GROUNDED
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# Report on Geotechnical Investigation

## Proposed Redevelopment of 105 Miller Street

105-153 Miller Street, North Syndey NSW

Prepared for Investa

Project 86964.03

4 April 2025

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

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

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## 1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a geotechnical investigation undertaken for a proposed redevelopment at 105-153 Miller Street, North Syndey NSW (the site). This investigation has been conducted concurrently with a detailed site investigation (DSI) by Douglas.

The aim of the investigation was to assess the subsurface geotechnical and groundwater conditions across the site, which is used to support the State Significant Development Application (SSDA) for the tertiary education use.

A number of comments and recommendations that address specific state and local legislations, policies and guidelines are outlined in the relevant sections of the report.

The geotechnical investigation included the drilling of two boreholes with groundwater monitoring wells installed within. The details of the field work are presented in this report, together with comments and recommendations.

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

## 2. Development Proposal

It is understood the proposed development involves the redevelopment and adaptive reuse of an existing heritage building at 105 Miller Street as a new mix use commercial (retail) / tertiary education institution.

Specifically, it will include:

- Adaptive reuse and restoration of the existing Miller Street wing;
- Demolition of the Denison Street wing and construction of a new 22 storey building;
- Adaptive reuse to the ground level to deliver a significantly enhanced public domain;
- Construction of a double height ground floor retail / tertiary education and the delivery of a public open space along Miller Street; and
- Basement carparking and loading dock accessed from a relocated entry off Denison Street.

## 3. Site Description

The site is regular in shape and covers one lot (Lot 2, D.P. 792740) with an area of approximately 6640 m$^2$. The site has an approximate 100 m frontage along Miller Street, 100 m frontage along Denison Street and 70 m frontage along Brett Whiteley Place. The site is bounded by the Victoria Cross Station Precinct along the northern boundary and is adjacent to Pacific Highway to the south-west.

The site is at an elevation of 60 m to 64 m, relative to Australian Height Datum (AHD), and drops gently to the east and south-east.

The existing development on site is the MLC Centre North Sydney constructed in 1957, including a 14-storey west wing building along Miller Street, an eight-storey east wing building along Denison Street and a 14-storey core building in between two wings, forming an overall 'H'-shaped complex. There are also a number of single-storey annexes between the west and east wings. The buildings share a common lower ground floor level (LGF) and a partial single-level basement (Basement)level beneath.

The construction of the twin rail tunnels of Sydney Metro City and Southwest line were recently completed and open to public, running below Miller Street at a depth of approximately 30 m, parallel and adjacent to the western site boundary.

The adjoining development immediately to the north comprises an Integrated Station Development (ISD) associated with the Victoria Cross Metro Station, currently under construction. Based on the architectural design drawings prepared by Bates Smart for the ISD titled *"s12188 - Victoria Cross SSDA Application, North Sydney NSW 2060"* (downloadable from planning.nsw.gov.au), the ISD development will include a new 42-storey commercial office tower with a seven-level basement. The lowest basement, with a design floor level at RL 37.6 m, will be connected directly to the station cavern underneath Miller Street. The basement excavation of the ISD, which has been completed, extends to the common boundary over its full length.

Other developments surrounding the site include:

- To the west across Miller Street: a commercial development known as "Northpoint Tower" at 100 Miller Street with 35 storeys above the ground and a six-level basement;
- To the east across Denison Street: a new commercial development at 1 Denison Street with 35 storeys above ground and a five and half basement;
- To the south-east across Denison Street: a commercial development at 80 Mount Street with 15 storeys above ground and a three-level basement; and
- To the south across Brett Whiteley Place: the heritage-listed two-three storey buildings with no basement, adjoined by a commercial development known as '2 Elizabeth Plaza' with 14 storeys above the ground and a four-level basement.

# 4. Review of Published Data

## 4.1 Geology

Reference to the Sydney 1:100 000 Series Geological Sheet 9130 indicates that the site is underlain by the Triassic Aged Hawkesbury Sandstone (see Figure 1). Hawkesbury Sandstone typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses.

Within the Sydney area the most common defects within the Hawkesbury Sandstone are widely spaced horizontal bedding planes, typically spaced at 1-3 m, and two orthogonal sets of steeply dipping joints. These joints typically have dips of 75 to 90 degrees from horizontal (i.e. close to vertical) and are oriented with strikes just east of north (about 010 to 020 degrees) and just south of east (about 110 degrees).

As well as these main defect sets there are likely to be other joints or faults with moderate dip angles (20-60 degrees).

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

## 4.2 Hydrogeology

The nearest surface water body is Sydney Harbour (Lavender Bay) which is located approximately 1 km to the south and east of the site.

A search of the publicly available registered groundwater bore database indicated that there is one registered groundwater bore within 500 m of the site. The groundwater bore details are summarised in Table 1.

**Table 1: Summary of available information from nearby registered groundwater bores**

| Bore ID | Authorised purpose | Completion year | Status | Location relative to site | Final depth (m) | Standing water level (m bgl) |
|---|---|---|---|---|---|---|
| GW107764 | Domestic bore | 2007 | Converted | 430 m north | - | - |

Based on the regional topography and the inferred flow direction of nearby water courses, the anticipated flow direction of groundwater beneath the site is to the south and southeast, towards Sydney Harbour. However, the local groundwater flow direction may be influenced by the nearby 'drained' basements and other below ground structures.

### 4.3 Soil Landscape

The corresponding Sydney 1:100,000 Soils Landscape Series Sheet (Figure 2), prepared by the former NSW Department of Land and Water Conservation, indicates that the site is within the Gymea soil landscape. This landscape is described as shallow to moderately deep (0.3 m-1.5 m) yellow earths and earthy sands overlying bedrock.

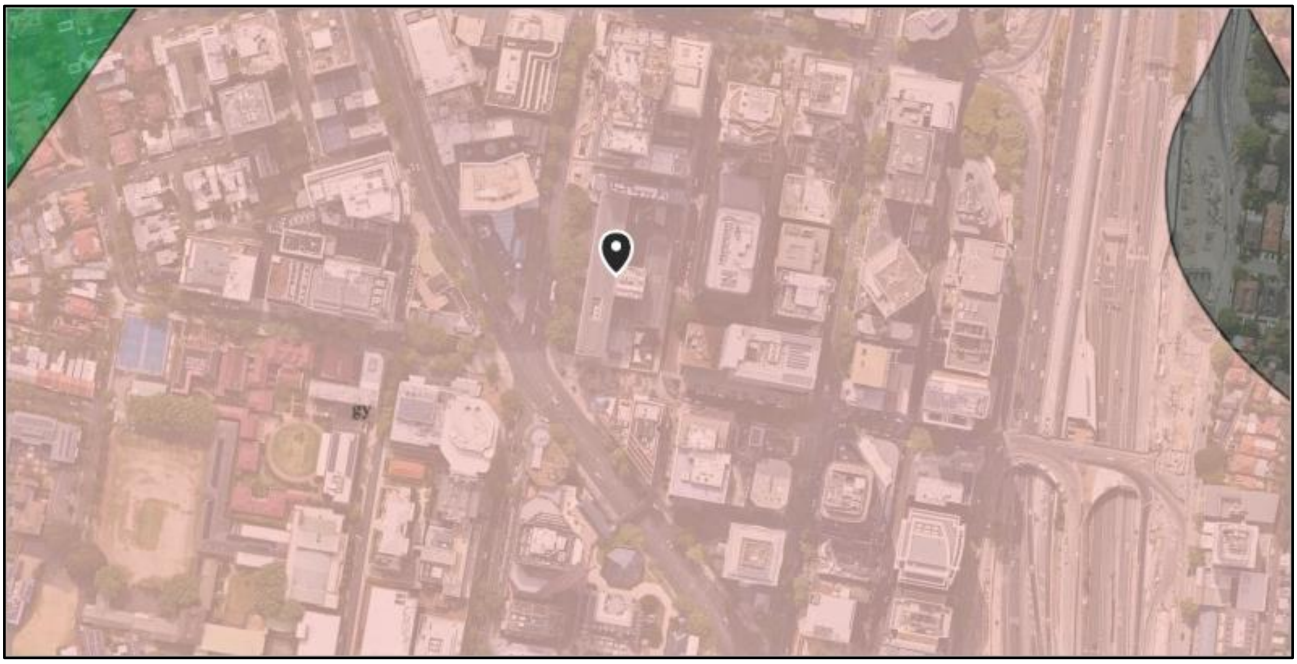


Figure 2: Soil landscape mapping with approximate site location

### 4.4 Acid Sulphate Soils and Salinity

Reference to the regional Acid Sulphate Soils (ASS) and Salinity Risk maps indicates that the site is located within an area that is considered not likely to contain ASS or salinity issues.

## 5. Previous Investigations

Douglas has undertaken the following geotechnical investigations in the area surrounding the site:

- 88 Walker Street in 2018 (east of the site). This investigation included four cored boreholes. This site is currently under construction.
- 1 Denison Street in 2016 (east of the site). Investigations on this site included four cored boreholes. Douglas also undertook numerous inspections during construction of this building, which was recently completed.
- 18-40 Mount Street in 2003 (west of site). This investigation included seven cored boreholes.
- 65 Berry Street (north of site) in 1962. This investigation included six cored boreholes.

Douglas has also undertaken the geotechnical inspections and provided advice during construction for a number of the nearby sites, primarily for assessing the rock face stability and the footing bearing capacities.

In addition, Douglas has undertaken geotechnical investigations for the adjacent Sydney Metro City and Southwest rail tunnels and also for the Victoria Cross Station, and is therefore familiar with the geology in the area.

## 6. Field work Methods

Field work of the geotechnical investigation comprised the drilling two boreholes (BH101 and BH102) at the locations shown on Drawing 1 in Appendix B using hand-portable drilling equipment. Detailed borehole logs and core photographs are provided in Appendix C.

BH101 was drilled from the existing LGF level to the depth of 22.55 m, whilst BH102 was drilled from the Basement level to the depth of 8.0 m. Both boreholes commenced using concrete coring equipment and hand tools to remove the existing concrete slab and sub-floor fill to the top of bedrock. Boreholes were cased and continued into the underlying rock using diamond drilling to obtain NMLC sized core samples of the bedrock for geotechnical logging and strength testing.

Groundwater monitoring wells (MW01 and MW02, corresponding to BH101 and BH102) were installed in the boreholes upon completion of the drilling to allow for groundwater level monitoring.

The ground surface levels at the boreholes were inferred from the survey drawings provided (refer Appendix D for survey drawings). The ground surfaces were provided as Reduced Levels (RL) in metres relative to Australian Height Datum (AHD). The locations of the boreholes were measured from existing site features.

The top of the wells was covered by steel gatics installed flush with the existing floors.

Purging of the wells and field measurements of the groundwater levels were undertaken on 24 and 30 September 2024, with a digital data logger installed in MW02 for long term monitoring of groundwater level fluctuations.

# 7. Field Work Results

## 7.1 Subsurface Conditions

Details of the subsurface conditions encountered are given in the borehole logs included in Appendix C, with notes defining classification methods and descriptive terms. Photographs of the rock cores were taken and are presented with the relevant borehole logs.

The sequence of subsurface materials encountered within the boreholes, in increasing depth order, may be summarised as follows:

| | |
|---|---|
| **Concrete Slab:** | Two layers reinforced concrete, 220 mm + 80 mm thick at BH101 and 220 mm + 110 mm thick at BH102; overlying |
| **Fill:** | Generally 90 mm - 170 mm thick subsoil drainage gravels, over 40 mm ripped sandstone fill; |
| **Sandstone**<br>**(Hawkesbury Sandstone):** | Medium to coarse grained sandstone, low to medium strength, grading to medium to high strength, slightly weathered then fresh with moderately weathered bands. Slightly fractured to unbroken<br>sub horizontally bedded, with frequent iron-stained or siltstone laminations.<br>With Intermittent presence of very low strength decomposed seams and low strength siltstone bands and clasts, becoming less frequent with depths. |

## 7.2 Groundwater Readings

Groundwater levels were gauged on 24 September 2024 using an electronic oil / water interface meter prior to developing the wells and again on 30 September 2024 prior to sampling. The measured water levels prior to sampling are shown in Table 2. Groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

**Table 2: Standing Water Levels in wells**

| Well No. | Screened Depth Range (m) | Date | Surface RL (m, AHD) | Manual Water Level Measurements in wells | |
|---|---|---|---|---|---|
| | | | | Depth below FFL (m, bgl) | Reduced Level (m, AHD) |
| BH101 / MW01 | 7.0 - 15.0 | 24/09/2024 | 58.4 | 11.8 | 46.6 |
| | | 30/09/2024 | | 11.7 | 46.7 |
| BH102 / MW02 | 2.0 – 5.0 | 24/09/2024 | 54.0 | 4.2 | 49.8 |
| | | 30/09/2024 | | 4.8 | 49.2 |

Notes: AHD – Australian Height Datum
bgl – below ground level

## 8. Point Load Index Testing

The results of point load index testing ($Is_{(50)}$), carried out at regular intervals on rock cores, are shown on the respective borehole logs in Appendix C. The results show $I_{s(50)}$ values in the range of 0.12 to 2.2 MPa, indicating that the rock tested ranged from low to high strength (Note that point load testing can be inaccurate in weak rock or very strong rock).

