0.2-0.2m	Topsoil	4.9	150	110	43
TP211/.4-0.5m	Silty Clay	5.4	270	180	210
TP218/1.4-1.5m	Siltstone	5.5	150	110	38
BH101/0.4-0.5m	Clay	6.4	170	110	74

Sample/ Depth (m)	Description	pH*	EC (µS/cm)*	Chloride (mg/kg)*	Sulphate (mg/kg)*
BH102/2.5-2.95m	Clay	7.6	510	540	99
BH103/2.5-2.95m	Clay/ Siltstone	5.1	430	310	190

Notes: *Sample mixed 1(soil):5(water) prior to testing

8. Geotechnical Model

For design and planning purposes, the subsurface profile encountered within the boreholes of the investigation has been grouped into four geological units. One geotechnical cross-section (Section A-A') showing the interpreted subsurface profile between the borehole locations along the southern boundary is shown on Drawing GI-2, in Appendix B.

The interpreted depth and RLs at the top of the various Units at each test location is shown in Table 3. Reference should be made to the borehole logs for more detailed information and descriptions for the soil and rock profile.

It is expected that the regional groundwater table in the area would be relatively deep and within the underlying rock. Perched seepage flows will, however, occur along the soil and rock interface and may also occur within fractured zones and joints in the rock.

- **Table 3: Summary of Geotechnical Model**

Material	Depth m / Reduced Level (AHD) to the top of each unit					
	BH1 (2012)	BH101	BH102	BH103	BH104	BH105
TS/RS	0 (96.0)	0 (86.2)	0 (95.2)	0 (85.8)	0 (83.5)	0 (80.3)
VL Siltstone (with M bands)	NE	1.9 (84.3)	3 (92.2)	2.7 (83.1)	2.3 (81.2)	1.2 (79.1)
L-M Siltstone (with VL bands)	2.4 (93.6)	3.6 (82.6)	3.5 (91.7)	8.1 (77.7)	8.2 (75.3)	NE
M Interbedded Siltstone and Sandstone (with H bands)	8.7 (87.3)	5.6 (80.6)	9.3 (85.9)	10 (75.8)	NE	NE
Base of Borehole	18 (78)	15.3 (70.9)	20.6 (74.6)	12.9 (72.9)	12.4 (71.1)	12 (68.3)

Notes: TS = Topsoil, RS = Residual Soil, VL = Very Low Strength, L= Low Strength, M = Medium Strength, NE = not encountered

9. Proposed Development

The proposed development will ultimately include the construction of a new industrial estate at the site.

The current concept plan indicates one road will enter the site along the northern boundary in a westerly direction from Wallgrove Road and will branch into two smaller cul-de-sac roads that head throughout the site. The roads will provide access to 14 new industrial lots of varying size that will support warehouses ranging in size from about 5,000 m^2 to more than 43,000 m^2. Associated road and car parking pavements, offices, subdivisional services and landscaping are also proposed. A copy of the current concept plan is presented overlain on Drawing GI-1 in Appendix B.

The proposed development will require extensive cut to fill earthworks to level the site into several terraced lots from its current undulating landform. Excavation to a depth of about 18 m below the crest of the hill at the southern central part of the site and fill of up to about 10 m at the lower lying areas of the site is proposed.

Based on the current concept plan prepared by Orion Consulting retaining walls to support proposed areas of cut and fill are proposed to vary in heights of up to maximum of 6 m. The deepest area of proposed cut (about 18 m) along the southern site boundary (near lots 6 and 7) is proposed to be supported by a three-tier retaining wall with a maximum height of 6 m per tier. Each retaining wall tier is proposed to be setback by about 7m from the subsequent tier.

10. Comments

10.1 Excavation

Based on the advised excavation depth of 18 m at the highest point on the site it is considered that excavation will encounter a thin layer of overburden soils and then mostly siltstone at lower elevations with some sandstone encountered near the crest of the hill as well as at depth within the siltstone. Excavations within soil will require the use of at least medium sized excavators and scrapers for excavation efficiency.

Excavations within the underlying fractured to slightly fractured rock will require larger plant, including large dozers of at least D10 size for pre-ripping, 30 tonne excavators fitted with rock hammers for higher strength layers and possibly large scrapers for loading and carting of spoil to filling areas, subject to rock size. Large rock fragments may result from ripping which may necessitate load and transport by trucks. If scrapers are suited to the task, they will probably need to work in pairs for push-pull loading and will probably require pushing by large dozer. The geometry of rock joints, fractures and bedding planes will assist site excavation.

Excavations will remove rock of various classes and strengths. Although Table 3 in Section 8 provides approximate reduced levels for the top of each rock class at six borehole locations, contractors are advised that higher strength rock is also likely, particularly when encountering sandstone layers or in deeper parts of the excavation. It is likely that a considerable portion of medium strength siltstone (with high strength bands) will be exposed within the southern central portions of the site within excavation depths exceeding 5.5 m to 8 m. Hence, contractors tendering for the work should select appropriate excavation machinery.

Although the earthworks are expected to be cut to fill balanced, any excavated material to be disposed of off-site should be tested for contaminants to allow Waste Classification Assessment in accordance with NSW EPA requirements.

10.2 Earthworks

Earthworks will be required to raise ground surface levels above current levels within the northern, eastern and western parts of the site. The following site preparation and fill placement measures are recommended:

Prior to fill commencement, remove all vegetation and root affected soil from the proposed filling area.

- Rip the exposed surface to a depth of not less than 300 mm and recompact to a minimum dry density ratio of 98%, relative to Standard compaction, adjusting the moisture content of the ripped and recompacted surface to within 2% of Standard optimum moisture content.
- Proof roll the treated surface using a minimum 10 tonne smooth drum roller in non-vibration mode. The surface should be rolled with a minimum of six passes with the last two passes observed by an experienced geotechnical engineer to detect any 'soft spots'.
- Any heaving materials identified during proof rolling should be treated as directed by the geotechnical engineer, which is likely to require the localised removal and replacement of unsuitable soil.
- Place all new fill in layers of 300 mm maximum compacted thickness. The fill should be free of oversize particles (>150 mm) and deleterious material.
- Compact all fill to a minimum dry density ratio of 98%, relative to Standard compaction, whilst maintaining a moisture content within 2% of Standard optimum moisture content. The minimum dry density ratio should be increased to 100% relative to Standard compaction within the upper 300 mm of pavement subgrades and building footprints. A maximum dry density ratio of 102% is recommended for all filling to reduce the potential for swelling post-compaction.
- Maintain the moisture within the clay until the area is covered by buildings or pavements. Recent monitoring of foundation/floor slab movement measured heave of up to 60 mm for a warehouse floor slab cast on dry clay fill.
- Density testing of the fill should be carried out in accordance with AS3798 "Guidelines for Earthworks for Commercial and Residential Developments". Fill placed beneath building platforms and pavements should be carried out to a Level 1 inspection and testing programme.

The moderately to highly reactive nature of the residual clays results in a potential for adverse shrink and swell ground movements as the moisture content of the soil changes. The potential for and extent of movement will increase if these soils are compacted too dry or too wet. Accordingly, the site soils are likely to be suitable for reuse on the site provided that the moisture content of the soils is carefully controlled during compaction and the soils are protected against drying out after compaction is completed i.e. by placement of subsequent filling layers or a protective layer such as by buildings or pavements as outlined in the preceding dot points.

The same fill placement measures are recommended when removing existing dams and backfilling with controlled fill. Prior to placement of fill though, it will be necessary to pump out all existing water from

the dam, remove all soft and wet sediments from the sides and base, remove all existing fill within dam embankments and strip the base of each dam to a suitable natural ground surface. Once stripped and prepared, all dams should be inspected by an experienced geotechnical engineer. The base on which fill is proposed should be proof rolled in the presence of the geotechnical engineer.

10.3 Excavation Support

Vertical excavations within soil and bedrock profile will require both temporary and permanent lateral support during and after excavation.

10.3.1 Batter Slopes

Suggested temporary and permanent batter slopes for unsupported excavations up to a maximum height of 4 m are shown in Table 4. Deeper excavations will need to incorporate intermediate benches to reduce the overall slope angle. If surcharge loads are applied near the crest of the slope, then further specific geotechnical review and probably flatter batters or stabilisation using rock bolts or soil nails may be required. Batters are not recommended near existing buildings or services.

Table 4: Recommended Batter Slopes for Exposed Material

Material	Maximum Temporary Batter Slope (H : V)	Maximum Permanent Batter Slope (H : V)**
Engineered Fill	1.5 : 1	2 : 1
Stiff / Very Stiff Clay	1 : 1	2 : 1
VL, L-M Siltstone	0.75 : 1*	1 : 1*
M Interbedded Siltstone and Sandstone	0.5 : 1*	1 : 1*

Note: VL = Very Low Strength, L = Low Strength, M = Medium Strength

* Subject to jointing assessment by experienced Geotechnical Engineer/Engineering Geologist

** Permanent batters in soil may need to be reduced to 3H: 1V to facilitate maintenance of grassed slopes, if required

10.3.2 Retaining Walls

Where batter slopes cannot be used, or the batter grades presented in Table 4 are exceeded, shoring walls will be required to support both temporary and permanent excavations in all material units. Anchored soldier pile walls are often used to provide temporary retaining support to soil and weathered rock. The soldier piles are usually spaced at approximately 2 m to 2.5 m centres, however, more closely spaced piles may be required to reduce wall movements, or prevent collapse of infill materials, particularly where pavements, structures or services are located in close proximity to the excavation.

Cantilevered pile walls should not be used where there are adjacent structures within a distance equal to the height of the excavation from the shoring wall. This is due to their greater propensity for outward rotation and the consequently high risk of disturbing such adjacent structures.

It is suggested that preliminary design of cantilevered shoring systems (or shoring with one row of anchors or propping) be based on a triangular earth pressure distribution using earth pressure coefficients provided in Table 5. The 'Active' earth pressure coefficient (K_a) value may be used where some wall movement is acceptable, whereas the 'at rest' earth pressure (K_0) values should be used where the wall movement needs to be reduced (i.e. adjacent to existing structures or utilities).

Table 5: Recommended Design Parameters for Shoring Systems

Material	Unit Weight (kN/m^3)	Earth Pressure Coefficient		Effective Cohesion c' (kPa)	Effective Friction Angle (Degrees)
		Active (K_a)	At Rest (K_o)		
Engineered Fill	20	0.4	0.6	0	25
Stiff / Very Stiff Clay	20	0.4	0.6	2	25
VL Siltstone	22	0.3	0.45	4	27
L-M Siltstone	23	0.2	0.3	10	30
M Interbedded Siltstone and Sandstone	24	0.1	0.15	15	32

Note: VL = Very Low Strength, L = Low Strength, M = Medium Strength

* Subject to jointing assessment by experienced Geotechnical Engineer/Engineering Geologist

The design for lateral earth pressures where multiple rows of anchors or propping are used (i.e. two rows or more of anchors or props) may be based on a trapezoidal earth pressure distribution. The following earth pressure magnitudes are considered appropriate, where H is the height of soil and very low to low strength rock to be retained, in metres:

- 4H kPa, where some lateral movement is allowed; and
- 6H kPa, where lateral movements need to be limited (e.g. next to buildings and services).

In each case the maximum pressure generally acts over the central 60% of the wall, reducing to zero at the top and base of the wall.

The design of the shoring should allow for all surcharge loads, including building footings, inclined slopes behind the wall, traffic, site sheds, and construction related activities.

The design will also need to consider adverse jointing in the rock that may form wedges requiring additional support. For deeper excavation the rock wedge loading can govern the design. Further specific geotechnical advice should be sought on rock wedge design.

If a more accurate assessment of predicted ground movements at nearby building/infrastructure as a result of the proposed excavation is required, then numerical modelling (using commercially available software such as Plaxis 2D or FLAC 2D) of the proposed excavation may be required.

Shoring walls should also be designed for full hydrostatic pressures unless drainage of the ground behind impermeable walls can be provided. Drainage could comprise 150 mm wide strip drains pinned to the face at 1 m to 2 m centres behind shotcrete in-fill panels. The base of the strip drains should

extend out from the shoring wall to allow any seepage to flow into a perimeter toe drain which is connected to the stormwater drainage system.

10.3.3 Ground Anchors

The design of temporary and permanent ground anchors/rock bolts for the support of excavation and/or shoring systems may be carried out based on the maximum bond strength given in Table 6.

Table 6: Recommended Bond Stresses for Rock Anchor Design

Foundation Stratum	Maximum Allowable Passive Pressure (kPa)	Maximum Ultimate Passive Pressure (kPa)
VL Siltstone	75	150
L-M Siltstone	100	200
M Interbedded Siltstone and Sandstone	200	400

The parameters given in Table 6 assume that the drilled holes are cleaned and adequately flushed. The anchors should be bonded behind a line drawn up at 45 degrees from the base of the shoring, 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.

10.3.4 Passive Resistance

Passive resistance for piles founded in rock below the base of the bulk excavation (including allowance for services and/or footings) may be based on the ultimate passive resistance values provided in Table 7. The ultimate values represent the pressures mobilised at high displacements and therefore it will be necessary to incorporate a factor of safety of at least 3 to limit wall movement. The top 0.5 m of the socket should be ignored due to possible disturbance and over excavation.

Table 7: Recommended Passive Resistance Values

Foundation Stratum	Maximum Allowable Passive Pressure (kPa)	Maximum Ultimate Passive Pressure (kPa)
VL Siltstone	150*	500*
L-M Siltstone	330*	1000*
M Interbedded Siltstone and Sandstone	600*	2000*

Note: *subject to geotechnical inspection

10.3.5 Southern Three Tier Retaining Wall

The southern three tier retaining wall may be designed as a three-tiered soldier pile wall where the pile sockets of each wall extend below the zone of influence of the adjacent (lower) tier. The walls will

require at least one row of ground anchors per tier which should be designed as 'permanent' anchors and incorporate sheathing, greasing and grouting procedures that will extend the life of the anchors. Shotcreting will be needed over the materials between the piles and should be undertaken in approximately 2.5 m drops as excavation proceeds in order to reduce the risk of local slippages.

Alternatives to soldier pile walls may include a 'top down' system of shotcrete facing supported by 'permanent' ground anchors or rock bolts. The shotcrete will be required to be designed to be sufficiently 'robust' to spread the ground anchors across the facing. It is expected that at least two to three rows of ground anchors or rock bolts will be required to support the shotcrete retaining walls to their individual proposed heights of 6 m.

A passive soil nail design may be considered for the bottom two benches setback further from the transmission line where movement is less critical. Shotcreting will need to be undertaken in maximum 1.5 m drops as excavation proceeds in order to reduce the risk of local slippages. Steepened batters may be used to optimise the design reducing the amount of lateral support required. The excavation should be inspected by an experienced geotechnical engineer in maximum 1.5m drops prior to the completion of shotcrete.

Prior to finalising the shoring system, the global stability of the three-tier retaining wall system as a whole, should be checked by numerical modelling using commercially available software such as Plaxis 2D, Wallap or Slope W.

10.4 Foundations

The construction of the proposed industrial estate will require significant cut and fill of the site to form large level pads for warehouse construction. Accordingly, foundations are likely to be formed from exposed residual soil and rock in cuttings and on engineered fill elsewhere. Allowable bearing capacities will vary across soil and rock foundations within a typical range of 150 kPa (soil) to 1000 kPa (rock), and higher locally within the southern central portion of the site (southern ends of lots 6 and 7).

For lightly loaded structures, the varying foundation types are likely to represent Class S through to Class H1 conditions, when assessed in accordance with AS2870 Residential Slabs and Footings.

To reduce the magnitude of shrink and swell movement on new structures, consideration could be given to placing a 0.5 m thick layer of ripped rock across the surface of the natural clay and fill areas. This would also have a beneficial effect on increasing the available California bearing ratio (CBR) value of the subgrades below pavements and hardstand areas.

Subject to final design levels and the proposed footing types, it is anticipated that footings for the new warehouses will most likely comprise shallow pads founding within the upper 0.5 m to 1 m of the new controlled fill, natural clays and bedrock. Alternatively, bored piles founding within the bedrock could be adopted, particularly in areas of deep fill, subject to column loads. Individual buildings should be founded on consistent foundations (ie all on soil or all on rock) to reduce potential iffrential movements.

The parameters listed in Table 8 are suggested for footing design.

Table 8: Suggested Footing Design Parameters

Soil / Rock Profile	End Bearing		Shaft Adhesion	
	Allowable	Ultimate	Allowable	Ultimate
Engineered Fill	150	500	15	20
Stiff / Very Stiff Clay	150	500	15	25
VL Siltstone	700	3000	50	100
L-M Siltstone	1000	3500	100	150
M Interbedded Siltstone and Sandstone	3500	10,000	350	700

Notes: The values listed in Table 3 are subject to confirmation during construction.

To confirm the appropriateness of the adopted footing design parameters, it is recommended that all pad footing excavations bearing in soil are subjected to geotechnical inspection and dynamic cone penetrometer (DCP) testing during construction to verify that the listed allowable bearing pressures are available.

Shallow footings founding near excavations (i.e. lift wells, service trenches or similar) must have all loads transferred to below an influence line inclined upwards at 45 degrees commencing from the lowest and closest side of the excavation or trench base. Pad footings can be deepened to accommodate this load transfer or alternatively pile footings may be used.

Local variations in rock strength and depth is likely to occur across the site. All pile or footing excavations in weathered rock should be inspected by a geotechnical engineer or engineering geologist and approved prior to concreting to confirm reduced pressures are not warranted due to extensively weathered or jointed zones.

10.5 Pavements and Drainage

Subject to earthworks and the final condition of the soils within the upper 1 m of the design subgrade level, natural and filled subgrades at this site can be assigned a preliminary design CBR value of 3%, which is higher than the lowest laboratory test results of 1.5% to account for variations in the fill and the probability that some gravel content will result from mixing of the soils and underlying weathered bedrock during excavation and fill.

To maintain this design value, or any other amended/alternate design CBR value, it will be necessary to prepare the subgrade soils into a well compacted condition that is free of significant adverse long-term or differential settlements and/or deflection under service loading.

The upper clayey soils and extremely weathered rock are typically categorised by lower CBRs and higher swells were as the lower (less weathered) rock profile is typically categorised by higher CBRs and lower swells which are preferable pavement founding conditions. Therefore, some preferential placement of site won rock fill in the upper 1 m to 1.5 m is expected to be favourable to the pavement thickness design. Following completion of the bulk earthworks to the pavement formation depth the subgrade CBR should be confirmed at approximately 100 m intervals along new roads to check if higher CBR values can be adopted.

It is noted that some subgrade improvement, or the placement of a surface capping layer may be required to increase the CBR value of the subgrade to the minimum design value of 3%, or to a higher value to enhance the economy of the pavement construction (e.g. placement of 300 mm or so of CBR 20% material on CBR 3% material may achieve an effective CBR of 5%).

The pavement designer should consider the following:

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

DP advises that the relatively low CBR value materials on the site indicate that some trafficability issues may eventuate during construction if the soils become wet following rainfall. Capping the site with a suitable granular fill may prove highly beneficial during the earthworks programme. The possibility that the soils on the site will lose considerable strength if they become wet reinforces the need for appropriate drainage to be installed across the pavement and hardstand areas. Subsoil drains should be installed around the perimeter of all pavement areas, including any internal pavement openings (e.g. for landscaped garden beds, or similar).

In addition, a regular and long-term inspection and maintenance programme of the pavement should be adopted by the operator of the pavement. This maintenance program should be primarily aimed at limiting the amount of moisture infiltrating to the subgrade (e.g. inspecting drainage lines and repairing as required, maintaining construction joints and sealing or repairing cracks as they develop).

10.6 Groundwater

Based on experience in the area, it is expected that the regional groundwater table in the area would be relatively deep and within the underlying rock. Perched seepage flows will, however, occur along the soil and rock interface and may also occur within fractured zones and joints in the rock.

The field investigation did encounter subsurface seepage flows within the lower lying areas of the site, however, it is considered that such flows are likely to be intermittent and of a relatively minor concern.

The groundwater below the site is expected to be moderately saline due to the mineral salts contained within the Bringelly Shales. Further investigation with installation and monitoring of groundwater wells is required to provide more detailed information on groundwater and likely fluctuations.

10.7 Soil Aggressivity

Provided the samples analysed represent the broader soils present at the site, then the soil conditions can be considered as being non-aggressive to buried steel elements and mildly aggressive (based on pH) to buried concrete elements. The laboratory test results were compared to the criteria listed within Australian Standard AS2159 (2009).

11. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at in accordance with DP's proposal SYD200488.P.002.Rev0 dated 27 July 2020 and acceptance received from Tim Sachs of Gazbuild Pty Ltd dated 30 July 2020. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Gazbuild 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 DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP 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 DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP 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.

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. DP 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 DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it

should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

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Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling Methods

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Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

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

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with ‘Mix of Soil and Cobbles/Boulders’ with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- ‘Moist, dry of plastic limit’ or ‘w <PL’ (i.e. hard and friable or powdery).
- ‘Moist, near plastic limit’ or ‘w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- ‘Moist, wet of plastic limit’ or ‘w >PL’ (i.e. soils usually weakened and free water forms on the hands when handling).
- ‘Wet’ or ‘w ≈LL’ (i.e. near the liquid limit).
- ‘Wet’ or ‘w >LL’ (i.e. wet of the liquid limit).

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

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

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:

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

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

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

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

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

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

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

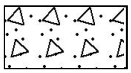
Symbols & Abbreviations

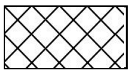
Graphic Symbols for Soil and Rock

General

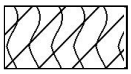

Asphalt

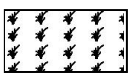

Road base

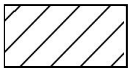

Concrete

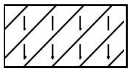

Filling

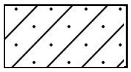
Soils


Topsoil

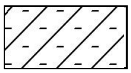

Peat

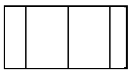

Clay

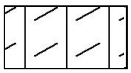

Silty clay

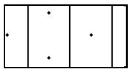

Sandy clay

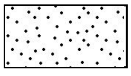

Gravelly clay

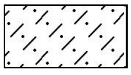

Shaly clay

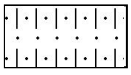

Silt


Clayey silt


Sandy silt

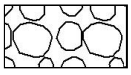

Sand

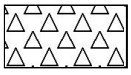

Clayey sand


Silty sand


Gravel

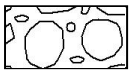

Sandy gravel


Cobbles, boulders

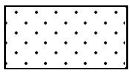

Talus

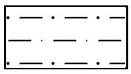
Sedimentary Rocks

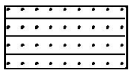

Boulder conglomerate

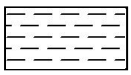

Conglomerate


Conglomeratic sandstone

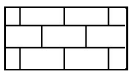

Sandstone


Siltstone

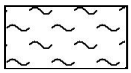

Laminite

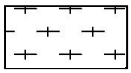

Mudstone, claystone, shale

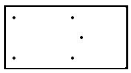

Coal


Limestone

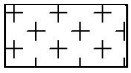
Metamorphic Rocks

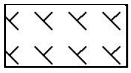

Slate, phyllite, schist

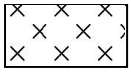

Gneiss

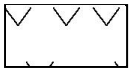

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite

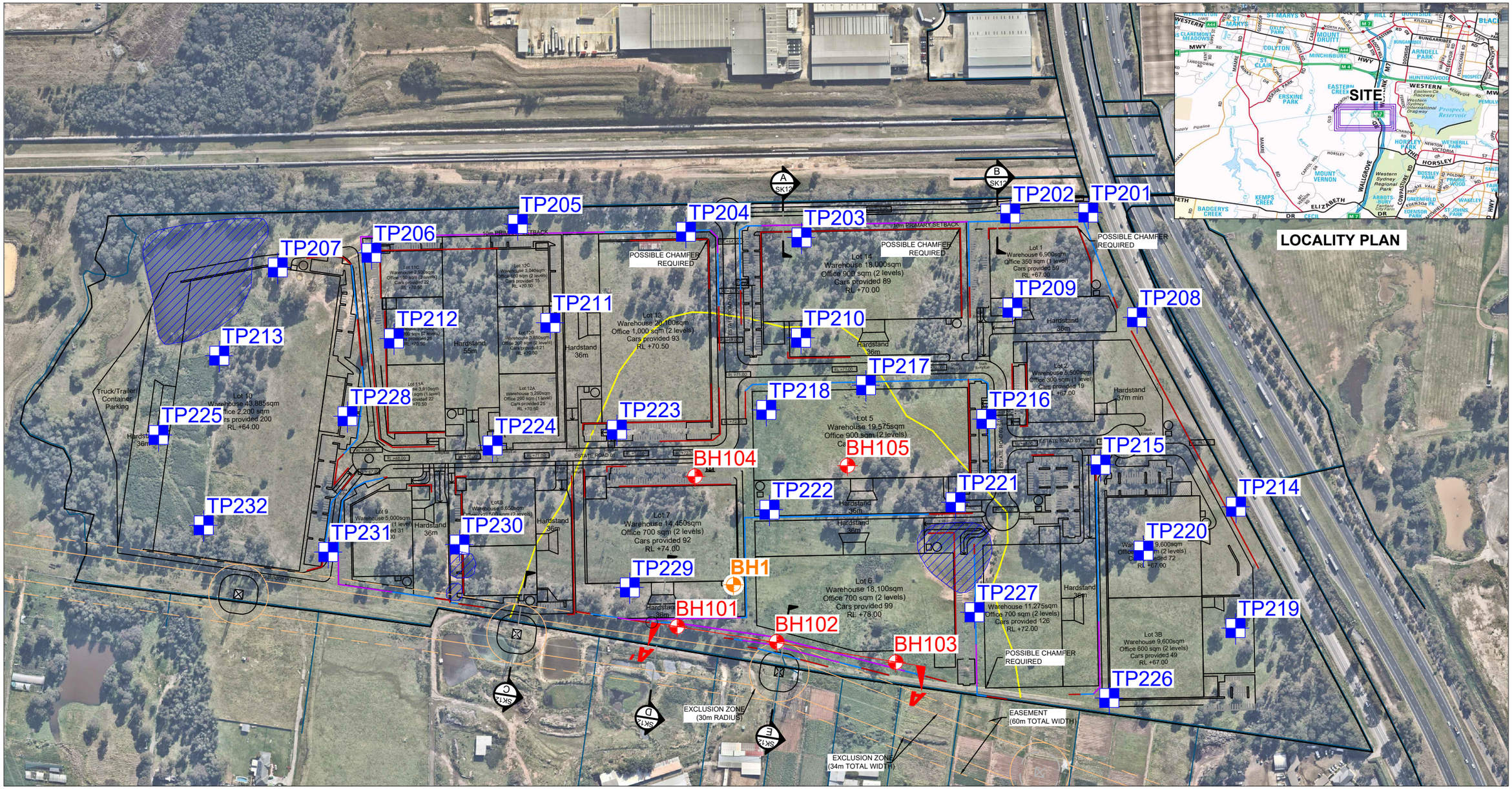

Dacite, epidote


Tuff, breccia


Porphyry

Appendix B

Drawings



LEGEND

- Geotechnical Cross Section A-A'
- Approximate Cut/Fill boundary
- WALLS 0-2.0m
- WALLS 2.0-4.0m
- WALLS 4.0-6.0m
- Current Borehole Locations
- Current Test Pit Locations
- Previous Cored Borehole DP (2012)
- Existing Dams on Site