## 9. Geotechnical and Hydrogeological Model

The interpreted geotechnical model for the site has been based on the above information and the results of the current and previous investigations in the vicinity. A summary of the interpreted subsurface profile below existing buildings is provided in Table 3.

**Table 3: Summary of Geotechnical Model**

| Geotechnical Unit [1] | Detailed Description | Approximate Depth / RL Range |
|---|---|---|
| Unit A: Pavement / Fill | Fill comprising subfloor drainage gravels directly below the reinforced concrete slabs, followed by a thin layer of ripped sandstone fill in some areas | From existing floor levels to approximately 0.5 m depths |
| Unit B: Low to medium strength Sandstone (Class III-) [2] | Sandstone bedrock of generally low to medium strength with intermittent very low strength decomposed seams, mainly slightly weathered with some moderately weathered bands, slightly fractured. | approximately 0.5 m depths from the existing floor slab levels to around RL51 m |
| Unit C: Medium to high strength Sandstone (Class II) | Sandstone of medium to high strength with infrequent very low to low strength decomposed seams, siltstone bands and clasts, mainly slightly weathered to fresh, slightly fractured to unbroken. | Below around RL51 m |

Note:
1. Rock Class in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech Jrnl., Dec, 1998.
2. Class III- indicating Unit B is slightly inferior to Class III as defined in Pells et al (1998)

The groundwater levels were measured at variable depths of between 4.2 m and 11.8 m (RL46.6 m to RL49.8 m) to the time of preparing this report. This is indicating that the groundwater table is well below the lowest floor level of the existing buildings and appears to be drained by the Victoria Cross Station cavern and the associated ISD basement.

## 10. Proposed Development

Specific details of the proposed development have not been finalised. Based on the geotechnical investigation brief prepared by the client and the project structural engineers, Enstruct Pty Ltd (Enstruct), it is anticipated that the proposed development will mainly include:

- Construction of new pad footings to take new column loads;

- Demolition and construction of a new core structure and Denison Street Wing; with,
  - A raft footing to support the new core; and
  - Ground (hold-down) anchors to resist footing tension forces generated by lateral building loads.
- Excavation to replace existing underground services or to install new services, specifically a sewer pit.

It is understood that there is currently no plan to deepen or expand the existing basement or lower ground levels.

## 11. Comments

### 11.1 Excavation Conditions

As the proposed development will not include the deepening or expansion of the exisitng basement and the lower ground levels, it is expected that only localised excavations are required for constructing new foundations (eg. core pad and high-level footings) and service trenches and pits. Such excavations are likely to encounter fill and low to high strength sandstone with potential for high strength, iron-cemented bands within the sandstone.

Any excavation of the fill, soils and low strength rock should be achievable using conventional earthmoving equipment.

Excavation of medium to high strength rock and iron-cemented bands will require the use of hydraulic rock hammers, rock saws or milling heads. Detailed excavations for cores, footings or for service trenches should be achievable using rock hammers, hydraulic rotary rock saws, or milling heads. Rock saws may also be required to reduce the risk of vibration causing damage to adjacent structures, such as the ISD to the north.

### 11.2 Vibration

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibration at the existing and adjacent buildings and structures within acceptable limits. The level of acceptable vibration is dependent on various factors including the type of building structure (e.g. reinforced concrete, brick, etc.), its structural condition, founding conditions, the frequency range of vibrations produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

Ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s peak particle velocity (PPV). This is generally much lower than the vibration levels required to cause structural damage to most buildings. The Standard AS/ISO 2631.2 – 2014 “Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Vibration in buildings (1 Hz to 80 Hz)” suggests an acceptable daytime limit of 8 mm/s PPVi for human comfort.

Based on the Douglas’ experience of and with reference to AS/ISO 2631.2, it is suggested that a maximum PPVi of 8 mm/s (measured at the first occupied level of existing buildings) be employed at this site for both architectural and human comfort considerations, although this vibration limit may need to be reduced if there are sensitive buildings (such as the heritage buildings to the south) or sensitive equipment in the area. The relatively minor excavations should be manageable but vibration criteria may also need to be confirmed with Sydney Metro and Sydney Water where excavations are located close to the assets.

Douglas maintains an extensive construction vibration database. As a preliminary estimate, Table 4 provides approximate minimum buffer distances for selected equipment, based on a set vibration limit of 8 mm/s (assuming that plant is appropriately sized for the ground conditions).

**Table 4: Approximate buffer distances for selected Plant (PPVi 8 mm/s)**

| Excavation Plant | | Distance from plant at which vibration attenuates to 8 mm/s[3] | |
|---|---|---|---|
| **Type** | **Operating Weight** | **From Douglas Trial Maxima[1]** | **From Douglas Trial Average** |
| Rock saw on excavator[2] | - | 1 m | 0.5 m |
| Ripper on 20 t excavator | - | 3 m | 0.7 m |
| Rock Hammer | <500 kg | 7 m | 3 m |
| | 501 – 1000 kg | 8 m | 3 m |
| | 1001 – 2000 kg | 13 m | 5 m |

Notes:
1. Smaller distances can generally be determined from individual trials, as indicated by those from trial averages.
2. Buffer distances for rock hammers may be slightly reduced by prior saw cutting along, or parallel to, excavation boundaries.
3. Loading effects from adjacent buildings may reduce vibration levels, to enable boundary saw cuts with few exceedances.

As the magnitude of vibration transmission is site specific, it is recommended that a vibration trial be carried out at the commencement of rock excavation. These trials may indicate that smaller or different types of excavation equipment or a different approach are required to reduce vibration to acceptable levels.

### 11.3 Dilapidation Surveys and Monitoring

Dilapidation surveys should be carried out on adjacent buildings, pavements and sensitive structures and infrastructure (including Sydney Metro assets) that may be affected by the excavation. A baseline (reference) survey should be carried out before the commencement of any demolition or excavation work in order to document existing defects so that any claims for damage due to construction related activities can be accurately assessed.

### 11.4 Disposal of Excavated Material

All surplus excavated materials will need to be disposed of in accordance with the Protection of the Environment Operations Act 1997 (POEO Act). All materials removed from the site are defined as waste under the POEO Act and must be disposed of in accordance with one of the following:

- Virgin excavated natural materials (VENM) as defined under the POEO Act, permitting beneficial reuse; or
- A waste category meeting the criteria set out in the NSW EPA Waste Classification Guidelines 2014, with the materials disposed to a landfill licenced to receive the waste under the assigned classification or taken to a recycling facility licenced to receive the waste; or
- Material complying with a Resource Recovery Order (RRO) as defined under the Protection of the Environment Operations (Waste) Regulation 2014, with complying materials able to be reused under certain conditions.

Accordingly, environmental testing will need to be carried out to determine the most appropriate off-site destination(s) for the surplus excavated material.

## 11.5 Excavation Support

### 11.5.1 Batter Slopes

Where space permits, temporary and permanent batters could be formed within the fill, natural soils and weak rocks to maintain safe and stable excavations. The maximum batter slopes recommended for dry excavations up to 3 m height are presented in Table 5. Deeper or more complex batter slopes (eg. under surcharge loadings or seepage encountered) generally require detailed analysis to assess slope stability.

**Table 5: Recommended Maximum Batter Slopes**

| Material Description | Temporary Batter | Permanent Batter |
|---|---|---|
| Fill | 1.5H:1V | 2.5H:1V |
| Natural Soil (clayey sand or sandy clay) (if encountered) | 1.5H:1V | 2H:1V |
| Very low strength sandstone (if encountered) | 1H:1V | 1.5H:1V |
| Very low to low strength sandstone (if encountered) | 0.5H:1V | 1H:1V |

### 11.5.2 Excavation support and vertical rock face

As there is currently no plan to deepen or expand the existing basement or lower ground levels, the existing perimeter retaining walls are expected to remain suitable for the future site retention. However, careful consideration should be given to the potential reduction or loss of lateral supports to these walls during any partial demolition, localised excavations, and other construction activities. The lateral supports to the existing walls could comprise their footings embedded into and laterally supported by the sandstone bedrock, as well as the propping by the existing floor slabs. Temporary support measures such as using ground anchors or rock bolts should be used to provide additional lateral support until the permanent lateral wall support is re-instated.

If new perimeter retaining walls are proposed to replace the existing ones, particular care should be taken where installation of the new walls is obstructed by the existing walls. A special approach will be required in such a case, where the old walls are systematically removed as the new walls are installed. This will require a design and construct approach and is generally carried out under close supervision of the geotechnical and structural engineers. Horizontal drilling and slot investigation will be required where existing basement walls are used.

For the proposed localised excavations for footings, core structures and service trenches and pits, vertical excavations with low to medium strength or stronger sandstone (Units B & C) are considered to be free-standing unless adversely affected by weathering, joints, faults or weak seams. Steeply dipping joints can form unstable rock slivers, blocks and wedges that will require systematic support on exposure. Other defects such as bedding planes, fractured or decomposed seams and weak siltstone bands and clasts are also common in Hawkesbury Sandstone.

Excavations should be carried out in a controlled manner, with inspections by a suitably experienced engineering geologist / geotechnical professional every 1.5 m drop to identify and support any potentially adverse rock defects in a timely manner. A site-specific excavation methodology should be prepared, particularly for the works within the zone-of-influence of the existing building foundations or retaining walls. This may include limiting excavation to 1.0 m drops and leaving a 2.0 m wide bench prior to excavating the face back to its final cut line, with both the excavated bench and final cut-line inspected by an experienced engineering geologist / geotechnical engineer.

The requirement for the above geotechnical inspections and excavation methodology for the should be explicitly stated on the issued for construction drawings and the earthworks contractor should be made aware of these requirements.

#### 11.5.3 **Earth Pressure for Retaining Wall Design**

Based on the current development proposal, no deep shoring / retaining wall is necessary at this stage.

If retaining walls are required, design of any minor walls (<4 m retained height) or assessment of existing walls should be based on a triangular earth pressure distribution using the earth pressure coefficients (K) provided in Table 6. To limit wall movement and the associated ground movements behind the wall, these values of K should generally be increased by 50% to reduce lateral (inward) wall deflections.

Additional surcharge loads, such as new and existing footings, pavements and construction related activities must also be allowed for in the design as a rectangular earth pressure distribution, applied over the depth of influence.

The earth pressure loading described above does not include either earthquake loads or hydrostatic pressure due to the build-up of groundwater behind impermeable walls, both of which must be considered in the design. Unless positive drainage measures are incorporated to prevent water pressure build-up behind the walls, full hydrostatic head should be allowed for in design while, at the same time, allowing for the soil unit weight to reduce to the buoyant condition.

**Table 6: Recommended Design Parameters for Retaining Walls**

| Material | Unit Weight (kN/m³) | Earth Pressure Coefficient K | |
|---|---|---|---|
| | | Short term (Temporary) | Long term (Permanent) |
| Fill | 20 | 0.3 | 0.4 |
| Natural Soil (clayey Sand or sandy clay) | 20 | 0.25 | 0.3 |
| Very low to low strength Sandstone | 23 | 0.1 | 0.15 |
| Low to medium strength Sandstone | 24 | 0 | 0.1 |
| Medium to high strength Sandstone | 24 | 0 | 0 |

Notes:
1. The values above assume a level surface behind the wall.
2. It is assumed that the rock mass is free of adverse dipping joints and seams.

Passive resistance for the toe of walls embedded in bedrock may be based on an Ultimate passive resistance pressure of at least 3,000 kPa in low to medium or greater strength sandstone not adversely affected by discontinuities, with a minimum factor of safety of 3 to obtain the Working load design value.

### 11.6 Ground Movement Due to Stress Relief

Horizontal ground movements due to in-situ stress relief will occur during the excavation works. Based on published literature, Douglas' experience and the previous monitoring results at similar sites, the stress relief movements typically vary from 0.5 to 2 mm/m depth of open rock excavation for basements, measured at the top of the midpoint of the face, reducing to near zero at the corners of the excavation. Similarly, stress relief movement decreases with distance away from the excavation. Horizontal stress relief movement can be expected to occur (albeit very minor) to distances back from the excavation of up to 2 times the height of the excavated face.

Only localised and small-extent excavations are currently proposed for this development, which is expected to remove less than 3 m depth sandstone with small footprints. The corresponding horizontal ground movement due to the stress relief is expected to be less than 5 mm with small zones-of-influence surrounding these excavations.

Therefore, the impact due to the stress relief is expected to be very low on this site.

#### 11.6.1 Ground Anchors and Rockbolts

Post-stressed ground anchors, rockbolts and dowels (support elements) can be used to laterally support existing walls, new shoring, underpinning works or unstable rock blocks and wedges. Support elements used for lateral support should be bonded in the stronger rock, inclined as required, but preferably not steeper than 30° below the horizontal. Table 7 provides ultimate and allowable bond stresses for concept design and estimating purposes.

These values should be confirmed by pull-out tests prior to installation of support elements. Ultimately, it is the contractor's responsibility to ensure that the correct design values (specific to the support system and method of installation) are used and that the support element holes are carefully cleaned prior to grouting.

After temporary support elements have been installed, it is recommended that they are tested to at least 125% of their nominal working load (but no more than 150% and in accordance with AS4678). Where stress relief or further unavoidable movement of the shoring is expected, it is recommended that the support elements are locked-off between 60% and 100% of their working loads, as required to accommodate additional movement and subsequent increase in stress in the support elements. Consideration should, however, be given to the immediate design requirements. The capacity of the anchor may have to be increased if a lower initial lock-off is not feasible. Checks should be carried out to confirm that the load in the support elements has been maintained and that losses due to creep effects or other causes have not occurred.

**Table 7: Anchor Bond Stresses**

| Material | Allowable Bond Stress (kPa) | Ultimate Bond Stress (kPa) |
|---|---|---|
| Low Strength Sandstone | 100 | 250 |
| Low to medium strength Sandstone | 200 | 500 |
| Medium to high strength Sandstone | 600 | 1,500 |
| High strength Sandstone | 1,200 | 3,000 |

Shorter support elements (i.e., rockbolts, dowels and pins) may be required to support any unstable rock wedges, slivers or blocks. Short dowels and pins may be required to support feather edges where sub-parallel joints acutely intersect the face. Shotcrete with mesh (or fibrecrete) may be required where beds / seams of extremely low or very low strength rock are encountered within higher strength sandstone, secured with anchors, rockbolts, dowels or pins, designed to secure the shotcrete.

Care should be exercised to ensure that anchors / bolts are installed progressively during excavation and stressed prior to excavation of the next drop to ensure that stability is maintained at all times.

It is anticipated that the new structure will support the shoring walls over the long term and therefore support elements are expected to be temporary only. The use of permanent rockbolts and ground anchors, if required, will need careful attention to corrosion protection.

It should be noted that permission will be required from authorities and adjacent property owners prior to installing rockbolts / ground anchors below their land. Due consideration should also be given to the location and type of below-ground excavations, services, etc.

Anchors could also be used vertically as hold down anchors. Hold-down anchors should be designed in accordance with AS4678-2002, with the consideration of both the piston and cone pullout mechanism.

### 11.7 Foundations

An investigation on a few selected footings of the existing buildings is being undertaken at the time of preparing this report and is not yet completed. Geotechnically, the investigation is targeted to provide information regarding footing dimensions, foundation depths and the founding stratum. The outcome of the footing investigation will be reported separately to supplement this report.

Nevertheless, the expected foundation levels (ie. 1-3 m below the existing FFLs) for the existing and new high-level footings (strip or pad footings), based on the results of the two geotechnical boreholes, are likely to be within low to medium strength sandstone, underlain by medium to high strength sandstone below around RL51 m.

If the proposed re-development results in a major increase in the column loads, it is expected that the new footings (or underpinning of the existing footings) will need to be founded within medium to high (or stronger) strength sandstone.

Typical parameters for the design of high-level on sandstone are shown in Table 8, subject to spoon testing / proof coring, where required. Although piled foundations are not proposed at this stage, piles may be required to reach sandstone of higher strength to avoid significant deepening of these 'shallow' footings. Design of piles could adopt the parameters in Table 8. Note that all the recommended shaft adhesion values in the table are for compression loading. For piles resisting tension loads, an additional reduction factor (a multiplier) of 0.75 is required to convert the compressive shaft adhesion values to those applicable for tension loading.

**Table 8: Recommended Parameters for Foundation Design**

| Foundation Stratum | Allowable Design Pressure (kPa) | | Ultimate Design Pressure (kPa) | | Design Deformation Modulus |
|---|---|---|---|---|---|
| | End Bearing | Shaft Adhesion | End Bearing | Shaft Adhesion | Ev (MPa) |
| Low to medium strength sandstone | 3,000 | 300 | 15,000 | 800 | 1,000 |
| Medium to high strength sandstone | 8,000 | 800 | 80,000 | 2,000 | 2,000 |

Foundations proportioned on the basis of the 'Working Load' design approach using allowable bearing pressures in Table 8 would be expected to experience total settlements of less than 1% of the footing width (or pile diameter) under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

As the adjoining basement of the ISD to the north of site is expected to be six levels deeper than the basement on site, the allowable bearing pressure of the high-level footings within the zone-of-influence of this excavation will need to be downgraded to account for the unconfined stress state along the face. The zone of influence may be taken as a 1H:1V line drawn up from the base of neighbour's excavation within medium sandstone or stronger, then flattened to 1.5H:1V after transitioning to low to medium strength sandstone. The same applies to those footings at LGF level adjacent to the existing 'step-down' face between LGF and Basement levels.

A reduction factor of 50% applied to the original allowable design pressures (i.e. 1,500 kPa allowable end bearing for low to medium strength and 150 kPa shaft adhesion) could be adopted for preliminary design purposes. The additional induced lateral and rotational movements towards excavation should also be considered.

Alternatively, foundations (especially piles) could be designed using the limit-state design approach with the Ultimate (strength) limit state and Serviceability (settlement) limit state assessed separately. An appropriate geotechnical strength reduction factor ($Ø_g$) should be applied to the Ultimate design pressures presented in Table 8, as outlined in AS 2159 – 2009 Piling – Design and installation, for the Ultimate limit state calculation. The selection of $Ø_g$ is based on a series of individual risk ratings (IRR) which are weighted to give an average risk rating (ARR). The IRR values depend on factors such as the type and quality of testing, design method and parameter selection, pile installation control and monitoring, pile testing regime, and the redundancy in the foundation system. Without a detailed ARR assessment, a preliminary geotechnical strength reduction factor ($Ø_g$) of 0.4 could be adopted. The Serviceability limit state design commonly involves predictions of the foundation settlements using the deformation modulus values in Table 8 and compare with the settlement limits specified by the structural designers.

All footing excavations should be inspected by a geotechnical engineer to confirm that foundation conditions are suitable for the design parameters. Spoon testing should be carried out in at least one third of the footings which are designed for an allowable end bearing pressure of greater than 3,500 kPa. Spoon testing generally involves drilling a 50 mm diameter hole below the base of the footing, to a depth of 1.5 times the footing width, followed by testing to check for the presence of weak / clay bands. If weak seams are detected, then footings may need to be taken deeper to reach suitable foundation material.

Proof coring and spoon testing would be required for all footings designed for more than 6,000 kPa.

### 11.8 Impact on TfNSW – Sydney Metro Infrastructure

The Sydney Metro City and Southwest rail tunnels and the deep excavation of the Victoria Cross ISD adjacent to the site to the west and north are indicatively shown on Figure 3. The tunnels are understood to be 7 m in diameter with the tunnel crown (roof) approximately 25 m depth beneath the LGF level and approximately 21 m depth beneath the Basement level. The basement of the ISD is understood to be approximately 6-levels deeper below the Basement level of the project site. Specific details will need to be obtained from and confirmed by TfNSW - Sydney Metro.

Reference should be made to Transport for NSW "*Sydney Metro – Technical Services, Sydney Metro Underground Corridor Protection Technical Guidelines*" (Reference: iCentral SM-20-00081444, Ver2, dated April 2021) with regards to impacts of the proposed development on Sydney Metro underground infrastructure. In particular, Section 4 details the 'Protection Reserves' around Metro infrastructure. These reserves are summarised as Figure 4 on the following page.

The existing LGF and Basement on site are located alongside the tunnels and partially within the '2nd Reserve' which extends to a height of "A + 25m" above the tunnel crowns. Additional pressures from the high-level footings designed to support the new or additional loads on the columns of the proposed re-development of the site could potentially increase the stresses in the permanent concrete lining of metro tunnels and caverns, as well as the lateral pressures applied to the retaining wall of the adjoining ISD basement.

Therefore, detailed numerical analysis and impact assessment will be required to assess the potential adverse effects of the proposed development on the Sydney Metro infrastructure. This will form part of the approval process by Sydney Metro / Transport for NSW and will also determine the minimum cover to be maintained between the proposed building foundations and tunnel crowns and the maximum bearing pressures to be allowed for the existing and new footings of the proposed re-development.