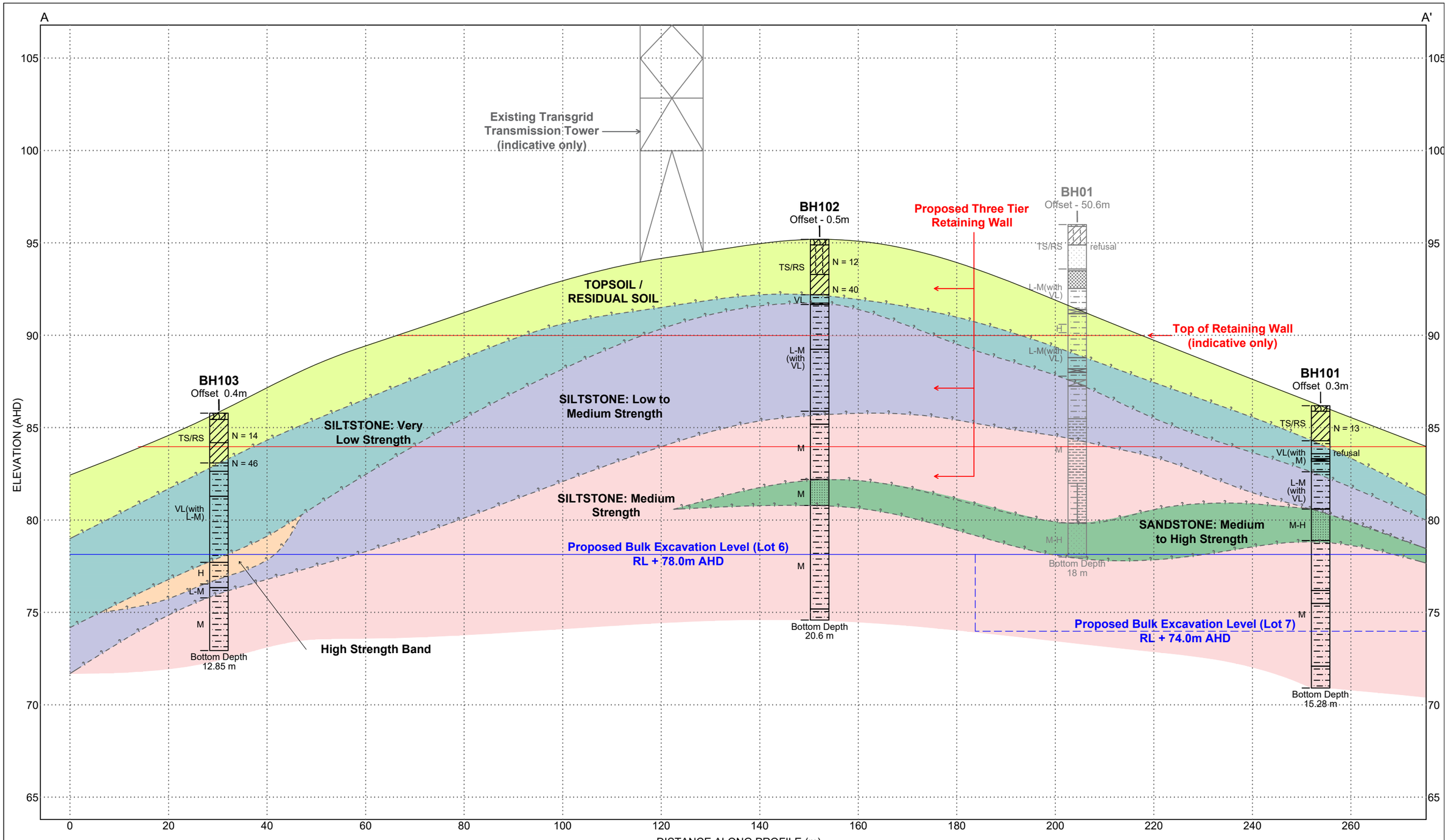
0 20 40 60 80 100 150 200 300 400m

1:4000 @ A3

NOTE:
1: Base image from Nearmap.com (Dated 03.08.2020)
2: Base plan from Orion Consulting Project No. 19-0108 Set No.02 Plan 001 Rev.1 Dated 10.07.2020
3: Test locations surveyed using differential GPS

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Gazbuild Pty Ltd		TITLE: **Borehole Location Plan**	PROJECT No: 99735.00
OFFICE: Sydney	DRAWN BY: AH	**Proposed Industrial Estate**	DRAWING No: GI-1
SCALE: 1:4000 @ A3	DATE: 04.09.2020	**813-913 Wallgrove Road, Horsley Park**	REVISION: 0



LEGEND

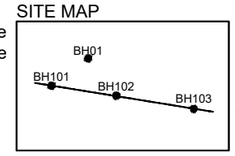
- Core Loss
- Clay
- Sandstone
- Sandstone coarse grained
- Sandstone fine grained
- Shale
- Siltstone
- Silty Clay
- Topsoil

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

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

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations.Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Test locations surveyed using differential GPS
4. BH01 taken from previous DP investigation (2012)

SITE MAP



0 15
Horizontal Scale (metres)
Vertical Exaggeration = 3.8

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Gazbuild Pty Ltd		TITLE: **Interpreted Geotechnical Cross-section A - A'**	PROJECT No: 99735.00
OFFICE: Sydney	DRAWN BY: CJ	**Proposed Industrial Estate**	DRAWING No: GI-2
SCALE: 1:750 (H) 1:200 (V) @ A3	DATE: 08.09.2020	**813-913 Wallgrove Road, Horsley Park**	REVISION: 0

Appendix C

Field Work Results

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 86.2 AHD
EASTING: 300773.1
NORTHING: 6255147.7
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 99735.00
DATE: 14/7/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
86	0.3	TOPSOIL/Silty CLAY (CL): low plasticity, grey-brown, trace fine sand and rootlets, moist, apparently firm, topsoil							A			
		CLAY (CH): high plasticity, pale grey-brown, moist, stiff, residual							A			
85	1								A			
									S			3,5,8 N = 13
84	1.9	SILTSTONE: grey, very low strength, Bringelly Shale						Unless otherwise stated, rock is fractured along rough, planar bedding plane dipping 0-10°				
	2								S			25/100 refusal
	2.6	SILTSTONE: grey-brown, 20% fine sandstone laminations, 5% clay seams, very low strength with medium strength bands, highly to moderately weathered, fragmented to fractured, Bringelly Shale						2.78-2.88m: Ds, 100mm, fg 2.88m: CORE LOSS: 120mm 3.05m: J70°-85°, cu, sm, cln 3.12-3.17m: Ds, 50mm, fe 3.17-3.32m: J, sv (85°) pl, ro, fe 3.35-3.40m: Cs, 50mm 3.50-3.57m: Cs, 50mm 3.57m: J(x2), 70° & 90°, st, ro, fe 3.78m: B0°, fe, cly 10mm 3.81-3.88m: J(x2) 70°, pl, ro, fe 4.01m: J70°, un, ro, fe 4.29-4.65m: Ds, 360mm 5.05m: J70°, pl, ro, cln 5.1m: J30°, pl, ro, fe 5.68-5.88m: B(x2), 0°, fe				PL(A) = 0.5
83	3								C	94	33	
	3.0											PL(A) = 0.7
	3.58	SILTSTONE: grey-brown, with 20% fine sandstone laminations, low to medium strength with clay seams, highly and moderately weathered, fractured, Bringelly Shale 5.15m-5.60m: with siltstone clasts										
82	4											
												PL(A) = 0.3
81	5											
	5.6	SANDSTONE: fine grained, pale grey with brown iron staining and 10% siltstone laminations, high strength, moderately weathered, slightly fractured, Bringelly Shale										PL(A) = 2.3
80	6								C	100	97	
								6.5m: B0°, cly, co, 5mm				PL(A) = 1.7
79	7	7.00m: medium strength										PL(A) = 0.6
	7.3	SILTSTONE: grey with orange-brown iron staining, trace siltstone clasts, medium strength, moderately then slightly weathered, slightly fractured, Bringelly Shale						7.42m: J35°, pl, sm , cln				
78	8							8.12-8.21m: Ds, 90mm				PL(A) = 0.3
								8.45-8.50m: J(x2), 45°, pl, ro, cln 8.62m: J85°, un, ro, fe 8.85m: J70°, pl, sm, fe, cly vn	C	100	94	
77	9							9.12-9.45m: J(x2), 70°-90°, cu, ro, fe				PL(A) = 0.5
	10.0							9.85m: J35°, pl, sm, fe				

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 2.6m

TYPE OF BORING: SFA (TC-bit) to 2.5 m, Rotary (wash bore) to 2.6m, NMLC coring to 15.28m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 86.2 AHD
EASTING: 300773.1
NORTHING: 6255147.7
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 99735.00
DATE: 14/7/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
76		SILTSTONE: pale grey brown, trace siltstone clasts, low to medium strength, slightly weathered, slightly fractured, Bringelly Shale						9.95m: J70°, pl, ro, fe 10.1m: J70°, ti	C	100	94	
	10.7							10.3m: J70°, pl, sm, fe 10.4-10.55m: J85°, un, ro, fe				PL(A) = 0.3
75	11	SILTSTONE: grey and pale grey, low to medium strength, slightly weathered, slightly fractured, Bringelly Shale						11.02m: J60°, un, ro, cln 11.03m: J85°, pl, ro, fe	C	100	100	PL(A) = 0.3
74	12							11.65m: B0°, cly 5mm 12.2m: J70°, pl, ro, fe				PL(A) = 0.3
73	13	13.10m: medium strength with some very low strength seams						12.6m: J45°-70°, cu, sm, cln 13.93-13.10m: Ds, 170mm, fe 13.22-13.25m: Ds, 30mm 13.47-13.50m: Ds, 30mm 13.68-13.72m: Ds, 30mm 13.92m: J45°, pl, ro, cly vn	C	100	85	PL(A) = 0.5
72	14 14.1	SILTSTONE: grey to dark grey, medium to high then high strength, fresh, unbroken, Bringelly Shale										PL(A) = 1
71	15 15.28	Bore discontinued at 15.28m Target depth reached										PL(A) = 1.3
70	16											
69	17											
68	18											
67	19											

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 2.6m

TYPE OF BORING: SFA (TC-bit) to 2.5 m, Rotary (wash bore) to 2.6m, NMLC coring to 15.28m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 101 PROJECT: HORSLEY PARK AUGUST 2020

2.60 – 7.00m

BORE: 101 PROJECT: HORSLEY PARK AUGUST 2020

7.00 – 12.00m

BORE: 101 PROJECT: HORSLEY PARK AUGUST 2020

12.00 – 15.28m

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 95.2 AHD
EASTING: 300873.6
NORTHING: 6255132.2
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 99735.00
DATE: 13/8/2020
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
95	0.3	TOPSOIL/Silty CLAY (CL): low plasticity, grey-brown, trace rootlets, w~PL, apparently firm, topsoil							A			
		Silty CLAY (CI-CH): medium plasticity, brown, trace fine ironstone gravel, w<PL, stiff, residual							A			
94	1								A			
									S			9,6,6 N = 12
	1.9	CLAY (CH): medium plasticity, brown mottled yellow-brown, trace fine ironstone gravel, w<PL, hard, residual										
93	2											
									S			18,17,23 N = 40
92	3							Unless otherwise stated, rock is fractured along rough, planar bedding plane dipping 0-10°				
	3.0	SILTSTONE: grey-brown, very low strength, Bringelly Shale										
	3.45											
	3.53	SILTSTONE: grey-brown, low to medium strength with very low strength bands, highly to moderately weathered, fragmented to fractured Bringelly Shale						3.45m: CORE LOSS: 80mm 3.53-3.60m: fg, 70mm 3.65-3.68m: Cs, 30mm 3.75m: J45°, pl, sm, cln 3.93-4.31m: B(x5) 0-5°, cly co 1-5mm	C	92	20	PL(A) = 0.5
91	4											PL(A) = 0.3
								4.53m: B5°, cly 10mm 4.66m: B5°, cly 10mm 4.80-4.86m: Cs, 60mm				
90	5							5.04m: J85°, pl, ro, fe	C	100	10	
								5.4m: J85°, pl, ro, fg				PL(A) = 0.4
								5.6m: J85°, pl, ro, fg 5.72m: J70, un, ro, cln 5.80-5.95m: fg, 150mm				
	5.95											
89	6	SILTSTONE: grey and pale grey, 20% clay seams, low to medium strength with some very low strength bands, highly weathered, fractured and slightly fractured, Bringelly Shale						5.95-6.00m: Cs, 50mm 6.00-6.05m: fg, 50mm 6.05-6.25m: Ds, 200mm				PL(A) = 0.2
												PL(A) = 0.3
88	7							6.98-7.02m: Cs, 40mm	C	100	28	
								7.3m: J80°, pl, ro, cln				PL(A) = 0.3
								7.50-7.53m: Cs, 30mm 7.62-7.70m: Ds, 80mm				
87	8											PL(A) = 0.1
								7.95-8.00m: Cs, 50mm				
								8.30-8.36m: Cs, 60mm				PL(A) = 0.1
								8.77-9.00m: fg, 230mm				
86	9											PL(A) = 0.3
	9.3	SILTSTONE: (see next page)						9.25m: B0°, cly 10mm 9.35m: J80°, un, ro, cln	C	100	86	
												PL(A) = 0.5
	10.0							9.88-9.92m: Cs, 40mm				

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 3.45m

TYPE OF BORING: SFA (TC-bit) to 2.5m, Rotary (wash bore) to 3.45m, NMLC to 20.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 95.2 AHD
EASTING: 300873.6
NORTHING: 6255132.2
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 99735.00
DATE: 13/8/2020
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
85	11	SILTSTONE: pale grey and grey, 20% fine to medium grained sandstone laminations, medium strength, fresh, slightly fractured and unbroken, Bringelly Shale						10.38-10.45m: Cz, 40mm	C	100	86	PL(A) = 0.3 PL(A) = 0.9
84	12							11.80-11.83m: Ds, 30mm 12.12-12.17m: Ds, 50mm				PL(A) = 0.6
83	13							13.02-14.05m: B(x5), 0°-5°, fe stn	C	100	95	PL(A) = 0.9 PL(A) = 0.6
82	13.0	SANDSTONE: fine grained, pale grey with orange-brown iron staining and 10% grey siltstone laminations, medium strength, fresh stained to fresh, Bringelly Shale										
81	14											
80	14.4	SILTSTONE: pale grey and grey, 20% fine to medium grained sandstone laminations, medium strength, fresh, slightly fractured and unbroken, Bringelly Shale										
79	15							15.39m: B0°, cly 5mm				PL(A) = 0.4
78	16							16.11m: B0°, fg 10mm 16.12m: J60° & 90°, st, ro, cln	C	100	97	PL(A) = 0.5
77	17	17.10m: unbroken						17.08-17.13m: Ds, 50mm				PL(A) = 0.5
76	18											PL(A) = 0.5
	19							18.75m: J50°, he	C	100	100	PL(A) = 0.5
	20.0											

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 3.45m

TYPE OF BORING: SFA (TC-bit) to 2.5m, Rotary (wash bore) to 3.45m, NMLC to 20.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 95.2 AHD
EASTING: 300873.6
NORTHING: 6255132.2
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 99735.00
DATE: 13/8/2020
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
75		SILTSTONE: pale grey and grey, 2% fine grained sandstone laminations, medium strength, fresh, unbroken, Bringelly Shale							C	100	100	PL(A) = 0.7
	20.6	Bore discontinued at 20.6m Target depth reached										
74	21											
73	22											
72	23											
71	24											
70	25											
69	26											
68	27											
67	28											
66	29											

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 3.45m

TYPE OF BORING: SFA (TC-bit) to 2.5m, Rotary (wash bore) to 3.45m, NMLC to 20.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: 102 PROJECT: HORSLEY PARK AUGUST 2020

3.45 – 8.00m

BORE: 102 PROJECT: HORSLEY PARK AUGUST 2020

8.00 – 13.00m

BORE: 102 PROJECT: HORSLEY PARK AUGUST 2020

13.00 – 18.00m

BORE: 102 PROJECT: HORSLEY PARK AUGUST 2020

18.00 – 20.60m

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 85.8 AHD
EASTING: 300993.8
NORTHING: 6255111.8
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 99735.00
DATE: 13/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
85	0.35	TOPSOIL/Silty CLAY (CL) : low plasticity grey, trace fine sand and rootlets, w~PL, apparently firm, topsoil							A			
		CLAY (CH): high plasticity, pale grey-brown, w~PL, stiff, residual							A			
84	1.6								A			
		CLAY (CH): high plasticity, pale grey brown, w~PL, very stiff, residual							S			2,6,8 N = 14
83	2.7	SILTSTONE: grey-brown, very low strength, Bringelly Shale						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	S			8,23,23 N = 46
82	3.15	SILTSTONE: pale grey-brown, very low strength with clay bands, highly weathered, slightly fractured, Bringelly Shale						3.28m: J30°, pl, sm , cly 3.42-4.00m: Cs, 580mm 4.05-4.50m: Ds, 450mm	C	100	0	
81	4.5	SILTSTONE: pale grey brown, 20% clay seams, very low strength and low to medium strength, highly and moderately weathered fractured and slightly fractured, Bringelly Shale						4.6-4.75m: J80°, pl, ro, fe 4.83m: J35°, pl, sm , cln 4.90-5.20m: fg, 300mm 5.00-5.20m: Cs, 200mm	C	100	0	PL(A) = 0.3
80								5.5m: J(x2), 45° & 85°he, cly 5.60-5.70m: Cs, 100mm 5.72-5.83m: fg, 110mm 5.83-6.15m: Cs, 320mm 6.30-6.50m: fg, cly, 200mm 6.70-7.00m: Cs, 300mm	C	100	0	
79								7.1m: J80°, pl, sm ,cln 7.28m: J45°, pl, sm, cln 7.45m: J85°, pl, sm, cln 7.66-8.08m: Cs, 420mm				PL(A) = 0.4 PL(A) = 0.4 PL(A) = 0.9
78	8.08	SILTSTONE: grey brown, high strength, moderately weathered, slighty fractured, Bringelly Shale						8.30-8.35m: fg, fe, 50mm 8.85-8.93m: B(x3),0°, cly, co, 3-5mm 9.3-9.45m: Ds, 150mm	C	100	90	PL(A) = 2
77	9.45	SILTSTONE: grey to dark grey, low to medium then medium strength, slightly weathered then fresh, slighty fractured, Bringelly Shale						9.45m: J80°, pl, ro, fe				PL(A) = 0.3
76												

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 3.15m

TYPE OF BORING: SFA (TC-bit) to 2.5m, Rotary (wash bore) to 3.15m, NMLC coring to 12.85m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 85.8 AHD
EASTING: 300993.8
NORTHING: 6255111.8
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 99735.00
DATE: 13/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
75	11	SILTSTONE: grey to dark grey, low to medium then medium strength, slightly weathered then fresh, slighty fractured, Bringelly Shale *(continued)*						10.00-10.15m: J85°, pl, ro, fe				PL(A) = 0.5
								10.65m: J65°-70°, pl, ro, cln				
74	12							11.15-11.30m: J80°, pl, ro, cln	C	100	100	PL(A) = 0.4
												PL(A) = 0.6
73	12.85							12.57m: J45°-85°, st, ro, cln				PL(A) = 0.4
	13	Bore discontinued at 12.85m Target depth reached										
72	14											
71	15											
70	16											
69	17											
68	18											
67	19											
66												

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 3.15m

TYPE OF BORING: SFA (TC-bit) to 2.5m, Rotary (wash bore) to 3.15m, NMLC coring to 12.85m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: 103 PROJECT: HORSLEY PARK AUGUST 2020

3.15 – 8.00m

BORE: 103 PROJECT: HORSLEY PARK AUGUST 2020

8.00 – 12.85m

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 83.5 AHD
EASTING: 300791.1
NORTHING: 6255299.5
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 99735.00
DATE: 14/7/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
83	0.4	TOPSOIL/Silty CLAY (CI): medium plasticity, grey-brown, trace rootlets, moist, apparently firm, topsoil							A			
	0.6	Silty CLAY (CL): low plasticity, grey-brown and dark grey, with decomposed organic material, 10% siltstone gravel, rounded to subrounded, moist, firm, possibly alluvial							A			
82	1								A			
									S			6,10,17 N = 27
	2	Silty CLAY (CI): medium plasticity, grey-brown, moist, stiff then very stiff, alluvial						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
81	2.3	SILTSTONE: pale grey-brown, very low strength, Bringelly Shale							S			25/130 refusal
	2.65	SILTSTONE: grey-brown, low and low to medium strength with very low strength bands, highly to moderately weathered, slightly fractured, Bringelly Shale						2.75m: J90°, pl, ro, cln 2.9m: J60°, un, ro, fe 3.04-3.08m: Ds, cly, 40mm 3.20-3.40m: Cs, 200mm 3.60-3.63m: Cs, 30mm 3.75-3.77m: Cs, 20mm 3.75-3.98m: B's, 0°, cly co, 1-3mm 3.82m: J75°, pl, ro, cln 4.08-4.52m: B's, 0°, cly, co, 1-3mm	C	100	65	PL(A) = 0.3 PL(A) = 0.2
80	4											
	4.2	SILTSTONE: pale grey-brown and yellow-brown, very low strength with low and medium strength bands, highly and moderately weathered fractured and slightly fractured, Bringelly Shale										PL(A) = 0.3
79	5							5.06-5.70m: Ds, 640mm	C	100	20	
78	6							5.8m: J40°, pl, sm , cln 5.98-6.60m: Ds, fg, 620mm	C	100	35	PL(A) = 0.3
77	7							6.60-6.80m: Ds, 200mm J80°, un, ro, cly 7.05-7.20m: J80°, un, ro, fe, fg 7.20-7.60m: fg, 400mm				PL(A) = 0.7
76	7.75	SILTSTONE: grey-brown then grey, low and medium strength, moderately and highly weathered, slightly fractured, Bringelly Shale						7.55m: CORE LOSS: 200mm 7.79-8.00m: fg, 210mm	C	84	42	PL(A) = 0.5
75	8							8.55m: B0°, fe, cly 5mm				PL(A) = 0.7
74	9							8.85-9.00m: fg, 150mm 9.10-9.25m: J90°, un, ro, fe, ti 9.57m: B10°, cbs, cly 5mm	C	100	15	PL(A) = 0.2
	9.6	SILTSTONE: (see next page)										
	10.0											

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 2.65m

TYPE OF BORING: SFA (TC-bit) to 2.5m, Rotary (wash bore) to 2.65m, NMLC coring to 12.35m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 83.5 AHD
EASTING: 300791.1
NORTHING: 6255299.5
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 99735.00
DATE: 14/7/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
73	11	SILTSTONE: pale grey and grey-brown, very low strength with low to medium strength bands, highly to moderately weathered, fractured and slight fractured, Bringelly Shale						10.05m: J(x2) 45° & 70°,st, ro, fe 10.40-10.50m: Ds, 100mm 10.70-10.78m: Cs, 80mm 11.00-11.20m: B(x4), 0-10°, cly 5-10mm 11.20-11.25m: J(x2) 80°, pl, ro, fe 11.4m: J55°, ti 11.70-11.85m: J90°, ti	C	100	15	PL(A) = 0.3
72	11.2	SILTSTONE: grey-brown, low and medium strength, moderately weathered, slightly fractured, Bringelly Shale							C	100	50	PL(A) = 0.5
	12							12.10-12.15m: Cs, 50mm				
71	12.35	Bore discontinued at 12.35m Target depth reached										PL(A) = 0.2
70	13											
69	14											
68	15											
67	16											
66	17											
65	18											
64	19											

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 2.5m HQ to 2.65m

TYPE OF BORING: SFA (TC-bit) to 2.5m, Rotary (wash bore) to 2.65m, NMLC coring to 12.35m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: 104 PROJECT: HORSLEY PARK AUGUST 2020

2.65 – 7.00m

BORE: 104 PROJECT: HORSLEY PARK AUGUST 2020

7.00 – 12.00m

BORE: 104 PROJECT: HORSLEY PARK AUGUST 2020

12.0 – 12.40m

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 80.3 AHD
EASTING: 300945.2
NORTHING: 6255310.3
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 99735.00
DATE: 13/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
80	0.4	TOPSOIL/Silty CLAY (CI): medium plasticity, grey-brown, trace rootlets, moist, apparently firm, topsoil							A			
		CLAY (CH): high plasticity, red-brown, with silt, moist, very stiff, residual							A			
79	1.2	SILTSTONE: pale grey-brown, very low strength, Bringelly Shale							A S			8,25,25/20mm refusal
								Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
78	2.5	SILTSTONE: pale grey-brown, very low strength with clay seams, highly to moderately weathered, fractured and slighty fractured, Bringelly Shale							C	98	0	PL(A) = 0.1
77	3.05							2.96m: CORE LOSS: 90mm 3.05-3.30m: Ds, 250mm	C	100	0	
								3.5m: J55° & 85°, st, sm, cln 3.72m: J35°, pl, sm, fe				
76								4.08-4.11m: Cs, 30mm 4.21-4.23m: Cs, 20mm	C	100	0	PL(A) = 0.2
								4.50-4.54m: Cs, 40mm 4.60-4.75m: fg, 150mm	C	100	0	
75	5.0	SILTSTONE: pale grey-brown, low to medium strength, moderately weathered, slightly fractured, Bringelly Shale						5m: J85°, pl, sm, cln 5.16m: J(x2), 30° & 45°, st, sm, fe 5.45m: J85° & 70°, st, fe, he 5.6m: J30° & 85°, st, sm, cln	C	100	80	PL(A) = 0.4
74	6.0	SILTSTONE: grey-brown, very low strength with low to medium strength bands, highly to moderately weathered, slightly fractured, Bringelly Shale						6.20-6.25m: fg, 50mm	C	100	0	
73								6.92m: J70°, he 7.074m: J30° & 85°: st, sm, fe 7.30-7.60m: Ds, 300mm	C	100	0	PL(A) = 0.5
72	8.15							7.80-7.90m: Cs, 100mm 7.9m: CORE LOSS: 250mm 8.15-8.55m: fg, cly, 400mm				
71	8.5	SILTSTONE: pale grey and grey, low strength with very low strength bands, moderately and slightly weathered, slightly fractured, Bringelly Shale							C	87	70	PL(A) = 0.3
								9.08m: B0°, cly 20mm 9.24m: B0°, cly, 10mm				PL(A) = 0.3
								9.48m: J80°, he, fe 9.7m: J35°, he, fe				
	10.0											

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 1.0m HQ to 2.5m

TYPE OF BORING: SFA (TC-bit) to 1.0 m, Rotary (wash bore) to 2.5m, NMLC coring to 12.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 80.3 AHD
EASTING: 300945.2
NORTHING: 6255310.3
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 99735.00
DATE: 13/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
70	10.45	SILTSTONE: grey, low and medium strength, highly then slightly weathered, slightly fractured, Bringelly Shale						10.06-10.25m: fg, 190mm 10.25m: CORE LOSS: 200mm 10.45-10.90m: Ds, 450mm				PL(A) = 0.2
69	11								C	90	60	PL(A) = 0.4
68	12 12.0	Bore discontinued at 12.0m Target depth reached						11.50-11.55m: Ds, 50mm				PL(A) = 0.2
67	13											
66	14											
65	15											
64	16											
63	17											
62	18											
61	19											

RIG: Scout 1 **DRILLER:** JE **LOGGED:** SI **CASING:** HW to 1.0m HQ to 2.5m

TYPE OF BORING: SFA (TC-bit) to 1.0 m, Rotary (wash bore) to 2.5m, NMLC coring to 12.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: 105 PROJECT: HORSLEY PARK AUGUST 2020

2.50 – 7.00m

BORE: 105 PROJECT: HORSLEY PARK AUGUST 2020

7.00 – 12.00m

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 62.6 AHD
EASTING: 301188
NORTHING: 6255566

PIT No: TP201
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
62	0.25	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft		D	0.1				
					0.2				
		Silty CLAY (CH): high plasticity, red-brown, trace rootlets, w>PL, stiff, residual		D	0.4				
					0.5				
		From 0.6m: pale grey mottled red-brown, w<PL, very stiff to hard							
	1				0.8				1
					0.9				
				D B	1.0				
		From 1.1m: hard, grading to weathered siltstone			1.1				
	1.4	SILTSTONE: pale grey and yellow brown, very low to low strength, Bringelly Shale		D	1.4				
61	1.5	Pit discontinued at 1.5m Refusal			1.5				
	2								2
60									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 62.7 AHD
EASTING: 301110
NORTHING: 6255565

PIT No: TP202
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
62	0.2	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft		D	0.1				
		Silty CLAY (CH): high plasticity, red-brown, trace rootlets, w>PL, stiff, residual			0.2				
				D	0.4				
		From 0.6m: pale grey mottled red-brown, trace fine to medium ironstone gravel, w<PL, very stiff to hard			0.5				
	1			D	0.9				
					1.0				
61		From 1.2m: with fine to medium subangular ironstone gravel, hard, grading into weathered siltstone		D	1.4				
					1.5				
				D	1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				
60									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)
LOGGED: TM
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 63.9 AHD
EASTING: 300899
NORTHING: 6255541

PIT No: TP203
PROJECT No: 99735.00
DATE: 11/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
63	0.25	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft to firm		D	0.1				
					0.2				
		Silty CLAY (CH): high plasticity, brown, trace fine to medium rounded to subrounded ironstone gravel, w>PL, firm to stiff, residual		D	0.4				
					0.5				
		From 0.7m: red-brown, w<PL, very stiff to hard		D	0.9				
	1				1.0				1
		From 1.1m: pale grey and red-brown, with fine to medium angular to sub angular ironstone gravel, w<PL, hard, grading into weathered siltstone		D	1.4				
					1.5				
62				D	1.9				
	2	2.0 Pit discontinued at 2.0m target depth reached			2.0				2
61									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)
LOGGED: TM
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 66.3 AHD
EASTING: 300782
NORTHING: 6255546

PIT No: TP204
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
66	0.2	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft		D	0.1				
		Silty CLAY (CH): high plasticity, red-brown, trace fine to medium subrounded ironstone gravel, w>PL, firm to stiff, residual		B	0.2				
		From 0.5m: pale grey mottled red-brown			0.5				
	1	From 1.0m: w<PL, very stiff		D	0.9				
65					1.0				
		From 1.5m: hard, grading into weathered siltstone		D	1.4				
					1.5				
				D	1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				
64									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 64.8 AHD
EASTING: 300612
NORTHING: 6255554

PIT No: TP205
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
64	0.15	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.1				
		Silty CLAY (CH): high plasticity, red-brown mottled pale brown, trace fine to medium subangular ironstone gravel, w>PL, firm to stiff, residual			0.15				
				D	0.4				
					0.5				
		From 0.6m: pale grey mottled red-brown, with fine to medium ironstone gravel, w<PL, very stiff to hard, grading into weathered siltstone							
	1			D	0.9				1
					1.0				
	1.2	SILTSTONE: dark grey with red-brown ironindurated bands, very low to low strength, Bringelly Shale							
63	1.35	Pit discontinued at 1.35m Refusal							
	2								2
62									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 61.4 AHD
EASTING: 300464
NORTHING: 6255525