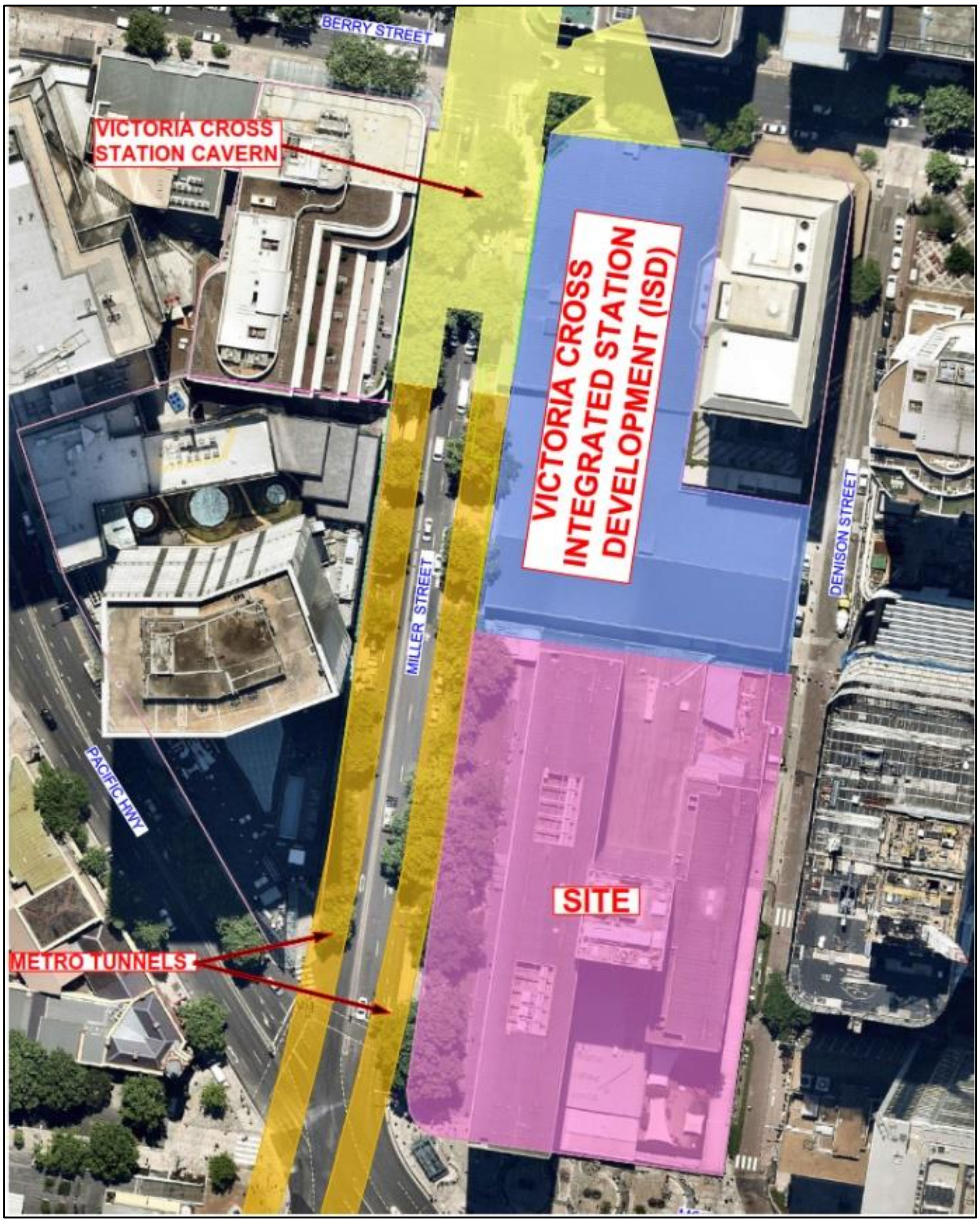
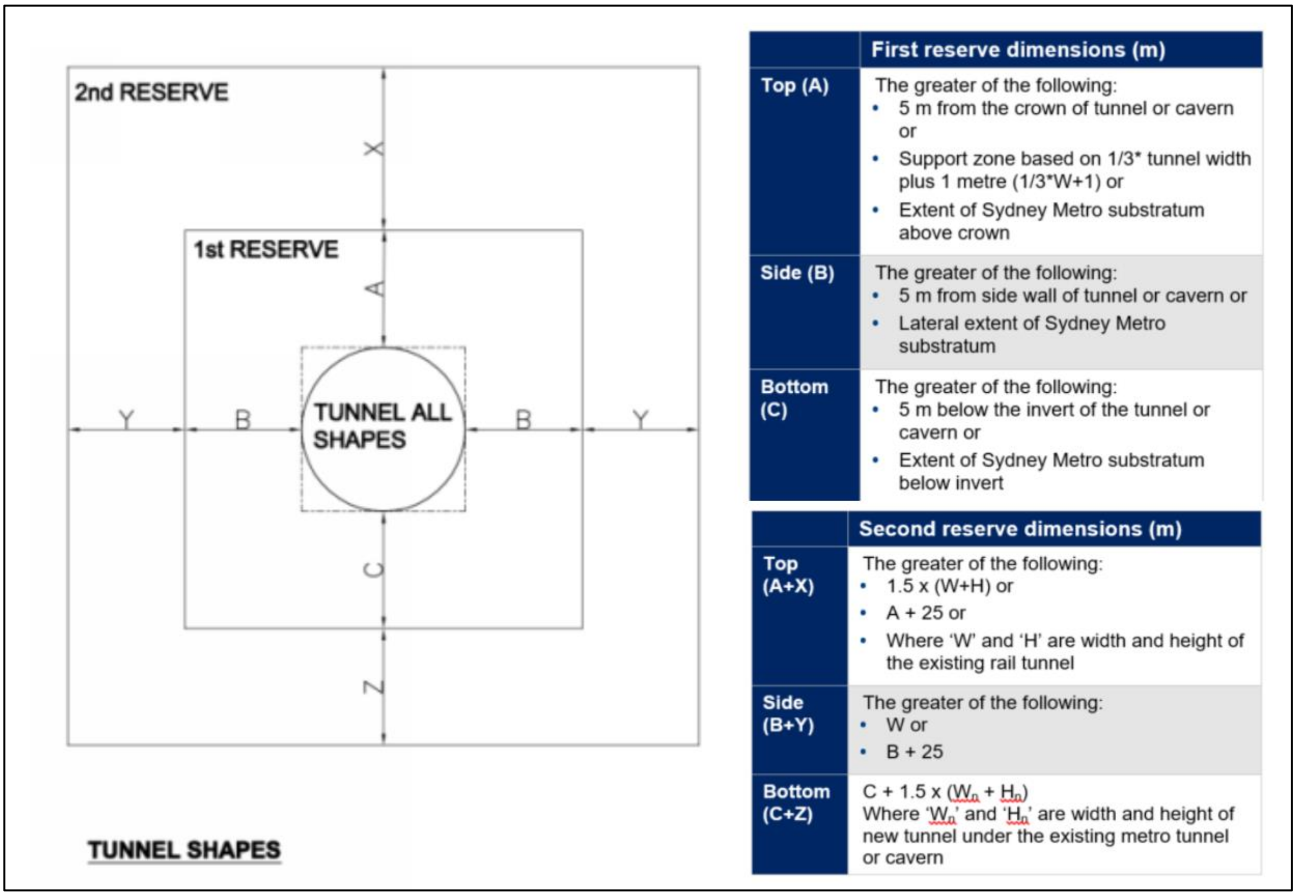


**Figure 3: Indicative location of Sydney Metro Tunnels**



| | First reserve dimensions (m) |
|---|---|
| **Top (A)** | The greater of the following:<br>• 5 m from the crown of tunnel or cavern or<br>• Support zone based on 1/3* tunnel width plus 1 metre (1/3*W+1) or<br>• Extent of Sydney Metro substratum above crown |
| **Side (B)** | The greater of the following:<br>• 5 m from side wall of tunnel or cavern or<br>• Lateral extent of Sydney Metro substratum |
| **Bottom (C)** | The greater of the following:<br>• 5 m below the invert of the tunnel or cavern or<br>• Extent of Sydney Metro substratum below invert |

| | Second reserve dimensions (m) |
|---|---|
| **Top (A+X)** | The greater of the following:<br>• 1.5 x (W+H) or<br>• A + 25 or<br>• Where 'W' and 'H' are width and height of the existing rail tunnel |
| **Side (B+Y)** | The greater of the following:<br>• W or<br>• B + 25 |
| **Bottom (C+Z)** | C + 1.5 x ($W_n$ + $H_n$)<br>Where '$W_n$' and '$H_n$' are width and height of new tunnel under the existing metro tunnel or cavern |

Figure 4: Sydney Metro Protection Reserves (extract from TfNSW document)

### 11.9 Impact on TfNSW – Road Infrastructure

The site is located adjacent to Pacific Highway to the south-west and Miller Street to the west, both of which are understood to be TfNSW road infrastructure. Reference should be made to TfNSW Technical Direction GTD 2020/001, Version No. 01, dated 2 July 2020 for the requirements of TfNSW concurrence for developments where there is a risk that it may affect the road reserves. An assessment of ground movement and monitoring requirements as well as instrumentation may be required by TfNSW prior to commencing construction, if the proposed development is deemed to have potential adverse impact upon their infrastructure.

It is recommended that the design team familiarise themselves with the relevant documents for future consultation with TfNSW.

### 11.10 Groundwater

Groundwater levels on the site has been measured during this geotechnical investigation at between RL46.6 m and RL49.8 m which is at least 4.5 m below the lowest floor levels of existing buildings. On this basis, with the consideration that the groundwater will fluctuate and may temporarily rise by 1 m following heavy and prolonged rainfall, it is expected the pre-development groundwater table will not be intercepted by the proposed re-development, given that the current proposal does not include any deepening of the existing basement, but with only minor excavations for footings and services, thus the constant or on-going treatment and drainage of groundwater should not be required. In other words, the proposed development is highly unlikely to involve any aquifer interference activities and therefore the relevant 'dewatering' approvals by WaterNSW under the Water Management Act 2000 is deemed not applicable.

Ongoing monitoring of water levels will be required to check water levels and fluctuations. In spite of this, some minor seepage may be expected along the interface of soil and the bedrock and within fractured zones and joints within the rock, if any hydrogeological linkage to surface water source (eg. rains or leaked water pipes) exists. Seepage flows are likely to increase following periods of extended wet weather. It is anticipated that seepage into the excavation should be readily controlled by perimeter drains connected to a "sump-and-pump" system. It will require permanent drainage below the basement floor slab to direct seepage to the 'sumps'. It is likely that iron oxides will precipitate from any such seepage, possibly leading to a build-up of an iron-oxide sludge. Allowance for periodic cleaning of such sludge should be made in the long-term maintenance requirements.

### 11.11 **Seismicity**

A Hazard Factor (*Z*) of 0.08 is appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2007 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class is considered to be Class $B_e$ based on the building being founded directly on rock.

### 11.12 **Further Investigation**

An investigation on a few selected footings of the existing building is being undertaken at the time of preparing this report and is not yet completed. The outcome of the footing investigation will be reported separately to supplement this report, to refine the geotechnical model and advise the variability of the founding conditions across the site for the existing and proposed building foundations.

Further geotechnical investigations may be required to target specific locations as deemed necessary during the detailed design and construction. Further geotechnical review and advice will be required once these investigations have been completed and after specific details of the proposed development have been confirmed.

## 12. **Limitations**

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 105-153 Miller Street, North Syndey NSW in line with Douglas' proposal dated 04/06/2024 and acceptance received from Callan Salter of Investa dated 16/07/2024. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Investa for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and / or their agents.

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

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

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

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

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

# Appendix A

## About This Report

# About this Report

October 2024

## Introduction

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

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

## Copyright

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

## Borehole and Test Pit Logs

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

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

## Groundwater

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

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

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

## Reports

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

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

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

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

## Site Anomalies

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

## Information for Contractual Purposes

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

## Site Inspection

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

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# Appendix B

## Drawings

**LEGEND**

🟥 Approximate Sire Boundary

⊕ Approximate Borehole Location

| REV | DESCRIPTION/COMMENT | DATE | DRAWN BY |
|---|---|---|---|
| 0 | Initial Issue | 18.10.2024 | MN |
| | | | |
| | | | |

SCALE:
0 10 20 30 40 m
1:700 @ A3

N

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

CLIENT:
**Investa Commercial Developments Pty Ltd**

NOTE:
1: Basemap from Metromap (Dated 22.09.2024)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
**Proposed Redevelopment**

PROJECT ADRESS:
**105 Miller Street, North Syndey**

DRAWING TITLE:
**Test Location Plan**

PROJECT NO:
**86964.03**

DRAWING NO:
**1**

REVISION:
**0**

\\dpsydnas02\Projects\86964.03 - NORTH SYDNEY, 105 Miller St, Geo Env Inv\7.0 Drawings\QGIS\86964.03.qgz

## Appendix C

Borehole Logs, Photographs and Explanatory Notes

# Terminology, Symbols and Abbreviations

November 2023

## Introduction to Terminology, Symbols and Abbreviations

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

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

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

### Abbreviation Codes

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

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

### Data Integrity Codes

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

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

### Graphic Symbols

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

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# Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

## Introduction

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

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

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

Particle size designation and Behaviour Model

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

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

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

[1] – refer grain size subdivision descriptions below

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

Component proportions

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

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

[1] As defined in AS1726-2017 6.1.4.4

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

Composite Materials

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

# Soil Descriptions

## Classification

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

## Soil Name

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

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

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

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

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

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

## Identification of minor components

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

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

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

## Soil Composition

Plasticity

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

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

Grain Size

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

Grading

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

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

# Soil Descriptions

## Soil Condition

Moisture

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

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

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

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

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

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

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

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

Consistency (fine grained soils)

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

Relative Density (coarse grained soils)

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

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

# Soil Descriptions

Compaction (anthropogenically modified soil)

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

Cementation (natural and anthropogenic)

| Cementation Term | Abbreviation Code |
|---|---|
| Moderately cemented | MOD |
| Weakly cemented | WEK |

Extremely Weathered Material

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

## Soil Origin

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

## Cobbles and Boulders

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

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

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# Rock Descriptions

Terminology
Symbols
Abbreviations

March 2024

## Rock Strength

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

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

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

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

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

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

## Degree of Weathering

The degree of weathering of rock is classified as follows:

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

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

# Rock Descriptions

## Degree of Alteration

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

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

## Degree of Fracturing

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

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

## Rock Quality Designation

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

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

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

## Stratification Spacing

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

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

# Rock Descriptions

## Defect Descriptions

Defect Type

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

Rock Defect Orientation

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

Rock Defect Coating

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

Rock Defect Infill

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

Rock Defect Shape/Planarity

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

Rock Defect Roughness

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

Defect Orientation

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

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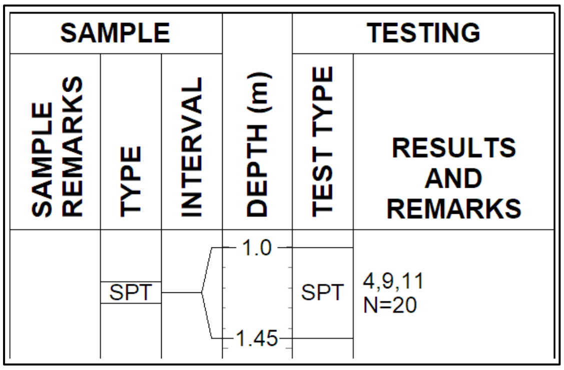
# Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

October 2024

## Sampling and Testing

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



Sampling

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

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

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

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

Field and Laboratory Testing

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

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

Field and laboratory testing (continued)

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

## Groundwater Observations

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

## Drilling or Excavation Methods/Tools

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

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

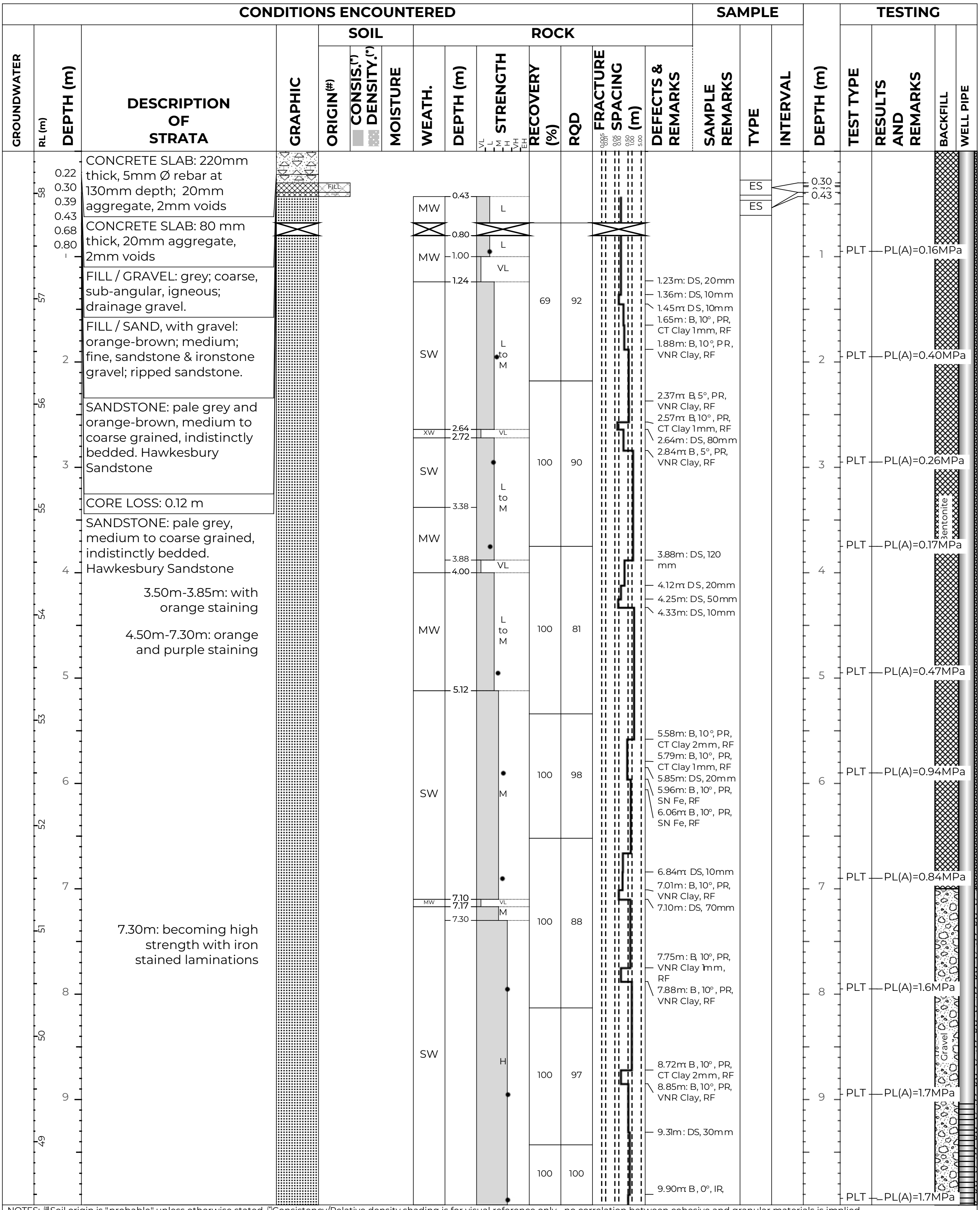
[1] – numeric suffixes indicate tool diameter/width in mm

# BOREHOLE LOG

**CLIENT:** Investa Commercial Developments Pty Ltd
**PROJECT:** Proposed Redevelopment
**LOCATION:** 105 Miller Street, North Syndey, NSW

**SURFACE LEVEL:** 58.4 AHD
**COORDINATE:** E:334117.0, N:6254339.4
**DATUM/GRID:** MGA2020 Zone 56
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH101/MW01
**PROJECT No:** 86964.03
**DATE:** 16/09/24
**SHEET:** 1 of 3



CONCRETE SLAB: 220mm thick, 5mm Ø rebar at 130mm depth; 20mm aggregate, 2mm voids

CONCRETE SLAB: 80 mm thick, 20mm aggregate, 2mm voids

FILL / GRAVEL: grey; coarse, sub-angular, igneous; drainage gravel.

FILL / SAND, with gravel: orange-brown; medium; fine, sandstone & ironstone gravel; ripped sandstone.

SANDSTONE: pale grey and orange-brown, medium to coarse grained, indistinctly bedded. Hawkesbury Sandstone

CORE LOSS: 0.12 m

SANDSTONE: pale grey, medium to coarse grained, indistinctly bedded. Hawkesbury Sandstone

3.50m-3.85m: with orange staining

4.50m-7.30m: orange and purple staining

7.30m: becoming high strength with iron stained laminations

1.23m: DS, 20mm
1.36m: DS, 10mm
1.45m: DS, 10mm
1.65m: B, 10°, PR, CT Clay 1mm, RF
1.88m: B, 10°, PR, VNR Clay, RF
2.37m: B, 5°, PR, VNR Clay, RF
2.57m: B, 10°, PR, CT Clay 1mm, RF
2.64m: DS, 80mm
2.84m: B, 5°, PR, VNR Clay, RF
3.88m: DS, 120 mm
4.12m: DS, 20mm
4.25m: DS, 50mm
4.33m: DS, 10mm
5.58m: B, 10°, PR, CT Clay 2mm, RF
5.79m: B, 10°, PR, CT Clay 1mm, RF
5.85m: DS, 20mm
5.96m: B, 10°, PR, SN Fe, RF
6.06m: B, 10°, PR, SN Fe, RF
6.84m: DS, 10mm
7.01m: B, 10°, PR, VNR Clay, RF
7.10m: DS, 70mm
7.75m: B, 10°, PR, VNR Clay 1mm, RF
7.88m: B, 10°, PR, VNR Clay, RF
8.72m: B, 10°, PR, CT Clay 2mm, RF
8.85m: B, 10°, PR, VNR Clay, RF
9.31m: DS, 30mm
9.90m: B, 0°, IR,

PLT — PL(A)=0.16MPa
PLT — PL(A)=0.40MPa
PLT — PL(A)=0.26MPa
PLT — PL(A)=0.17MPa
PLT — PL(A)=0.47MPa
PLT — PL(A)=0.94MPa
PLT — PL(A)=0.84MPa
PLT — PL(A)=1.6MPa
PLT — PL(A)=1.7MPa
PLT — PL(A)=1.7MPa

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

**PLANT:** Hand Tools and Proline
**OPERATOR:** TightSite (BB)
**LOGGED:** J.Miller
**METHOD:** 200mm Ø DT to 0.30m, HA to 0.43m, HQ to 0.68m, NMLC to 25.0m
**CASING:** HW to 0.6m
**REMARKS:** No free groundwater observed whilst augering. Concrete and gatic cover on top of well. Surface level obtained from survey plans by RPS AAP Consulting AU2130xxxxxx-001-A-Boreholes.

Refer to explanatory notes for symbol and abbreviation definitions

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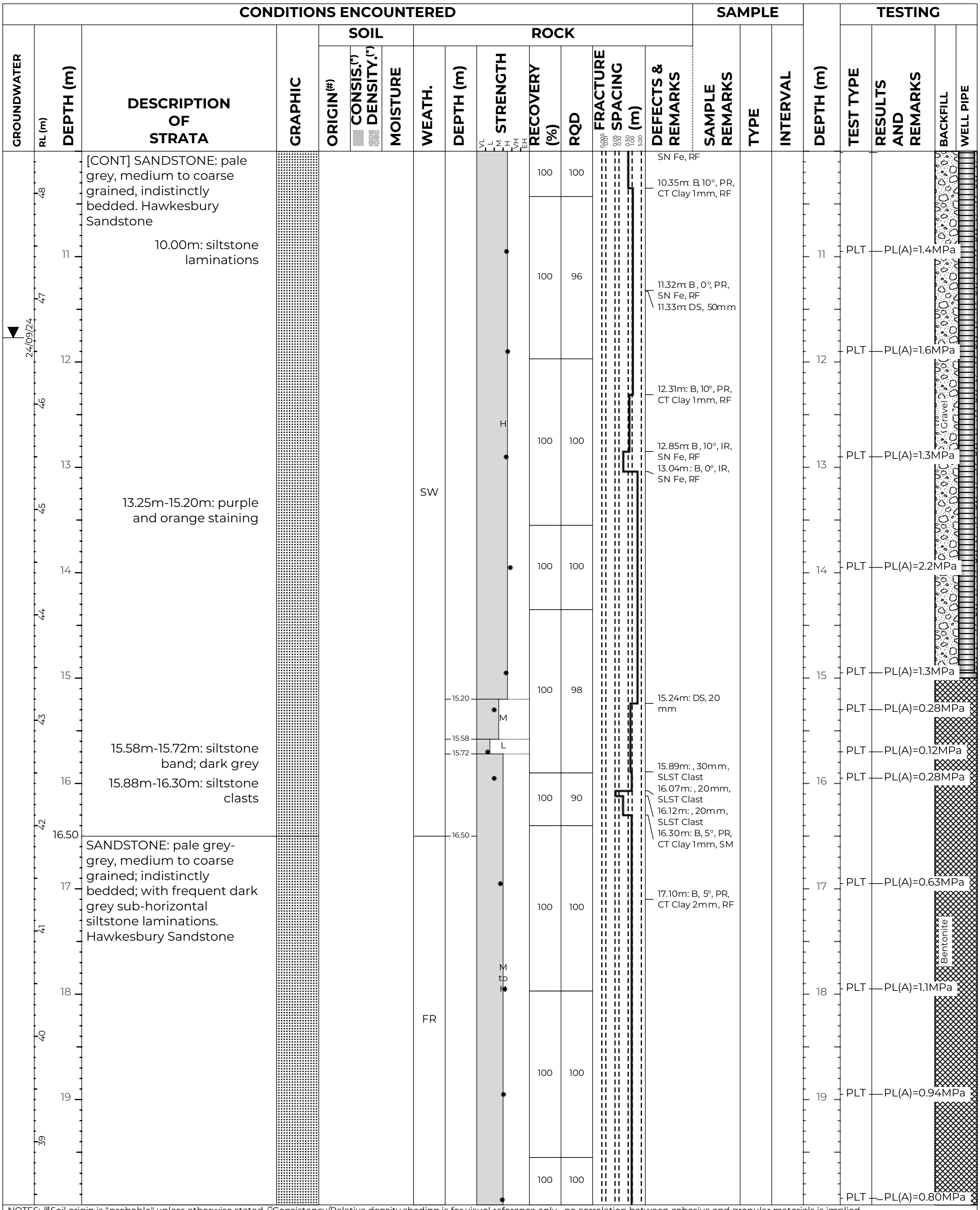
Douglas PARTNERS