PIT No: TP206
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
61	0.0	FILL/ Gravelly CLAY: low to medium plasticity, dark grey, with building rubble, tile, plastic and glass fragments, w>PL, generally soft to firm, apparently poorly compacted		D	0.1				
					0.2				
	0.6	FILL/ GRAVEL: glass fragments, trace plastic fragments, wet, sulfurous odour		D	0.6			▽	
					0.7				
	0.9	Pit discontinued at 0.9m Pit collapsing due to groundwater ingress							
	1								1
60									
	2								2
59									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Groundwater seepage from 0.6m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 60.9 AHD
EASTING: 300370
NORTHING: 6255510

PIT No: TP207
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
									5 10 15 20
	0.25	FILL/Silty CLAY: low to medium plasticity, dark brown, trace rootlets, trace glass and tile fragments, w<PL, apparently in a stiff condition		D	0.1 0.2				
	0.7	FILL/Silty CLAY: medium plasticity, dark brown and red-brown, with tile, glass and concrete fragments, trace rootlets, w<PL, apparently in a stiff condition		D	0.4 0.5				
60	1	FILL/ Silty CLAY: low plasticity, brown, with glass fragments, w<PL, apparently in a very stiff to hard condition		D	0.9 1.0				1
	1.1	TOPSOIL/Silty CLAY: low plasticity, dark brown, with rootlets, w<PL, hard							
	1.3	Silty CLAY (CH): high plasticity, red-brown with some yellow-brown, trace rootlets, w~PL, hard, residual		D	1.9				
59	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				2
58									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 62.5 AHD
EASTING: 301238
NORTHING: 6255460

PIT No: TP208
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
62	0.2	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft to firm		D	0.1				
		Silty CLAY (CH): high plasticity, pale yellow-brown, trace rootlets, trace fine to medium subangular ironstone gravel, w>PL, stiff, residual			0.2				
				D	0.5				
		From 0.6m: pale grey mottled red-brown, w<PL, very stiff to hard			0.6				
				D	0.9				
61	1	From 1.1m: hard, grading into weathered siltstone			1.0				1
	1.3	SILTSTONE: very low to low strength, pale grey and yellow brown iron indurated bands, Bringelly Shale		D	1.3				
	1.4	Pit discontinued at 1.4m Refusal			1.4				
60	2								2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 66.1 AHD
EASTING: 301112
NORTHING: 6255470

PIT No: TP209
PROJECT No: 99735.00
DATE: 11/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
66	0.2	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.1				
		Silty CLAY (CH): high plasticity, red-brown, trace rootlets, w>PL, firm to stiff, residual			0.2				
				D	0.5				
		From 0.6m: pale grey mottled red-brown, w<PL, very stiff			0.6				
				D	0.9				
65	1	From 1.1m: hard, grading into weathered siltstone			1.0				1
	1.3	SILTSTONE: grey with orange-brown iron indurated bands, very low to low strength		D	1.3				
					1.4				
	1.7	Pit discontinued at 1.7m Refusal							
64	2								2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 70.4 AHD
EASTING: 300898
NORTHING: 6255439

PIT No: TP210
PROJECT No: 99735.00
DATE: 11/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
70	0.15	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.1				
		Silty CLAY (CH): high plasticity, pale grey mottled red-brown, trace fine ironstone gravel, w>PL, stiff, residual		D	0.4				
					0.5				
	1	From 0.9m: pale grey mottled red-brown, with iron indruated bands, w<PL, hard, grading into weathered siltstone		D	0.9				
					1.0				
					1.3				
69	1.4	SILTSTONE: grey with red-brown iron indurated bands, very low to low strength, Bringelly Shale		D	1.4				
				B	1.5				
	1.6	Pit discontinued at 1.6m Refusal			1.6				
68	2								

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 66.1 AHD
EASTING: 300645
NORTHING: 6255455

PIT No: TP211
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
66	0.2	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.1				
		Silty CLAY (CH): high plasticity, red-brown mottled pale-grey, trace fine to medium subangular ironstone gravel, w>PL, stiff, residual		D	0.2 0.4				
					0.5				
		From 0.9m: pale grey mottled red-brown, w<PL, very stiff to hard		D	0.9				
65	1				1.0				1
		From 1.3m: grading into weathered siltstone, pale grey with red-brown, iron indurated bands, hard		D	1.4				
		At 1.5m: very low to low strength grey-brown iron indurated band			1.5				
	1.9	SILTSTONE: dark grey and orange-brown, very low to low strength		D	1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				2
64									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 62.6 AHD
EASTING: 300487
NORTHING: 6255439

PIT No: TP212
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.1				
	0.2	Silty CLAY (CH): high plasticity, red-brown mottled yellow-grey, trace rootlets, w>PL, firm to stiff, residual			0.2				
62				D	0.4				
					0.5				
		From 0.9m: pale grey mottled red-brown, w<PL, very stiff		D	0.9				
	1				1.0				1
		From 1.5m: trace fine subangular ironstone gravel, w<PL, very stiff to hard		D	1.4				
61					1.5				
				D	1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				2
60									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)
LOGGED: TM
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 60.5 AHD
EASTING: 300311
NORTHING: 6255421

PIT No: TP213
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
60	0.3	FILL/ Silty CLAY: low plasticity, dark brown, trace fine igneous gravel, with coarse crushed concrete fragments, w<PL, generally in a firm to stiff condition, apparently poorly compacted		D	0.1				
					0.2				
		Silty CLAY (CH): high plasticity, orange-brown, trace rootlets, trace fine to medium subrounded ironstone gravel, w>PL, stiff, residual		D	0.4				
		From 0.5m: pale grey mottled red-brown			0.5				
					0.8				
				D	0.9				
59	1			B	1.0				
					1.4				
		From 1.5m: w<PL, very stiff		D	1.5				
					1.9				
58	2	2.0 Pit discontinued at 2.0m target depth reached		D	2.0				

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 61.5 AHD
EASTING: 301338
NORTHING: 6255269

PIT No: TP214
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
61	0.22	TOPSOIL/Silty CLAY: medium plasticity, grey-brown, with rootlets, w>PL, soft		D	0.1				
					0.2				
		Silty CLAY (CH): high plasticity, yellow-brown mottled pale grey, trace rootlets, w>PL, firm to stiff, residual		D	0.5				
		From 0.6m: w<PL, very stiff to hard			0.6				
		From 0.9m, red-brown mottled pale grey, trace fine angular ironstone gravel		D	0.9				
60	1				1.0				1
				B	1.3				
				D					
					1.6				
	1.8	Pit discontinued at 1.8m target depth reached			1.8				
59	2								2

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 66.5 AHD
EASTING: 301201
NORTHING: 6255311

PIT No: TP215
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
66	0.1	TOPSOIL/ Silty CLAY: low to medium plasticity, dark brown, trace rootlets, w>PL, soft		D	0.1				
	0.3	Silty CLAY (CH): high plasticity, red brown, trace rootlets, trace fine angular ironstone gravel, w>PL, stiff to very stiff, residual			0.2				
		From 0.6m: pale grey mottled yellow brown, w<PL, hard, grading into weathered siltstone		D	0.5				
					0.6				
					0.8				
				D	0.9				
65	1.0	SILTSTONE: very low to low strength, pale yellow-brown, Bringelly Shale		B	1.0				
	1.3	Pit discontinued at 1.3m Refusal			1.3				
64									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1 m, 2 m

RIG: 5T Excavator (450mm Bucket)
LOGGED: TM
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 70.8 AHD
EASTING: 301086
NORTHING: 6255357

PIT No: TP216
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
70	0.15	TOPSOIL: Silty CLAY, very low to low plasticity, dark brown, with rootlets, w>PL, soft			0.1				5 10 15 20
		Silty CLAY (CH): high plasticity, red-brown, trace fine subrounded ironstone gravel, w>PL, firm to stiff, residual		D	0.2				
					0.5				
		From 0.6m: very stiff, pale grey mottled red-brown		D	0.6				
	1				0.9				1
				D	1.0				
69		From 1.4m: w<PL, hard, grading into weathered siltstone							
	1.9	SILTSTONE: very low strength, pale grey and red brown, Bringelly Shale							
	2 2.0	Pit discontinued at 2.0m target depth reached							2
68									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 71.5 AHD
EASTING: 300964
NORTHING: 6255392

PIT No: TP217
PROJECT No: 99735.00
DATE: 11/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft		D	0.1				
	0.2	Silty CLAY (CH): high plasticity, orange-brown, trace fine subrounded ironstone gravel, w>PL, stiff to very stiff, residual			0.19				
71				D	0.4				
					0.5				
				B					
		From 0.9m: pale grey mottled red-brown, w<PL, very stiff to hard		D	0.9				
	1				1.0				1
				D	1.4				
70		From 1.5m: grading into weathered siltstone			1.5				
				D	1.9				
	2	2.0 Pit discontinued at 2.0m target depth reached			2.0				2
69									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)
LOGGED: TM
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 78.6 AHD
EASTING: 300863
NORTHING: 6255367

PIT No: TP218
PROJECT No: 99735.00
DATE: 11/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
78	0.1	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm							
		Silty CLAY (CH): high plasticity, red-brown mottled yellow-brown, trace rootlets, trace fine to medium subangular ironstone gravel, w>PL, firm to stiff, residual			0.2				
					0.4				
				B D	0.5				
					0.7				
					0.9				
	1	From 1.1m: pale grey mottled red-brown, trace iron indurated bands, w<PL, very stiff		D	1.0				1
77	1.4	SILTSTONE: grey and orange-brown, very low to low strength, Bringelly Shale		D	1.4				
					1.5				
	1.7	Pit discontinued at 1.7m Refusal							
76	2								2

5 10 15 20

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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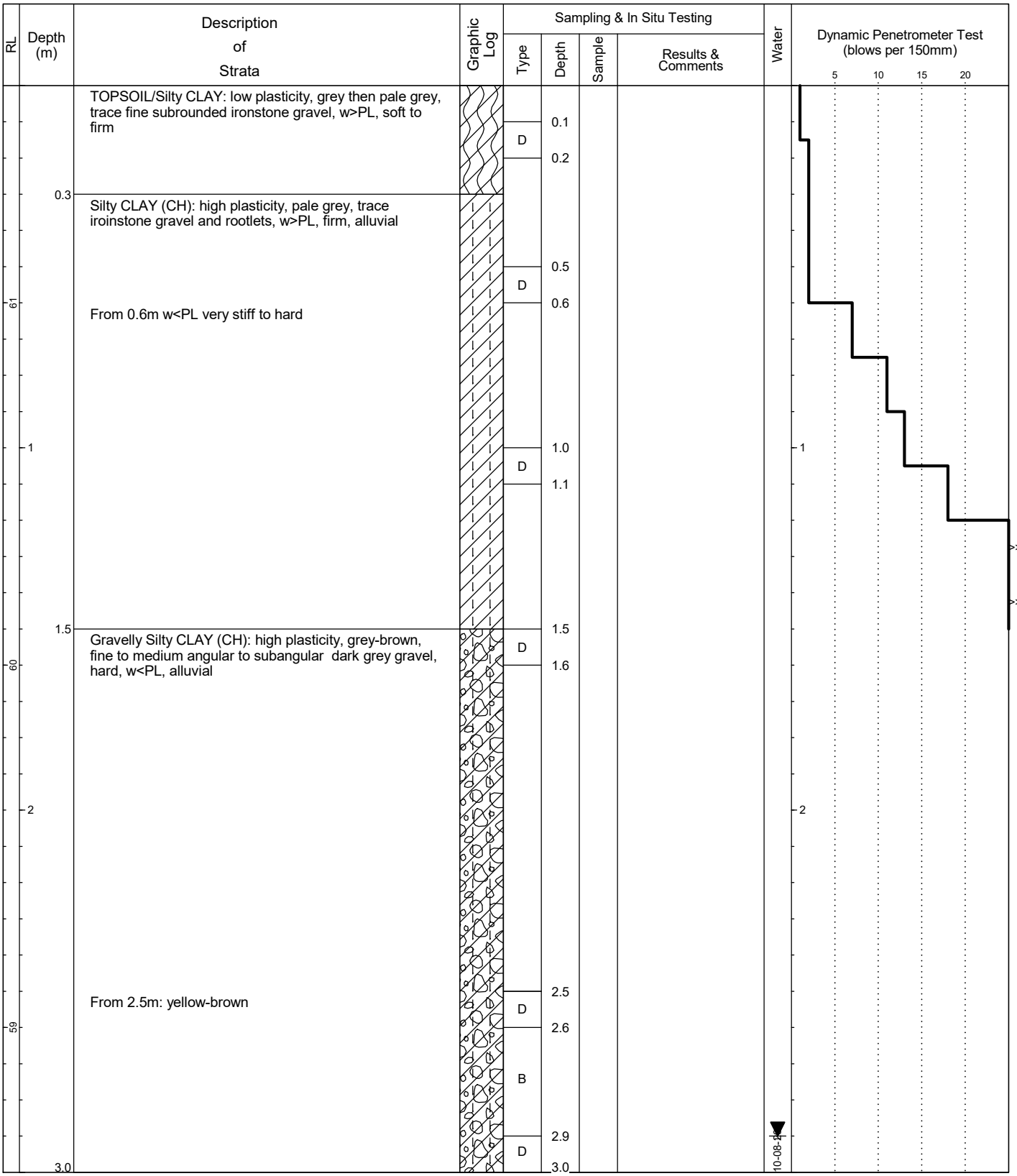
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 61.6 AHD
EASTING: 301337
NORTHING: 6255146

PIT No: TP219
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1



RIG: 5T Excavator (450mm Bucket)
LOGGED: SI
SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 2.9m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 65.1 AHD
EASTING: 301244
NORTHING: 6255225

PIT No: TP220
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
65	0.0	TOPSOIL/Silty CLAY: medium plasticity, grey-brown, with rootlets, w>PL, soft to firm		D	0.05				
					0.14				
	0.3	Silty CLAY (CH): medium to high plasticity, orange brown, trace rootlets, w>PL, stiff to very stiff, residual		D	0.5				
		From 0.6m: w<PL very stiff to hard			0.6				
				D	0.9				
64	1	From 1.0m: trace fine to medium subrounded ironstone gravel			1.0				1
		From 1.6m: pale grey		D	1.8				
					1.9				
	2								2
63	2.1	Pit discontinued at 2.1m target depth reached							

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 75.0 AHD
EASTING: 301054
NORTHING: 6255273

PIT No: TP221
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
75		TOPSOIL/Silty CLAY: low to medium plasticity, dark brown, trace rootlets, w>PL, stiff			0.1				
	0.15	Silty CLAY (CH): high plasticity, red-brown, trace rootlets, w>PL, stiff, residual		D	0.2				
		From 0.6m: pale grey mottled red-brown, trace fine to medium angular to subangular ironstone gravel, w<PL, very stiff to hard, grading into weathered siltstone		D	0.5 0.6				
	0.8	SILTSTONE: very low to low strength, pale yellow brown, Bringelly Shale		D	0.9 1.0				
74	1								1
	1.2	Pit discontinued at 1.2m Refusal							
73	2								2