# BOREHOLE LOG

**CLIENT:** Investa Commercial Developments Pty Ltd
**PROJECT:** Proposed Redevelopment
**LOCATION:** 105 Miller Street, North Syndey, NSW

**SURFACE LEVEL:** 58.4 AHD
**COORDINATE:** E:334117.0, N:6254339.4
**DATUM/GRID:** MGA2020 Zone 56
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH101/MW01
**PROJECT No:** 86964.03
**DATE:** 16/09/24
**SHEET:** 2 of 3



| DEPTH (m) | DESCRIPTION OF STRATA |
|---|---|
| | [CONT] SANDSTONE: pale grey, medium to coarse grained, indistinctly bedded. Hawkesbury Sandstone<br>10.00m: siltstone laminations<br>13.25m-15.20m: purple and orange staining<br>15.58m-15.72m: siltstone band; dark grey<br>15.88m-16.30m: siltstone clasts |
| 16.50 | SANDSTONE: pale grey-grey, medium to coarse grained; indistinctly bedded; with frequent dark grey sub-horizontal siltstone laminations. Hawkesbury Sandstone |

| RECOVERY (%) | RQD |
|---|---|
| 100 | 100 |
| 100 | 96 |
| 100 | 100 |
| 100 | 100 |
| 100 | 98 |
| 100 | 90 |
| 100 | 100 |
| 100 | 100 |
| 100 | 100 |

DEFECTS & REMARKS

SN Fe, RF
10.35m: B, 10°, PR, CT Clay 1mm, RF
11.32m: B , 0°, PR, SN Fe, RF
11.33m: DS, 50mm
12.31m: B, 10°, PR, CT Clay 1mm, RF
12.85m: B , 10°, IR, SN Fe, RF
13.04m : B, 0°, IR, SN Fe, RF
15.24m: DS, 20 mm
15.89m: , 30mm, SLST Clast
16.07m: , 20mm, SLST Clast
16.12m: , 20mm, SLST Clast
16.30m: B, 5°, PR, CT Clay 1mm, SM
17.10m: B, 5°, PR, CT Clay 2mm, RF

| TEST TYPE | RESULTS AND REMARKS |
|---|---|
| PLT | PL(A)=1.4MPa |
| PLT | PL(A)=1.6MPa |
| PLT | PL(A)=1.3MPa |
| PLT | PL(A)=2.2MPa |
| PLT | PL(A)=1.3MPa |
| PLT | PL(A)=0.28MPa |
| PLT | PL(A)=0.12MPa |
| PLT | PL(A)=0.28MPa |
| PLT | PL(A)=0.63MPa |
| PLT | PL(A)=1.1MPa |
| PLT | PL(A)=0.94MPa |
| PLT | PL(A)=0.80MPa |

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

**PLANT:** Hand Tools and Proline
**OPERATOR:** TightSite (BB)
**LOGGED:** J.Miller
**METHOD:** 200mm Ø DT to 0.30m, HA to 0.43m, HQ to 0.68m, NMLC to 25.0m
**CASING:** HW to 0.6m
**REMARKS:** No free groundwater observed whilst augering. Concrete and gatic cover on top of well. Surface level obtained from survey plans by RPS AAP Consulting AU2130xxxxxx-001-A-Boreholes.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

# BOREHOLE LOG

**CLIENT:** Investa Commercial Developments Pty Ltd
**PROJECT:** Proposed Redevelopment
**LOCATION:** 105 Miller Street, North Syndey, NSW

**SURFACE LEVEL:** 58.4 AHD
**COORDINATE:** E:334117.0, N:6254339.4
**DATUM/GRID:** MGA2020 Zone 56
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH101/MW01
**PROJECT No:** 86964.03
**DATE:** 16/09/24
**SHEET:** 3 of 3

| CONDITIONS ENCOUNTERED | | | | | | | | | | | | | | | SAMPLE | | | | TESTING | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SOIL | | | ROCK | | | | | | | | | | | | | | |
| GROUNDWATER | RL (m) | DEPTH (m) | DESCRIPTION OF STRATA | GRAPHIC | ORIGIN(#) | CONSIS.(*) DENSITY.(*) | MOISTURE | WEATH. | DEPTH (m) | STRENGTH VL L M H VH EH | RECOVERY (%) | RQD | FRACTURE SPACING (m) 0.005 0.01 0.05 0.10 0.50 1.00 5.00 | DEFECTS & REMARKS | SAMPLE REMARKS | TYPE | INTERVAL | DEPTH (m) | TEST TYPE | RESULTS AND REMARKS | BACKFILL | WELL PIPE |
| | 38<br>37<br>36 | 21<br>22 | [CONT] SANDSTONE: pale grey-grey, medium to coarse grained; indistinctly bedded; with frequent dark grey sub-horizontal siltstone laminations. Hawkesbury Sandstone<br>22.36m-22.42m: siltstone band; dark grey | | | | | FR | | M to H | 100<br>100 | 100<br>100 | | 20.70m: B, 5 °, PR, CT Clay 5mm, RF<br>21.60m: B, 5°, UN, VNR Clay, RF<br>22.37m: , 50mm, SLST Clast | | | | 21<br>22 | PLT<br>PLT<br>PLT | PL(A)=0.95MPa<br>PL(A)=0.96MPa<br>PL(A)=1.2MPa | Bentonite | |
| | | 23<br>24<br>25<br>26<br>27<br>28<br>29 | Borehole discontinued at 22.55m depth.<br>Target depth reached. | | | | | | | | | | | | | | | | | | | |

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

**PLANT:** Hand Tools and Proline
**OPERATOR:** TightSite (BB)
**LOGGED:** J.Miller
**METHOD:** 200mm Ø DT to 0.30m, HA to 0.43m, HQ to 0.68m, NMLC to 25.0m
**CASING:** HW to 0.6m
**REMARKS:** No free groundwater observed whilst augering. Concrete and gatic cover on top of well. Surface level obtained from survey plans by RPS AAP Consulting AU2130xxxxxx-001-A-Boreholes.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas
PARTNERS

# CORE PHOTO LOG

| | | | | | |
|---|---|---|---|---|---|
| **CLIENT:** | Investa Commercial Developments Pty Ltd | **SURFACE LEVEL:** | 58.4 AHD | **LOCATION ID:** | BH101/MW01 |
| **PROJECT:** | Proposed Redevelopment | **COORDINATE:** | E:334117.0, N:6254339.4 | **PROJECT No:** | 86964.03 |
| **LOCATION:** | 105 Miller Street, North Syndey, NSW | **DATUM/GRID:** | MGA2020 Zone 56 | **DATE:** | 16/09/24 |
| | | **DIP/AZIMUTH:** | 90°/---° | **SHEET:** | 1 of 3 |

0.68-5.00 m depth

5.00-10.00 m depth

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# CORE PHOTO LOG

| | | | | | |
|---|---|---|---|---|---|
| **CLIENT:** | Investa Commercial Developments Pty Ltd | **SURFACE LEVEL:** | 58.4 AHD | **LOCATION ID:** | BH101/MW01 |
| **PROJECT:** | Proposed Redevelopment | **COORDINATE:** | E:334117.0, N:6254339.4 | **PROJECT No:** | 86964.03 |
| **LOCATION:** | 105 Miller Street, North Syndey, NSW | **DATUM/GRID:** | MGA2020 Zone 56 | **DATE:** | 16/09/24 |
| | | **DIP/AZIMUTH:** | 90°/---° | **SHEET:** | 2 of 3 |

10.00-15.00 m depth

15.00-20.00 m depth

# CORE PHOTO LOG

**CLIENT:** Investa Commercial Developments Pty Ltd
**PROJECT:** Proposed Redevelopment
**LOCATION:** 105 Miller Street, North Syndey, NSW

**SURFACE LEVEL:** 58.4 AHD
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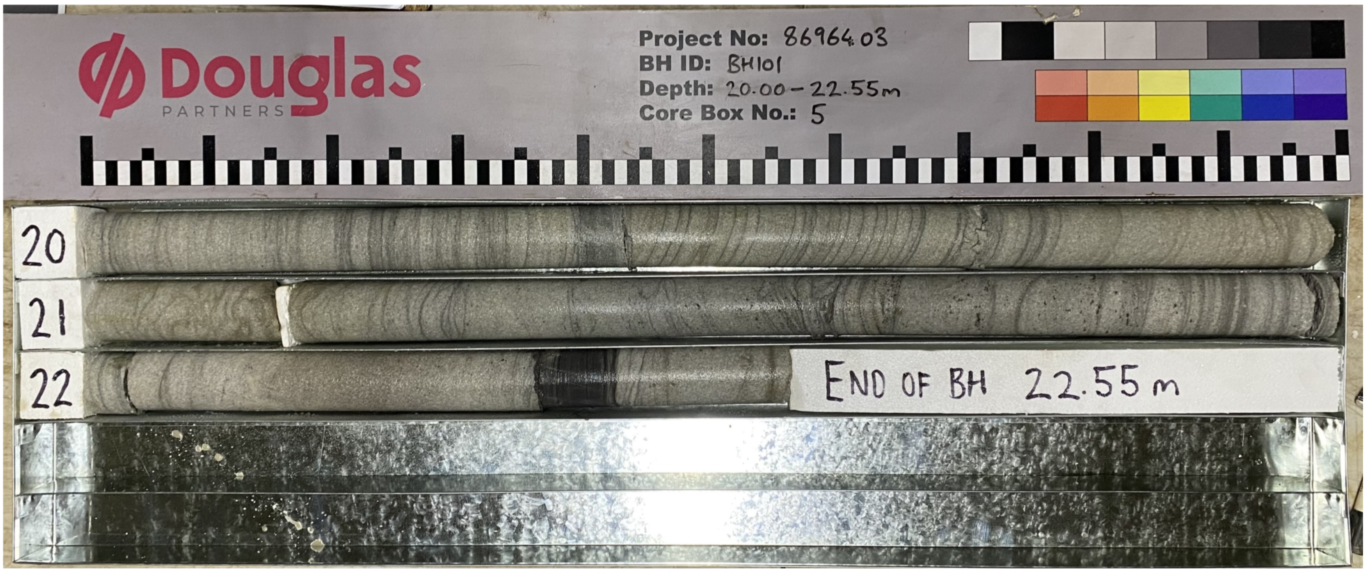
**DATE:** 16/09/24
**SHEET:** 3 of 3