5 10 15 20

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 90.0 AHD
EASTING: 300866
NORTHING: 6255266

PIT No: TP222
PROJECT No: 99735.00
DATE: 11/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
90		TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, trace fine subangular ironstone gravel, w>PL, firm		D	0.1				
					0.2				
	0.25	Silty CLAY (CH): medium to high plasticity, red-brown and yellow-brown, trace fine subangular ironstone gravel, trace rootlets, w>PL, firm to stiff, residual		D	0.4				
					0.5				
				D	0.9				
89	1	From 0.9m: pale grey mottled red-brown, very low to low strength iron indurated bands w<PL, very stiff to hard			1.0				1
		From 1.2m: hard, grading into weathered siltstone							
					1.6				
				B	1.8				
				D	1.9				
88	2	2.0 Pit discontinued at 2.0m target depth reached			2.0				2

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 72.7 AHD
EASTING: 300712
NORTHING: 6255345

PIT No: TP223
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft to firm		D	0.1				
	0.2	Silty CLAY (CH): high plasticity, red-brown with some pale brown, trace rootlets, trace fine subangular to subrounded ironstone gravel, w>PL, firm to stiff, residual			0.2				
				D	0.4				
72				B	0.5				
		From 0.8m: stiff to very stiff			0.8				
				D	0.9				
	1				1.0				1
		From 1.4m: pale grey mottled red-brown, w<PL, hard, residual		D	1.4				
					1.5				
71		From 1.8m: grading into weathered siltstone		D	1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				2
70									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

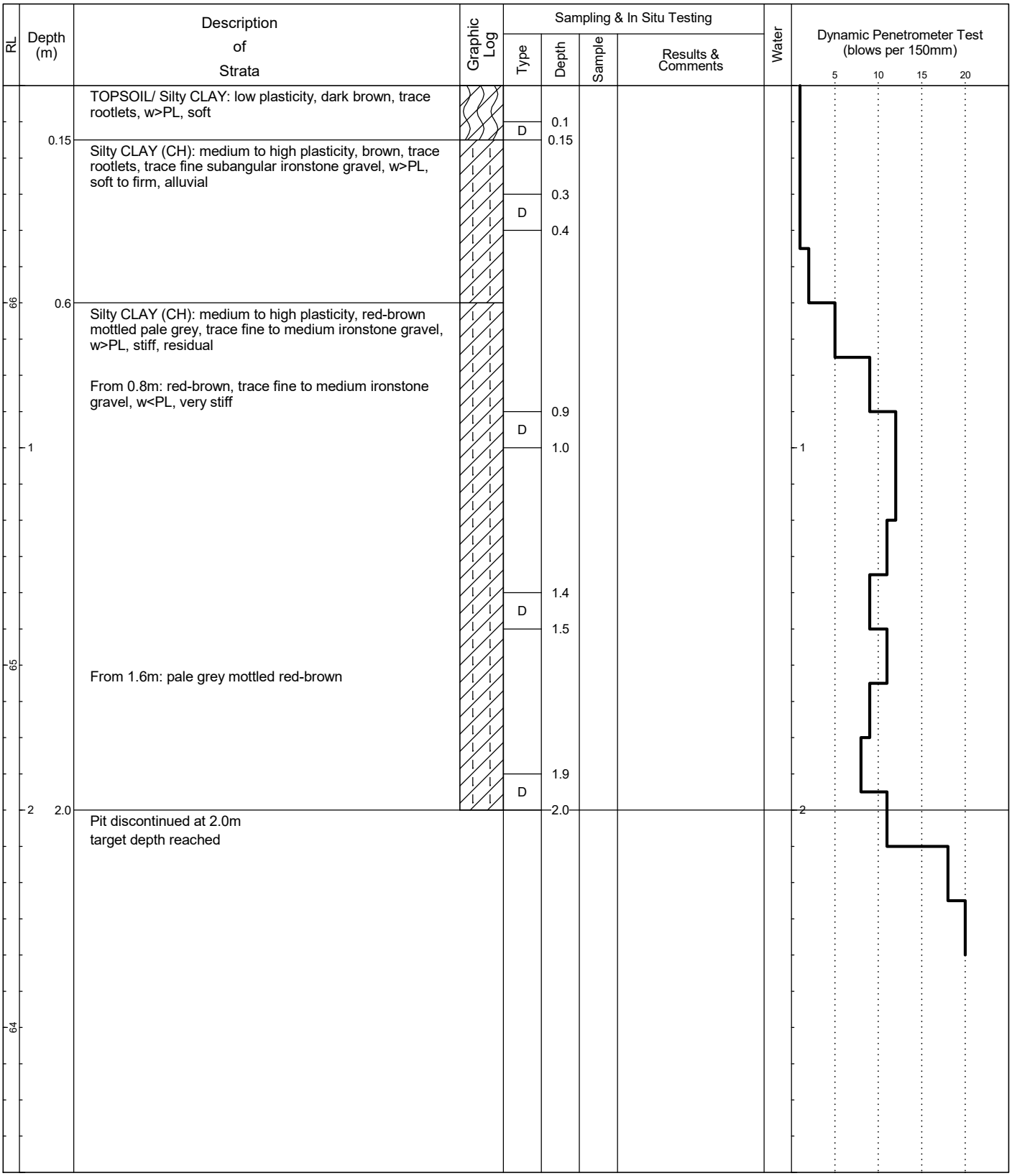
Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 66.6 AHD
EASTING: 300587
NORTHING: 6255331

PIT No: TP224
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1



RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 59.9 AHD
EASTING: 300249
NORTHING: 6255341

PIT No: TP225
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
59	0.0	TOPSOIL/ Silty CLAY: medium plasticity, dark brown, trace rootlets, w>PL, firm		D	0.1				
					0.2				
	0.3	Silty CLAY (CH): high plasticity, orange-brown mottled pale grey, trace rootlets, trace fine subrounded ironstone gravel, w>PL, firm to stiff, residual		D	0.4				
					0.5				
		From 0.6m: very stiff			0.6				
					0.9				
	1	From 1.0m: hard		D B	1.0				1
					1.4				
				D	1.5				
58					1.9				
				D					
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				2
57									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 66.7 AHD
EASTING: 301210
NORTHING: 6255076

PIT No: TP226
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL/ Silty CLAY: low plasticity, grey, trace rootlets, w>PL, firm		D	0.1				
	0.2	CLAY (CH): high plasticity, brown, trace rootlets, w>PL, firm to stiff, residual			0.2				
				D	0.5				
66					0.6				
	1	From 1.0m: pale grey mottled brown, trace iron indurated bands, very stiff then hard, w<PL		D	1.0				1
					1.1				
				D	1.5				
					1.6				
65	1.7	SILTSTONE: grey brown, very low to low strength, Bringelly Shale		D	1.7				
					1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached		D	2.0				2
64									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)
LOGGED: SI
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 73.7 AHD
EASTING: 301073
NORTHING: 6255162

PIT No: TP227
PROJECT No: 99735.00
DATE: 10/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
73	0.15	TOPSOIL/Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft							
		Silty CLAY (CH): high plasticity, brown, trace fine ironstone gravel and rootlets, w>PL, firm to stiff, residual		D	0.2				
				D	0.5				
	1	From 0.9m: brown mottled pale grey, w<PL, very stiff then hard		D	1.0				1
		From 1.5m: grading into weathered siltstone		D	1.5				
72	1.8	SILTSTONE: pale grey, very low strength, Bringelly Shale		B	1.8				
	2 2.0	Pit discontinued at 2.0m target depth reached		D	2.0				2
71									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)
LOGGED: TM
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 64.8 AHD
EASTING: 300440
NORTHING: 6255360

PIT No: TP228
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL/Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, soft		D	0.1				
	0.25				0.2				
		Silty CLAY (CH): high plasticity, red-brown mottled orange-brown, trace fine subrounded ironstone gravel and rootlets, w>PL, stiff to very stiff, residual		D	0.4				
					0.5				
64		From 0.8m: pale grey mottled red-brown, w<PL, very stiff to hard		D	0.9				
	1				1.0				1
				D	1.4				
					1.5				
63		From 1.7m: pale grey with red-brown, iron indurated bands, hard, grading into weathered siltstone		D	1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				2
62									

RIG: 5T Excavator (450mm Bucket)
LOGGED: TM
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 80.9 AHD
EASTING: 300725
NORTHING: 6255187

PIT No: TP229
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
80	0.15	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.05				
		Silty CLAY (CH): high plasticity, red-brown and yellow-brown, trace fine to medium subangular ironstone gravel, w>PL, firm to stiff, residual			0.15				
					0.2				
				B	0.3				
				D	0.4				
					0.5				
					0.6				
				D	0.7				
		From 0.8m: orange-brown mottled red-brown, w<PL, hard							
	1								1
		From 1.1m: with very low to low strength grey and red-brown iron indurated bands							
					1.4				
				D	1.5				
	1.55	Pit discontinued at 1.55m Refual on iron indurated band							
79	2								2
78									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 69.6 AHD
EASTING: 300553
NORTHING: 6255230

PIT No: TP230
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
69	0.15	TOPSOIL/Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.05				
		Silty CLAY (CH): high plasticity, red-brown, trace rootlets, trace fine to medium subangular ironstone gravel, w>PL, stiff, residual			0.15				
				D	0.4				
		From 0.6m:yellow-brown mottled red-brown, w<PL, very stiff			0.5				
				D	0.7				
	1	From 0.9m: pale grey mottled red-brown, with iron indurated bands, hard, grading into weathered siltstone			0.8				1
	1.1	SILTSTONE: grey and orange-brown, very low to low strength, Bringelly Shale		D	1.1				
68	1.3	Pit discontinued at 1.3m Refual on iron indurated band			1.2				
	2								2
67									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 66.4 AHD
EASTING: 300421
NORTHING: 6255223

PIT No: TP231
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
66	0.2	TOPSOIL/ Silty CLAY: low plasticity, dark brown, trace rootlets, w>PL, firm		D	0.05 0.15				
		Silty CLAY (CH): high plasticity, red-brown mottled orange-brown, trace fine to medium subangular ironstone gravel, w>PL, firm to stiff, residual		B	0.2				
					0.7				
	1			D	0.9 1.0				1
65		From 1.0m pale grey mottled red-brown, w<PL, very stiff							
				D	1.4 1.5				
		From 1.7m: grading into weathered siltstone, with iron indurated bands							
				D	1.9				
	2 2.0	Pit discontinued at 2.0m target depth reached			2.0				2
64									

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Gazbuild Pty Ltd
PROJECT: Proposed Industrial Estate
LOCATION: 813-913 Wallgrove Road, Horsley Park

SURFACE LEVEL: 62.6 AHD
EASTING: 300295
NORTHING: 6255250

PIT No: TP232
PROJECT No: 99735.00
DATE: 12/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
62	0.1	FILL/Silty CLAY: low plasticity, dark brown, trace rootlets, trace medium to coarse building rubble (tile and concrete fragments), w>PL, generally in a stiff condition, apparently poorly compacted		D	0.1				
	0.2				0.2				
	0.3	Silty CLAY (CH): high plasticity, red-brown mottled yellow-brown, trace fine to medium rounded to subrounded ironstone gravel, w>PL, stiff, residual		D	0.4				
	0.5				0.5				
		From 0.6m: pale grey mottled yellow brown, w<PL, very stiff							
	0.9			D	0.9				
1	1.0				1.0				1
	1.4			D	1.4				
61	1.5	From 1.5m: pale grey mottled red-brown, with iron indurated bands, hard, grading into weathered siltstone			1.5				
	1.9			D	1.9				
2	2.0	Pit discontinued at 2.0m target depth reached			2.0				2
60									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 5T Excavator (450mm Bucket)

LOGGED: TM

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TP201 - 10 August 2020

TP202 - 10 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT: 99735.00 Page No: 1 of 16 REV: 0
	CLIENT: Gazbuild Pty Ltd	DATE: 8-Sep-20

TP203 - 11 August 2020

TP204 - 12 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	2 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP205 - 12 August 2020

TP206 - 12 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	3 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP207 - 12 August 2020

TP208 - 10 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	4 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP209 - 11 August 2020

TP210 - 11 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	5 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP211 - 12 August 2020

TP212 - 12 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	6 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP213 - 12 August 2020

TP214 - 10 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	7 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP215 - 10 August 2020

TP216 - 10 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	8 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP217 - 11 August 2020

TP218 - 11 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	9 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

NO PHOTO TAKEN

TP219 - 10 August 2020

TP220 - 10 August 2020

TP221 - 10 August 2020

TP222 - 11 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	11 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP223 - 12 August 2020

TP224 - 12 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	12 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP225 - 12 August 2020

NO PHOTO TAKEN

TP226 - 10 August 2020

TP227 - 10 August 2020

TP228 - 12 August 2020

TP229 - 12 August 2020

TP230 - 12 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT:	99735.00
		Page No:	15 of 16
		REV:	0
	CLIENT: Gazbuild Pty Ltd	DATE:	8-Sep-20

TP231 - 12 August 2020

TP232 - 12 August 2020

Douglas Partners Geotechnics / Environment / Groundwater	**Test Pit Photographs** **813-913 Wallgrove Road** **Horsely Park**	PROJECT: 99735.00 Page No: 16 of 16 REV: 0
	CLIENT: Gazbuild Pty Ltd	DATE: 8-Sep-20

Appendix D

Laboratory Results

Material Test Report

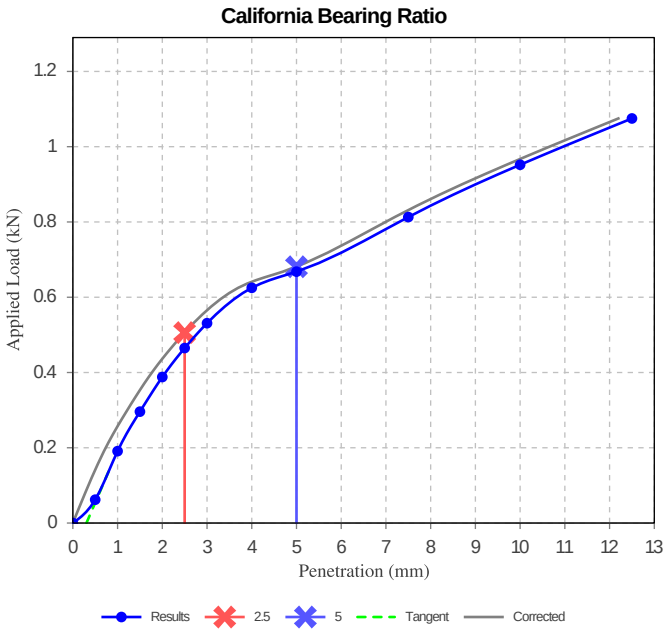
Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **99735.00-4**
Issue Number: 1
Date Issued: 09/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6605
Sample Number: SY-6605A
Date Sampled: 10/08/2020
Dates Tested: 25/08/2020 - 08/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP204 (0.2-0.5m)**
Material: Silty CLAY: red-brown, trace fine to medium subrounded ironstone gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.72		
Optimum Moisture Content (%)	20.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	97.5		
Dry Density after Soaking (t/m^3)	1.70		
Field Moisture Content (%)	22.4		
Moisture Content at Placement (%)	19.5		
Moisture Content Top 30mm (%)	24.1		
Moisture Content Rest of Sample (%)	20.3		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	192.4		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

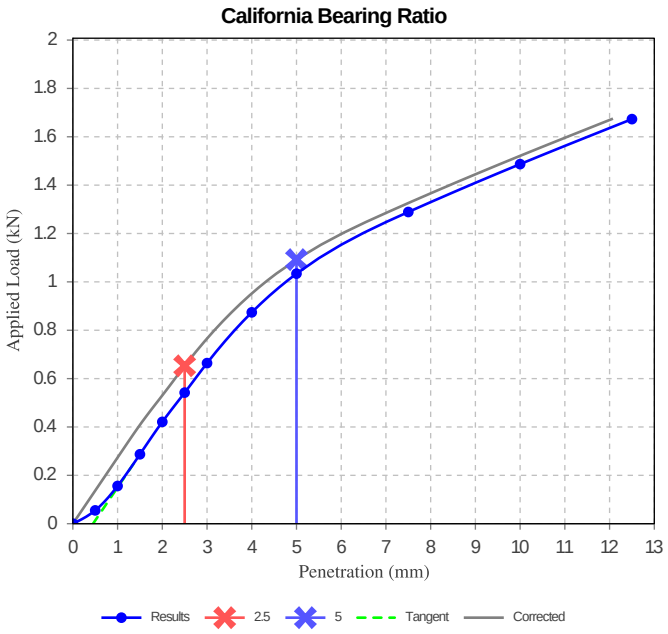
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **99735.00-3**
Issue Number: 1
Date Issued: 08/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6586
Sample Number: SY-6586A
Date Sampled: 12/08/2020
Dates Tested: 20/08/2020 - 07/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP215 (0.8 - 1.3m)**
Material: SILTSTONE: very low to low strength, pale yellow-brown

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**6**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.87		
Optimum Moisture Content (%)	14.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.5		
Dry Density after Soaking (t/m^3)	1.85		
Field Moisture Content (%)	10.3		
Moisture Content at Placement (%)	14.8		
Moisture Content Top 30mm (%)	18.3		
Moisture Content Rest of Sample (%)	16.3		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	218.8		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	25		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	32		
Plastic Limit (%)	17		
Plasticity Index (%)	**15**		



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Douglas Partners Pty Ltd
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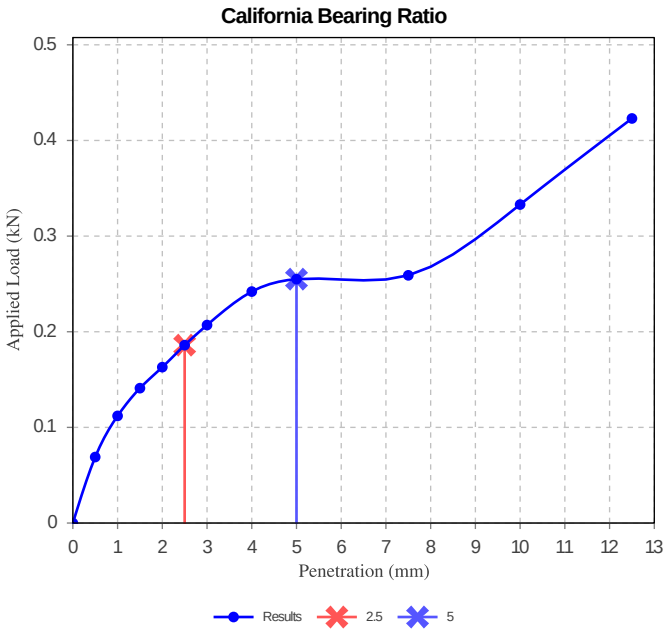
Report Number: **99735.00-3**
Issue Number: 1
Date Issued: 08/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6586
Sample Number: SY-6586B
Date Sampled: 12/08/2020
Dates Tested: 20/08/2020 - 07/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP217 (0.5 - 1.0m)**
Material: Silty CLAY: pale grey mottled red-brown, trace fine to medium ironstone gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**1.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.67		
Optimum Moisture Content (%)	21.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	100.5		
Dry Density after Soaking (t/m^3)	1.62		
Field Moisture Content (%)	22.8		
Moisture Content at Placement (%)	21.1		
Moisture Content Top 30mm (%)	29.7		
Moisture Content Rest of Sample (%)	22.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	216.9		
Swell (%)	3.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	63		
Plastic Limit (%)	20		
Plasticity Index (%)	**43**		



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Douglas Partners Pty Ltd
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Report Number: **99735.00-3**
Issue Number: 1
Date Issued: 08/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6586
Sample Number: SY-6586C
Date Sampled: 12/08/2020
Dates Tested: 20/08/2020 - 02/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP219 (2.5 - 3.0m)**
Material: Gravelly Silty CLAY: yellow brown, fine to medium angular, subangular iron-cemented gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	64		
Plastic Limit (%)	21		
Plasticity Index (%)	**43**		

Material Test Report

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Douglas Partners Pty Ltd
Sydney Laboratory
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Phone: (02) 9809 0666
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Email: andrew.hutchings@douglaspartners.com.au

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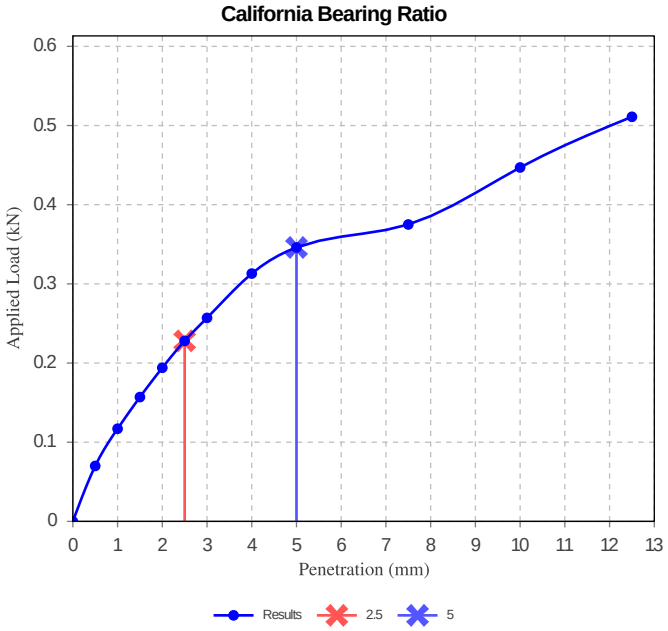
Report Number: **99735.00-3**
Issue Number: 1
Date Issued: 08/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6586
Sample Number: SY-6586D
Date Sampled: 12/08/2020
Dates Tested: 20/08/2020 - 04/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP222 (1.6 - 2.0m)**
Material: Shaly CLAY: pale grey mottled red-brown, trace ironstone bands, trace bands of very low to low strength iron indurated siltstone

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**1.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.69		
Optimum Moisture Content (%)	20.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m^3)	1.63		
Field Moisture Content (%)	18.3		
Moisture Content at Placement (%)	20.2		
Moisture Content Top 30mm (%)	28.4		
Moisture Content Rest of Sample (%)	22.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	142.2		
Swell (%)	4.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.9		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	57		
Plastic Limit (%)	23		
Plasticity Index (%)	**34**		



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Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
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Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

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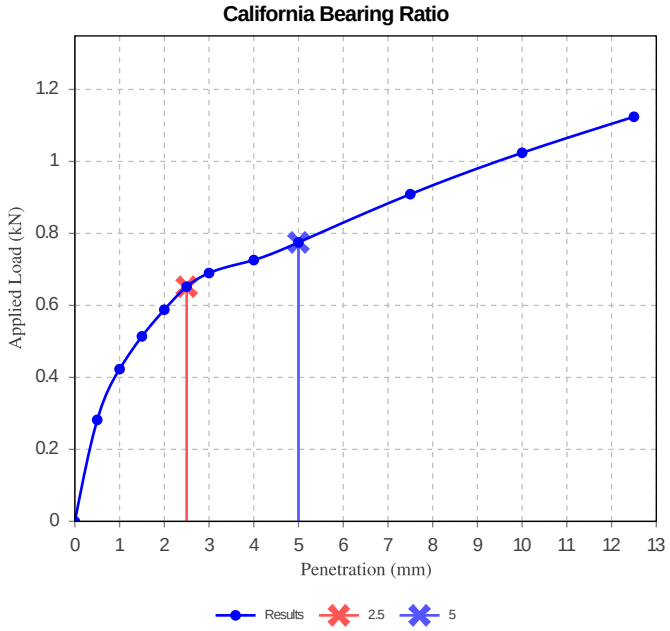
Report Number: **99735.00-3**
Issue Number: 1
Date Issued: 08/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6586
Sample Number: SY-6586E
Date Sampled: 12/08/2020
Dates Tested: 20/08/2020 - 07/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP223 (0.2 - 0.8m)**
Material: Silty CLAY (CH): red-brown with some pale brown, trace rootlets, trace fine subangular to subrounded ironstone gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**5.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.65		
Optimum Moisture Content (%)	22.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	102.0		
Dry Density after Soaking (t/m^3)	1.62		
Field Moisture Content (%)	24.5		
Moisture Content at Placement (%)	22.9		
Moisture Content Top 30mm (%)	28.0		
Moisture Content Rest of Sample (%)	23.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	215.8		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	59		
Plastic Limit (%)	21		
Plasticity Index (%)	**38**		



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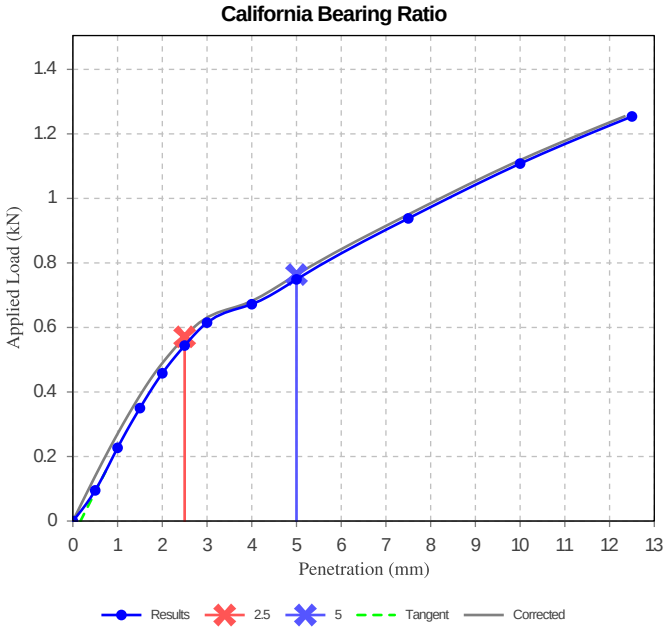
Report Number: **99735.00-3**
Issue Number: 1
Date Issued: 08/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6586
Sample Number: SY-6586F
Date Sampled: 12/08/2020
Dates Tested: 20/08/2020 - 07/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP225 (0.6 - 1.4m)**
Material: Silty CLAY: orange-brown mottled pale grey, trace rootlets, trace fine subrounded ironstone gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.72		
Optimum Moisture Content (%)	20.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	101.0		
Dry Density after Soaking (t/m^3)	1.70		
Field Moisture Content (%)	23.2		
Moisture Content at Placement (%)	20.7		
Moisture Content Top 30mm (%)	24.6		
Moisture Content Rest of Sample (%)	21.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	193.4		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	52		
Plastic Limit (%)	17		
Plasticity Index (%)	**35**		



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Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
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Phone: (02) 9809 0666
Fax: (02) 9809 0666
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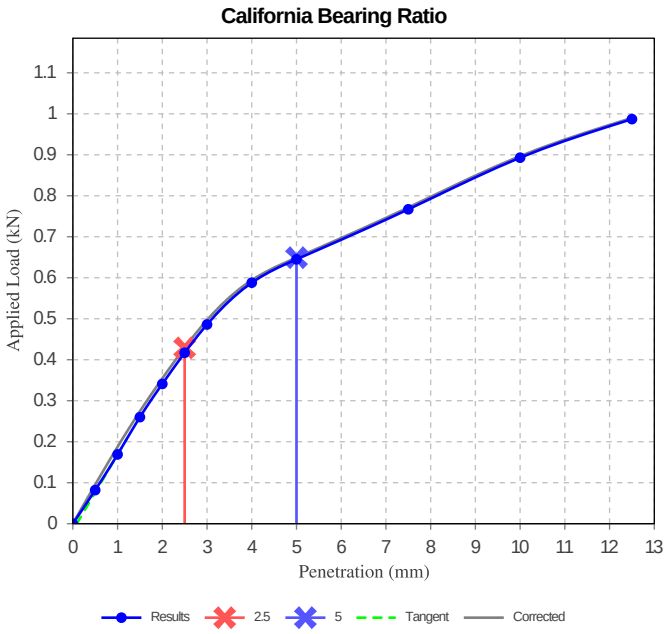
Report Number: **99735.00-3**
Issue Number: 1
Date Issued: 08/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6586
Sample Number: SY-6586G
Date Sampled: 12/08/2020
Dates Tested: 20/08/2020 - 07/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP227 (1.8 - 2.0m)**
Material: SILTSTONE: pale grey, very low strength

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**3.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.81		
Optimum Moisture Content (%)	17.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m^3)	1.78		
Field Moisture Content (%)	15.0		
Moisture Content at Placement (%)	17.1		
Moisture Content Top 30mm (%)	22.3		
Moisture Content Rest of Sample (%)	19.2		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	192.9		
Swell (%)	2.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	13.5		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	54		
Plastic Limit (%)	22		
Plasticity Index (%)	**32**		