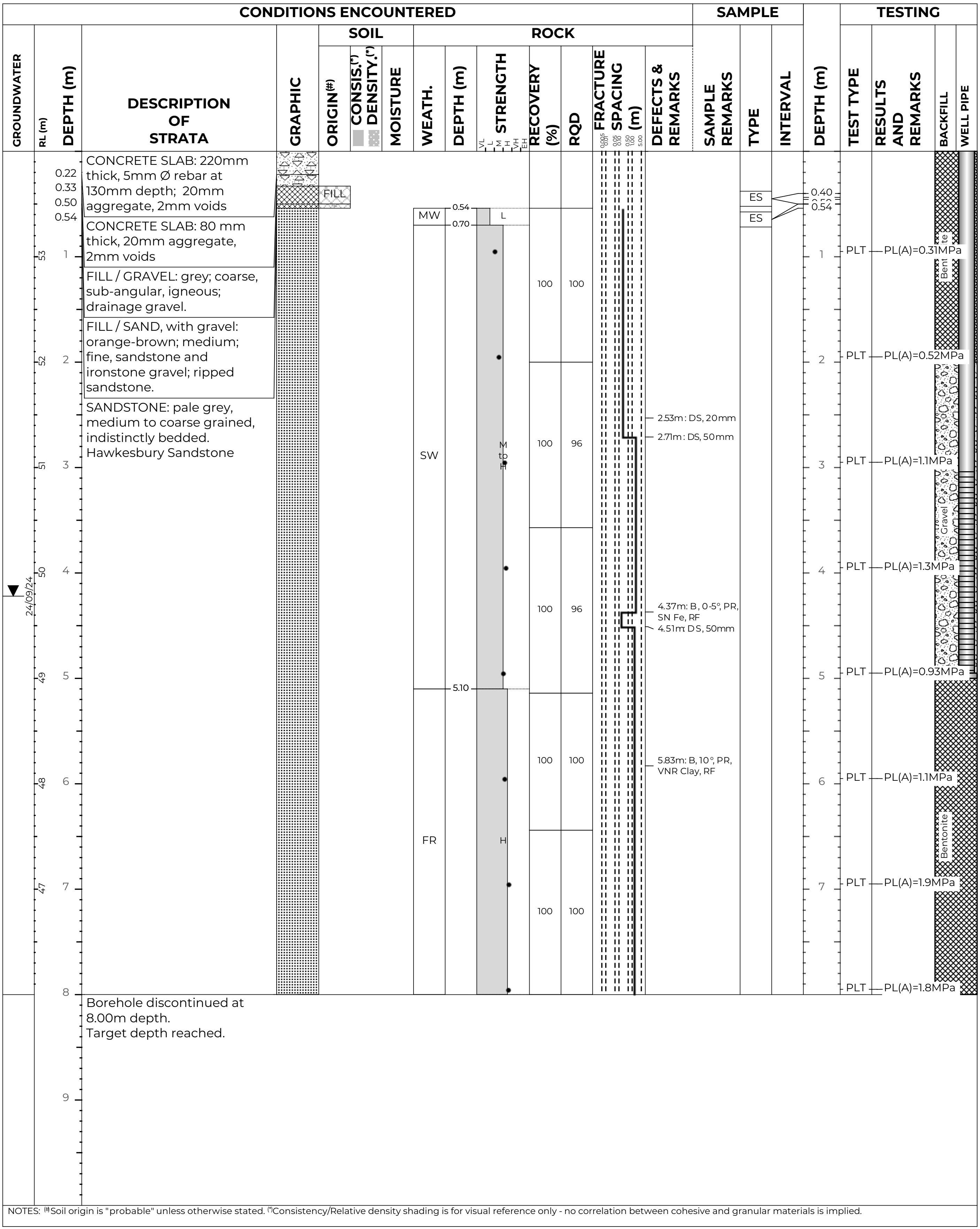
20.00-22.55 m depth

# BOREHOLE LOG

**CLIENT:** Investa Commercial Developments Pty Ltd
**PROJECT:** Proposed Redevelopment
**LOCATION:** 105 Miller Street, North Syndey, NSW

**SURFACE LEVEL:** 54.0 AHD
**COORDINATE:** E:334172.0, N:6254300.8
**DATUM/GRID:** MGA2020 Zone 56
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH102/MW02
**PROJECT No:** 86964.03
**DATE:** 23/09/24
**SHEET:** 1 of 1



| DEPTH (m) | DESCRIPTION OF STRATA |
|---|---|
| 0.22 | CONCRETE SLAB: 220mm thick, 5mm Ø rebar at 130mm depth; 20mm aggregate, 2mm voids |
| 0.33 | CONCRETE SLAB: 80 mm thick, 20mm aggregate, 2mm voids |
| 0.50 | FILL / GRAVEL: grey; coarse, sub-angular, igneous; drainage gravel. |
| 0.54 | FILL / SAND, with gravel: orange-brown; medium; fine, sandstone and ironstone gravel; ripped sandstone. |
| | SANDSTONE: pale grey, medium to coarse grained, indistinctly bedded. Hawkesbury Sandstone |
| 8 | Borehole discontinued at 8.00m depth. Target depth reached. |

2.53m : DS, 20mm
2.71m : DS, 50mm
4.37m: B , 0-5°, PR, SN Fe, RF
4.51m: DS, 50mm
5.83m: B, 10°, PR, VNR Clay, RF

| DEPTH (m) | TEST TYPE | RESULTS AND REMARKS |
|---|---|---|
| 1 | PLT | PL(A)=0.31MPa |
| 2 | PLT | PL(A)=0.52MPa |
| 3 | PLT | PL(A)=1.1MPa |
| 4 | PLT | PL(A)=1.3MPa |
| 5 | PLT | PL(A)=0.93MPa |
| 6 | PLT | PL(A)=1.1MPa |
| 7 | PLT | PL(A)=1.9MPa |
| 8 | PLT | PL(A)=1.8MPa |

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

**PLANT:** Hand Tools and Proline
**OPERATOR:** TightSite (BB)
**LOGGED:** J.Miller
**METHOD:** 200mm Ø DT to 0.33m, HA to 0.54m, NMLC to 8.00m
**CASING:** HW to 0.6m
**REMARKS:** No free groundwater observed whilst augering. Concrete and gatic cover on top or well. Surface level obtained from survey plans by RPS AAP Consulting AU2130xxxxxx-001-A-Boreholes.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

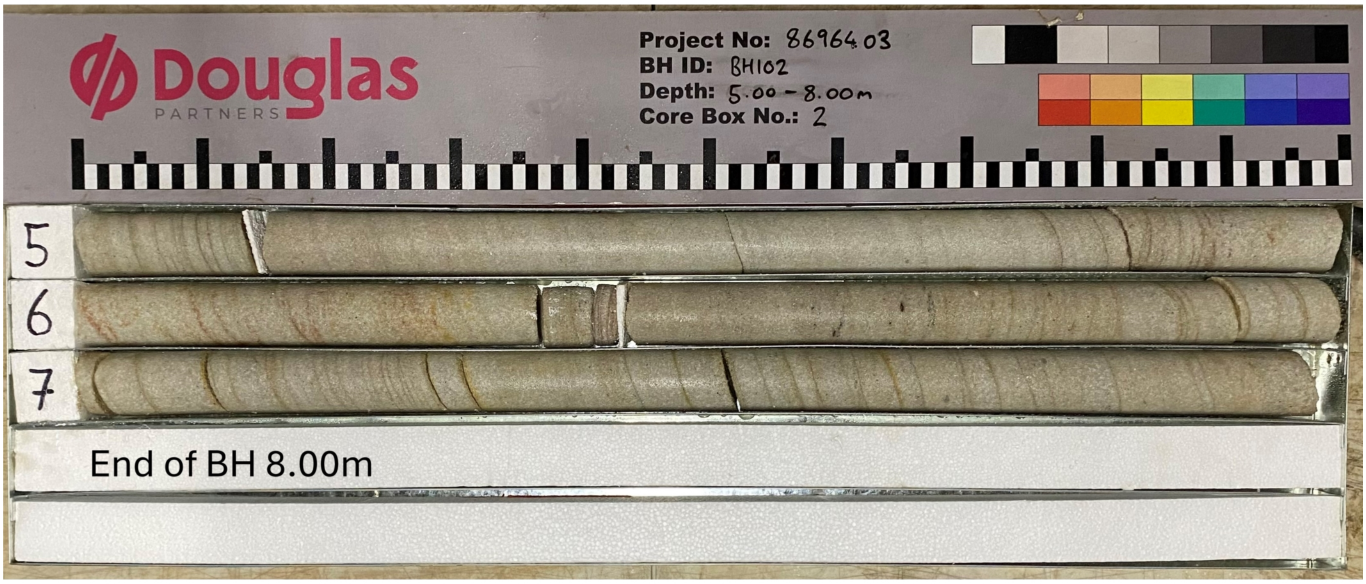
# CORE PHOTO LOG

**CLIENT:** Investa Commercial Developments Pty Ltd
**PROJECT:** Proposed Redevelopment
**LOCATION:** 105 Miller Street, North Syndey, NSW

**SURFACE LEVEL:** 54.0 AHD
**COORDINATE:** E:334172.0, N:6254300.8
**DATUM/GRID:** MGA2020 Zone 56
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH102/MW02
**PROJECT No:** 86964.03
**DATE:** 23/09/24
**SHEET:** 1 of 1

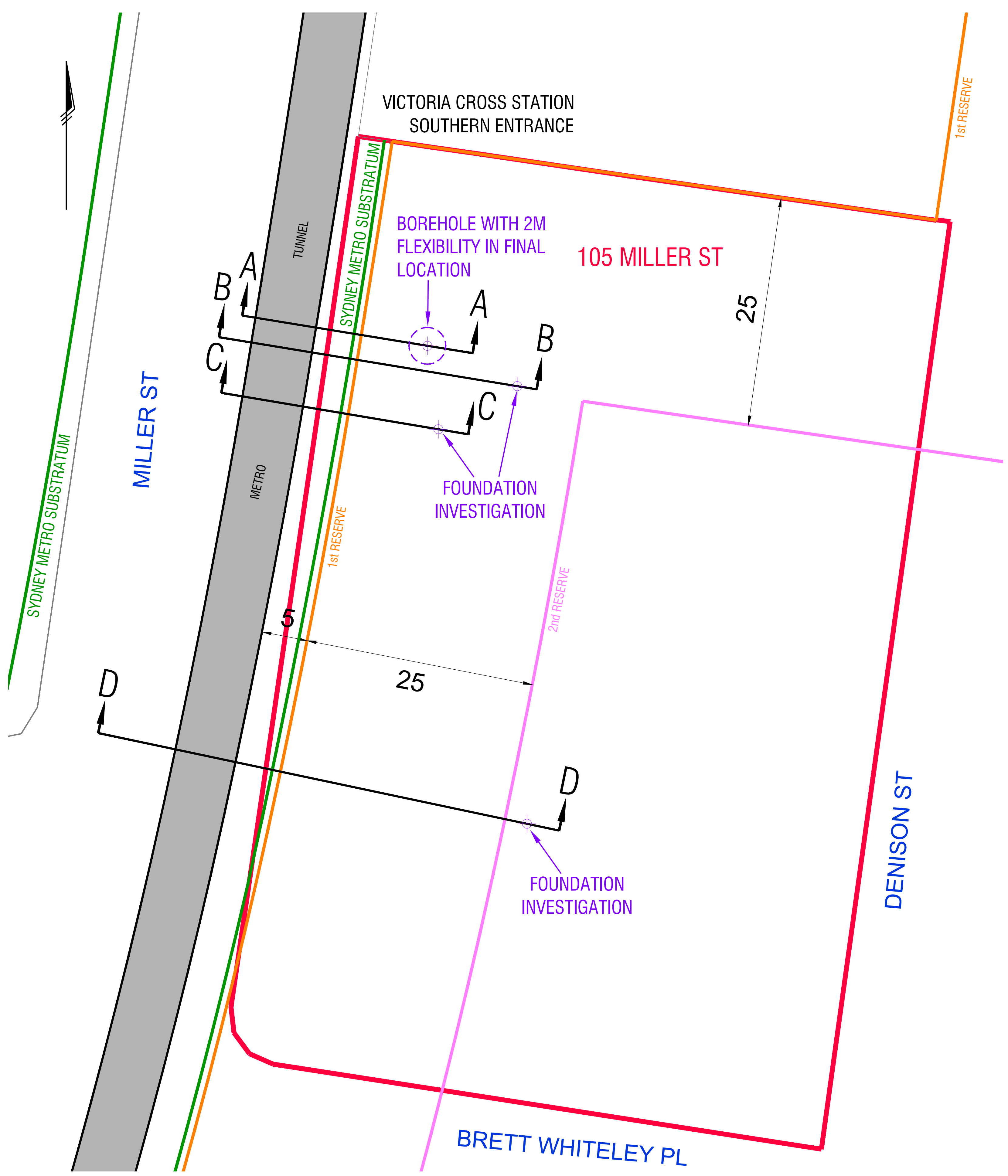
0.54-5.00 m depth



5.00-8.00 m depth

# Appendix D

## Supplied Drawings



EXPLANATORY NOTES:

METRO TUNNEL HAS BEEN MODELLED BASED ON PANS RECEIVED 08.09.2020
ADOPTED DIAMETER OF METRO TUNNEL 6.69M
UPLINE TUNNEL MODELLED BETWEEN CHAINAGE 10KM+650 AND 10KM+849.349
SMCSWTSE-JAB-TPW-AL-DRG-505121 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000053.01.01.PDF)
SMCSWTSE-JAB-TPW-AL-DRG-505011 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000024.03.AFC.03.01.PDF)
SMCSWTSE-JAB-TPW-AL-DRG-505014 (FILE NAME SMCSWTSE-JCG-1NL-DM-DWG-000027.03.AFC.03.01.PDF)
SMCSWTSE-JHO-TPW-DN-DRG-9 (FILE NAME SMCSWTSE-JCG-TPW-DM-DWG-000514.00.AFC.00.01.PDF)

METRO DOWN LINE GEOMETRY WAS NOT SUPPLIED AND HAVE NOT BEEN MODELLED IN THIS EXERCISE, HENCE THE PROTECTION ZONE TO THE WEST OF THE METRO TUNNEL HAS NOT BEEN DETERMINED.