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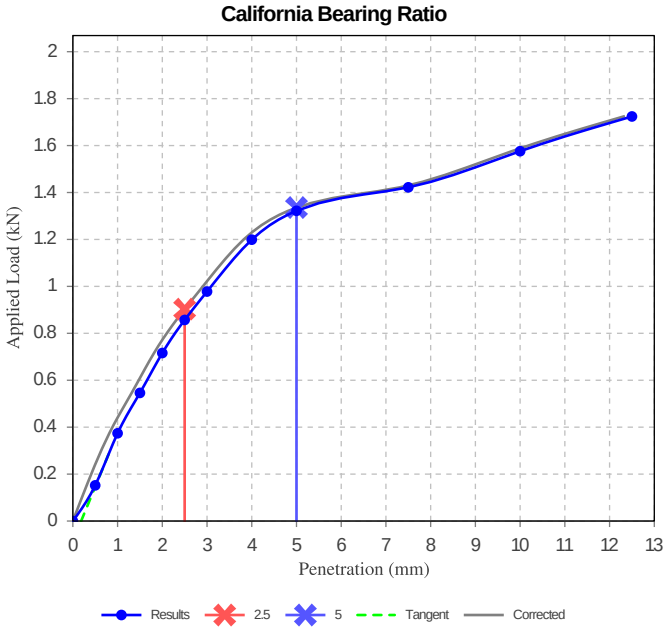
Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **99735.00-4**
Issue Number: 1
Date Issued: 09/09/2020
Client: Gazbuild Pty Ltd
Level 10, 60 Park St, Sydney NSW 2000
Contact: Michael De Zilva
Project Number: 99735.00
Project Name: Proposed Road Upgrade
Project Location: 813 Wallgrove Road, HORSLEY PARK
Work Request: 6605
Sample Number: SY-6605B
Date Sampled: 10/08/2020
Dates Tested: 25/08/2020 - 08/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP231 (0.2-0.7m)**
Material: Silty CLAY: red-brown mottled orange-brown, trace fine to medium subangular ironstone gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**7**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.90		
Optimum Moisture Content (%)	17.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m^3)	1.90		
Field Moisture Content (%)	18.3		
Moisture Content at Placement (%)	17.3		
Moisture Content Top 30mm (%)	19.2		
Moisture Content Rest of Sample (%)	17.3		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72.6		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



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 250016

Client Details

Client	Douglas Partners Pty Ltd
Attention	Alexander Hanna
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**99735.00, Horsley Park**
Number of Samples	6 Soil
Date samples received	28/08/2020
Date completed instructions received	28/08/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	04/09/2020
Date of Issue	03/09/2020

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Soil Aggressivity						
Our Reference		250016-1	250016-2	250016-3	250016-4	250016-5
Your Reference	UNITS	TP209_0.1-0.2	TP211_0.4-0.5	TP218_1.4-1.5	BH101_0.4-0.5	BH102_2.5-2.95
Date Sampled		11/08/2020	12/08/2020	11/08/2020	14/08/2020	13/08/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
pH 1:5 soil:water	pH Units	4.9	5.4	5.5	6.4	7.6
Electrical Conductivity 1:5 soil:water	µS/cm	150	270	150	170	510
Chloride, Cl 1:5 soil:water	mg/kg	110	180	110	110	540
Sulphate, SO4 1:5 soil:water	mg/kg	43	210	38	74	99

Soil Aggressivity		
Our Reference		250016-6
Your Reference	UNITS	BH103_2.5-2.95
Date Sampled		13/08/2020
Type of sample		Soil
pH 1:5 soil:water	pH Units	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	430
Chloride, Cl 1:5 soil:water	mg/kg	310
Sulphate, SO4 1:5 soil:water	mg/kg	190

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

QUALITY CONTROL: Soil Aggressivity						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	4.9	5.0	2	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	150	130	14	104	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	110	89	21	104	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	43	42	2	109	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

pH / EC
Samples were out of the recommended holding time for this analysis.

Appendix E

Previous Field Work Results

BOREHOLE LOG

CLIENT: GAZCORP Pty Ltd
PROJECT: Proposed Business Centre
LOCATION: 813-913 Wallgrove Rd, Horsley Park

SURFACE LEVEL: 96.0 AHD*
EASTING: 300830
NORTHING: 6255190
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 73207
DATE: 8/10/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
96	0.1	TOPSOIL - brown, fine grained sandy clay topsoil with some grass rootlets, damp							A			
		SILTY CLAY - brown, silty clay with trace of fine grained sand, moist							A			
95	1								A			12,19,25/100mm refusal
	1.1	SANDSTONE - extremely low strength, light grey-brown, fine to medium grained sandstone						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			
94	2											
	2.4											
	2.5	SANDSTONE - very low strength, brown, fine to medium grained sandstone										
93	3	SANDSTONE - low strength, highly weathered, fractured and slightly fractured, brown, medium grained sandstone						2.82m: B10°, fe, cly co, 2mm 3.08m: B5°, he 3.21m: J30°, ro, un, fe, cly 3.24 & 3.29m: B0°- 5°, fe, cly 3.31m: J45°- 55°, ro, cu, fe, cly 3.38m: J25°- 55°, ro, st, fe 3.43m: B0°- 5°, fe, cly, 5mm 3.53m: B0°, fe, cly, 3mm 3.59m: B0°, fe, cly, 2mm 3.76m: B0°, fe, cly & J50°, he 3.8m: B5°, fe 3.85m: J45°, ro, pl, fe 3.91-4.0m: Ds, 90mm 4.12-4.25m: Ds, 130mm 4.2m: B5°, fe, cly 4.33m: B5°, fe 4.43m: J45°, sm, pl, cln 4.48-4.6m: Ds, 120mm 4.6m: CORE LOSS: 220mm 4.82-5.0m: fg 5.0-5.2m: J, sv, ro, un, fe, cly 5.16m: B5°, fe, cly, 5mm 5.24-5.38m: B (x3) 0°, fe, cly co 5.6m: J90°, ro, pl, fe 5.84m: B0°, fe, cly, 10mm 6.15m: J85°, ro, un, fe, cly 6.28m: J45°, ro, pl, cln 6.5 & 6.53m: J65°, ro, un, fe, cly 6.65m: J85°, ro, un, fe, cly 6.65-6.9m: B (x5) 0°- 5°, fe 6.9-7.35m: fg, fe (possible drilling break) 7.35m: J75°, ro, un, fe 7.5m: J85°, ro, pl, fe 7.8m: CORE LOSS: 200mm 8m: J70°, ro, pl, cln 8.12m: B0°, cly, 10mm	C	100	60	PL(A) = 0.2 PL(A) = 0.4
	3.45	SILTSTONE - low strength, highly and slightly weathered, fractured and slightly fractured, grey-brown siltstone. Some extremely low and very low strength bands										
92	4											PL(A) = 0.2
	4.82								C	92	37	
91	5	5.4-5.85m: high strength, fine grained sandstone band										PL(A) = 2
90	6											
		6.65-7.2m: fragmented to fractured										PL(A) = 0.2
89	7								C	100	20	
	7.2	SILTSTONE - medium strength, slightly weathered, slightly fractured, grey-brown siltstone with some fine grained sandstone laminations. Some extremely low strength bands										PL(A) = 0.5
88	8											
	8.0											PL(A) = 0.5
	8.74								C	74	68	
87	9											PL(A) = 0.7

RIG: DT100 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 2.0m

TYPE OF BORING: Solid flight auger to 1.7m; Rotary to 2.5m; NMLC-Coring to 18.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: 50% water loss at 6.3m. Level interpolated from A Allen Consulting Surveyors Pty Ltd plan, Ref No. 004-0.8, Issue A

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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BOREHOLE LOG

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BORE No: 1
PROJECT No: 73207
DATE: 8/10/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
86								8.4m: CORE LOSS: 340mm	C	100	100	PL(A) = 0.4
	10.5	SHALE - low to medium and medium strength, fresh, slightly fractured, grey shale						8.8m: J75°, ro, un, fe 8.96m: J70°, ro, pl, fe 9.14m: J45°, ro, pl, fe 9.31m: B0°, fe 9.6m: B0°, cln 9.63m: B0°, cly, 10mm 10.15m: J35°, sm, pl, cln 10.95m: J30°, sm, pl, cln 11.05m: J65°, sm, pl, cln 11.6m: J90°, ro, un, cln 11.85m: J85°, ro, pl, cln 12.12m: J35°, sm, pl, cly				PL(A) = 0.5
85	11								C	100	93	PL(A) = 0.3
84	12											PL(A) = 0.3
								12.6m: B0°, cly vn 12.85m: J70°, ro, un, cln				
83	13											PL(A) = 0.5
								13.72m: J70°, ro, un, cln 13.86m: J45°, ro, un, cln	C	100	100	
82	14	14.0 SILTSTONE/SHALE - medium strength, fresh, slightly fractured and unbroken, grey-brown siltstone/shale										PL(A) = 0.4 PL(A) = 0.9
81	15							15.05m: B0°, fe 15.5m: J75°, ro, un, cln				PL(A) = 0.4
80	16											PL(A) = 0.4
	16.15	SANDSTONE - high then medium strength, slightly weathered then fresh, slightly fractured, light grey-brown to grey, fine to medium grained sandstone with some siltstone laminations						16.15m: J55°, ro, un, fe	C	100	97	PL(A) = 1.3
79	17							16.82m: J40°, ro, un, fe 16.9m: B0°, fe 17m: J90°, ro, un, fe 17.11m: B0°, fe				PL(A) = 2.3
78	18	18.0 Bore discontinued at 18.0m						17.6m: B0°, fe				PL(A) = 0.8
77	19											

RIG: DT100 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 2.0m

TYPE OF BORING: Solid flight auger to 1.7m; Rotary to 2.5m; NMLC-Coring to 18.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: 50% water loss at 6.3m. Level interpolated from A Allen Consulting Surveyors Pty Ltd plan, Ref No. 004-0.8, Issue A

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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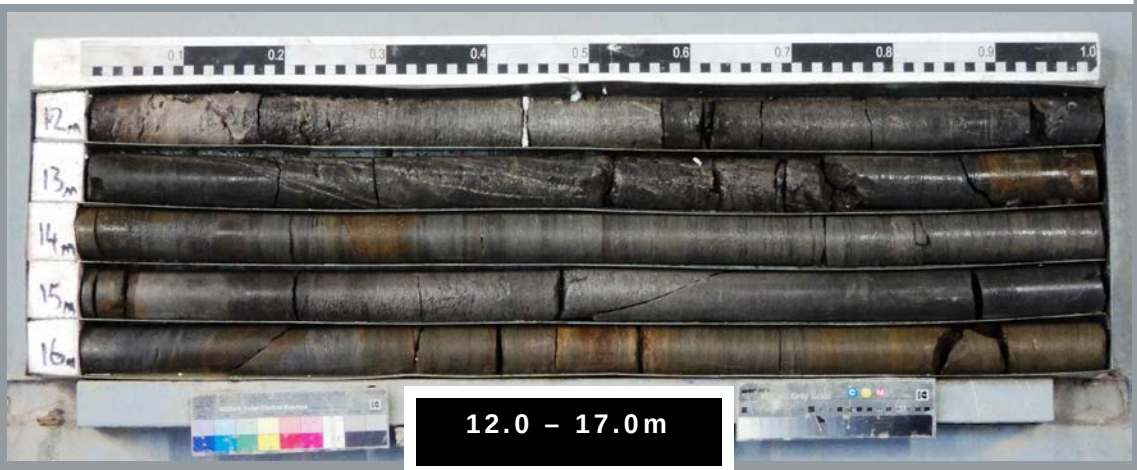
PROPOSED BUSINESS CENTRE – HORSLEY PARK

BORE 1 PROJECT 73207 OCT 2012

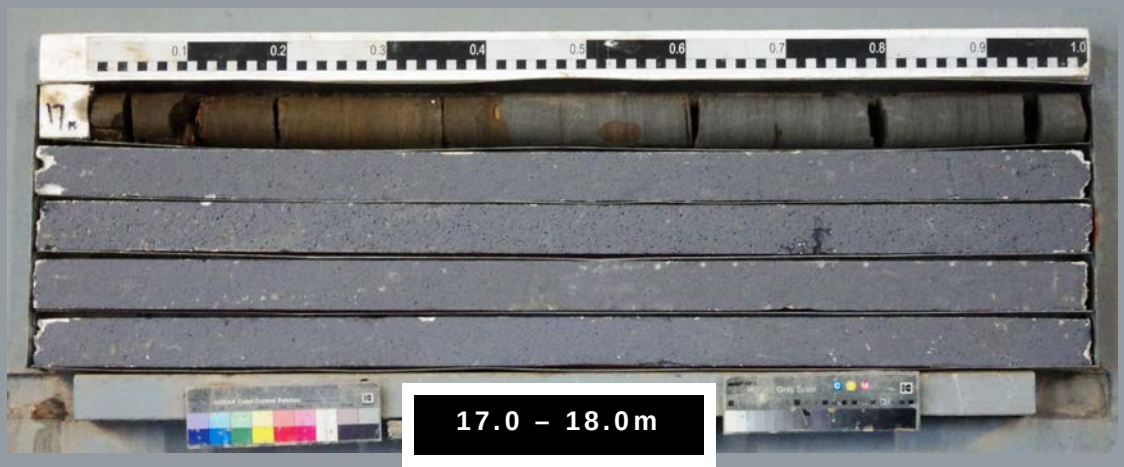


12.0 – 17.0m

DOUGLAS PARTNERS PTY LTD

PROPOSED BUSINESS CENTRE – HORSLEY PARK

BORE 1 PROJECT 73207 OCT 2012



17.0 – 18.0m

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2.5 – 7.0m

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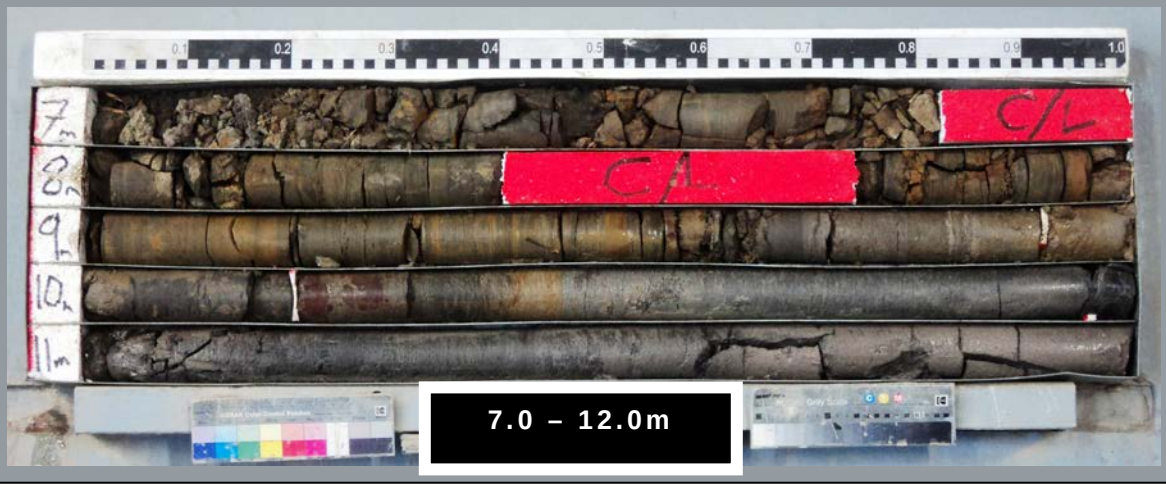
PROPOSED BUSINESS CENTRE – HORSLEY PARK

BORE 1 PROJECT 73207 OCT 2012



7.0 – 12.0m