METRO PROTECTION RESERVES HAS BEEN MODELLED BASED ON SYDNEY METRO PROTECTION GUIDELINES AND HAS ONLY BEEN DETERMINED AS FAR AS IT AFFECTS 105 MILLER ST.
(NWRLSRT-PBA-SRT-TU-REP-000008_SYDNEY METRO UNDERGROUND CORRIDOR PROTECTION GUIDELINES - REV C)

BASED ON THE SUPPLIED INFORMATION THE 1st RESERVE HAS BEEN DETERMINED TO BE:

ABOVE: SYDNEY METRO SUBSTRATUM

BELOW: SYDNEY METRO SUBSTRATUM

EAST OF METRO TUNNELS: 5M OFFSET FROM DESIGN TUNNEL

BASED ON THE SUPPLIED INFORMATION THE 2nd RESERVE HAS BEEN DETERMINED TO BE:

ABOVE: SYDNEY METRO SUBSTRATUM +25M

BELOW: SYDNEY METRO SUBSTRATUM +1.5M
IT IS PROPOSED THAT ROCK ANCHORS MAY EXTEND INTO THE AREA BELOW THE METRO TUNNELS. EXCAVATION SIZE OF 1m X 1m HAS BEEN PROVIDED FOR THESE ROCK ANCHORS IN CALCULATING THE 2nd RESERVE EXTENT BELOW THE METRO TUNNELS

EAST OF METRO TUNNELS: 30M (5+25) FROM DESIGN TUNNEL

INTERNAL BASEMENT EXTENTS SHOWN ARE BASED ON RPS SURVEY CONDUCTED IN FEB 2017.
(NWRLSRT-RPS-SVC-SR-DWG-000022 -A-105 Miller Street.pdf)

BOUNDARIES:

THE BOUNDARIES SHOWN (LAYER: E_BOUNDARY_105 MILLER) ARE BY SURVEY AND HAVE BEEN COMPILED FROM SURVEY PLANS DP1231920, DP1230458 and DP792740

THE BOUNDARIES SHOWN ARE ON MGA GROUND DISTANCES, USING SURVEYED CONNECTIONS TO LOCAL SCIMS MARKS AS SHOWN ON SURVEY PLAN DP1230458.

NO EASEMENT INVESTIGATION HAS BEEN CONDUCTED AND NO EASEMENTS HAVE BEEN PLOTTED. IT IS KNOWN THAT EASEMENTS AND OTHER RESTRICTIONS EXIST ON THE TITLE TO 105 MILLER STREET (CT 2/792740).

BOREHOLES / FOUNDATION INVESTIGATIONS:

LOCATION OF PROPOSED BOREHOLE HAS BEEN DIGITISED FROM PLANS PROVIDED ON THE 13/08/2024 (Geotech Env Scope Markup 6.08.24 - HT.pdf AND 105M Borehole Location in Metro 2nd Res.pdf. )

BASEMENT FLOOR LEVEL OF 105 MILLER ST ARE DERIVED FROM RPS SURVEY DATED Feb 2017 (NWRLSRT-RPS-SVC-SR-DWG-000022 -A-105 Miller Street.pdf)

INDICATIVE BOREHOLE EXTENTS HAS BEEN MODELLED AT 0.1M DIAMETER AND 25M IN DEPTH.

INDICATIVE FOUNDATION INVESTIGATIONS HAS BEEN MODELLED AT 0.1M DIAMETER AND 5M IN DEPTH.

GARY SHARP
NSW REGISTERED SURVEYOR
ID NO. SU008841

REVISIONS

| No. | DATE | REVISION DETAILS | DRAWN | CHK | APP |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| A | 14.08.2024 | INITIAL VERSION | HY | GS | GS |

SCALE: 1:500 @ A3
COORDINATES: MGA94
ORIGIN:
DATUM: AHD
ORIGIN:
CROSS SECTION:
V : N/A H : N/A
SCALE BAR:
10 5 0 10 20 30 Metres

CLIENT: enstruct

SURVEY:
DRAWN: HY
DESIGNED: GS
APPROVED: GS
DATE OF SURVEY:
DATE OF PLAN: 14.08.2024
DATE LAST SAVED: 29.08.2024
DATE APPROVED: 14.08.2024

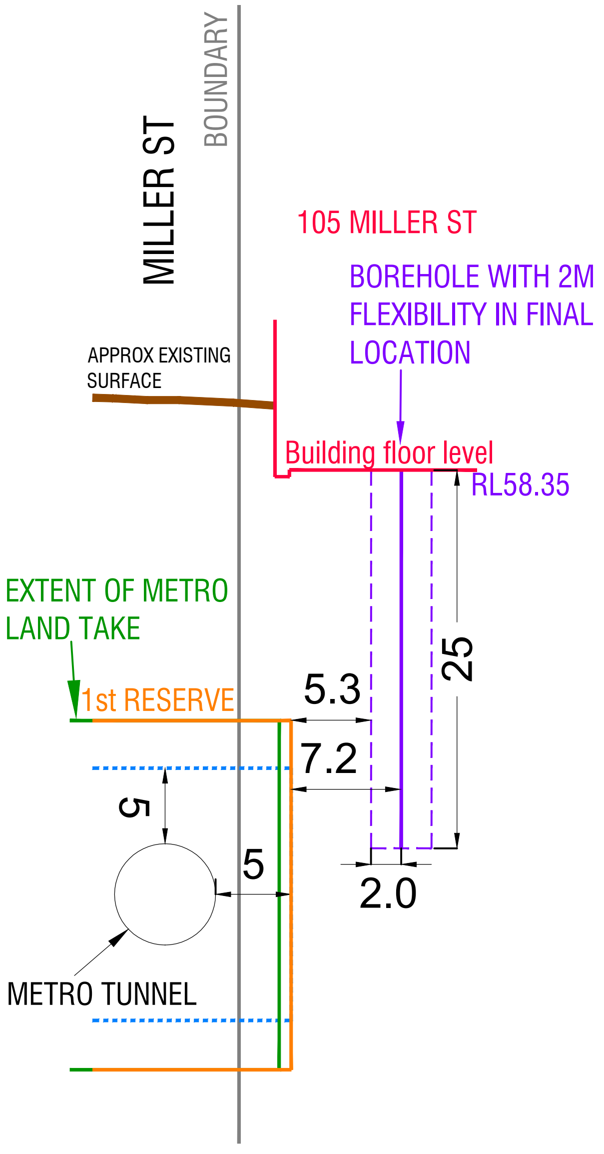
TITLE
Proposed Boreholes 105 Miller St Nth Sydney
DWG No AU2130xxxxxx-001-A-Boreholes-105 MIller St.dwg

JOB No AU213XXXXXX
ISSUE A
SHEET 1 OF 2 SHEETS
SIZE A3

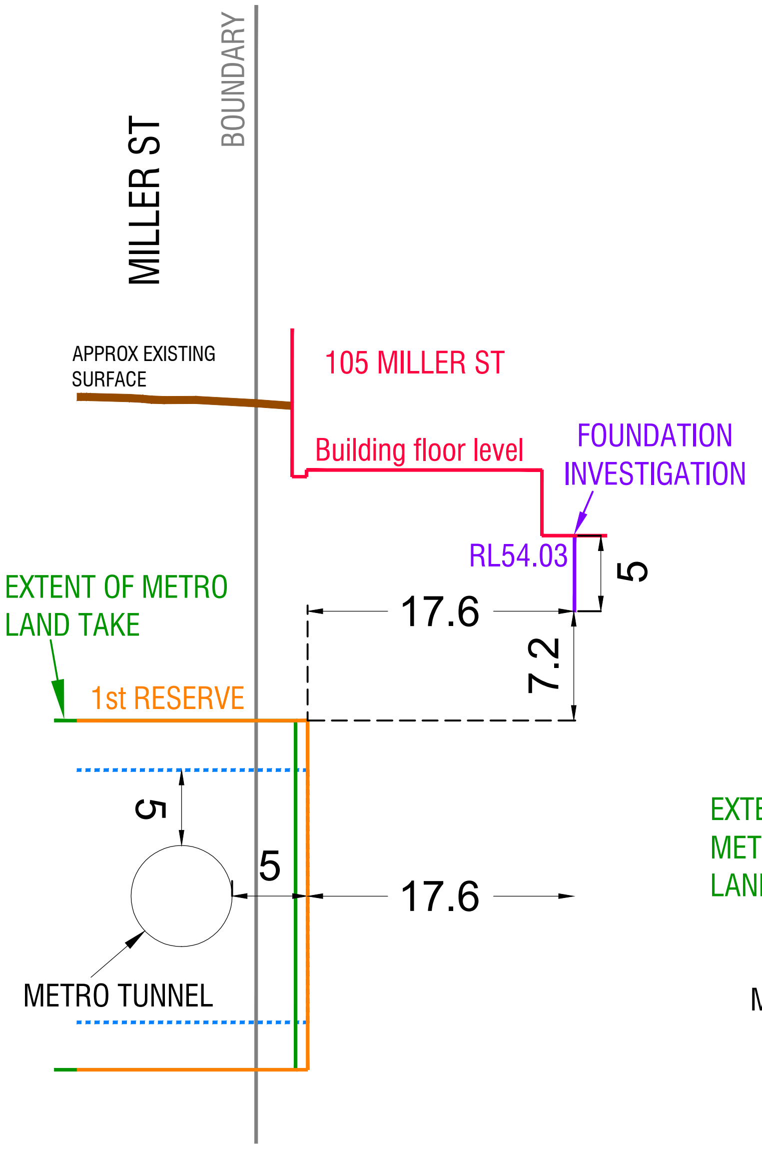
RPS AAP CONSULTING PTY LTD ( ABN 97 117 883 173 )
LEVEL 13 420 GEORGE STREET SYDNEY NSW 2000
T: 02 8270 8300 F: 02 9248 9810 www.rpsgroup.com.au

THIS IS A COLOURED PLAN.
REPRODUCTION IN COLOUR ONLY.

MAKING COMPLEX EASY



SECTION 'A' - 'A'



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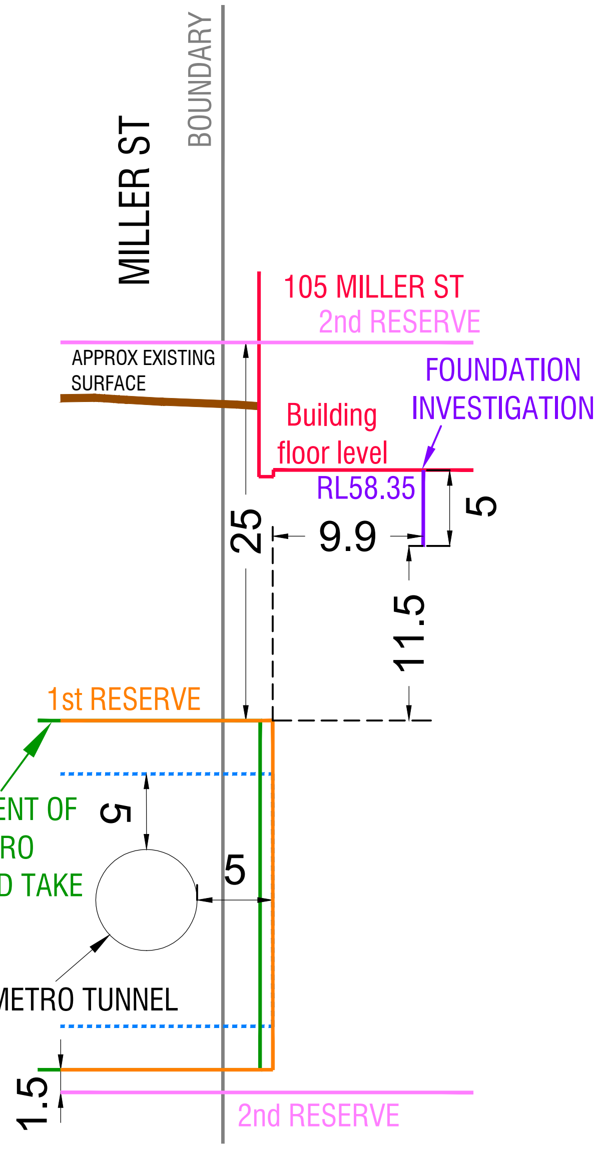

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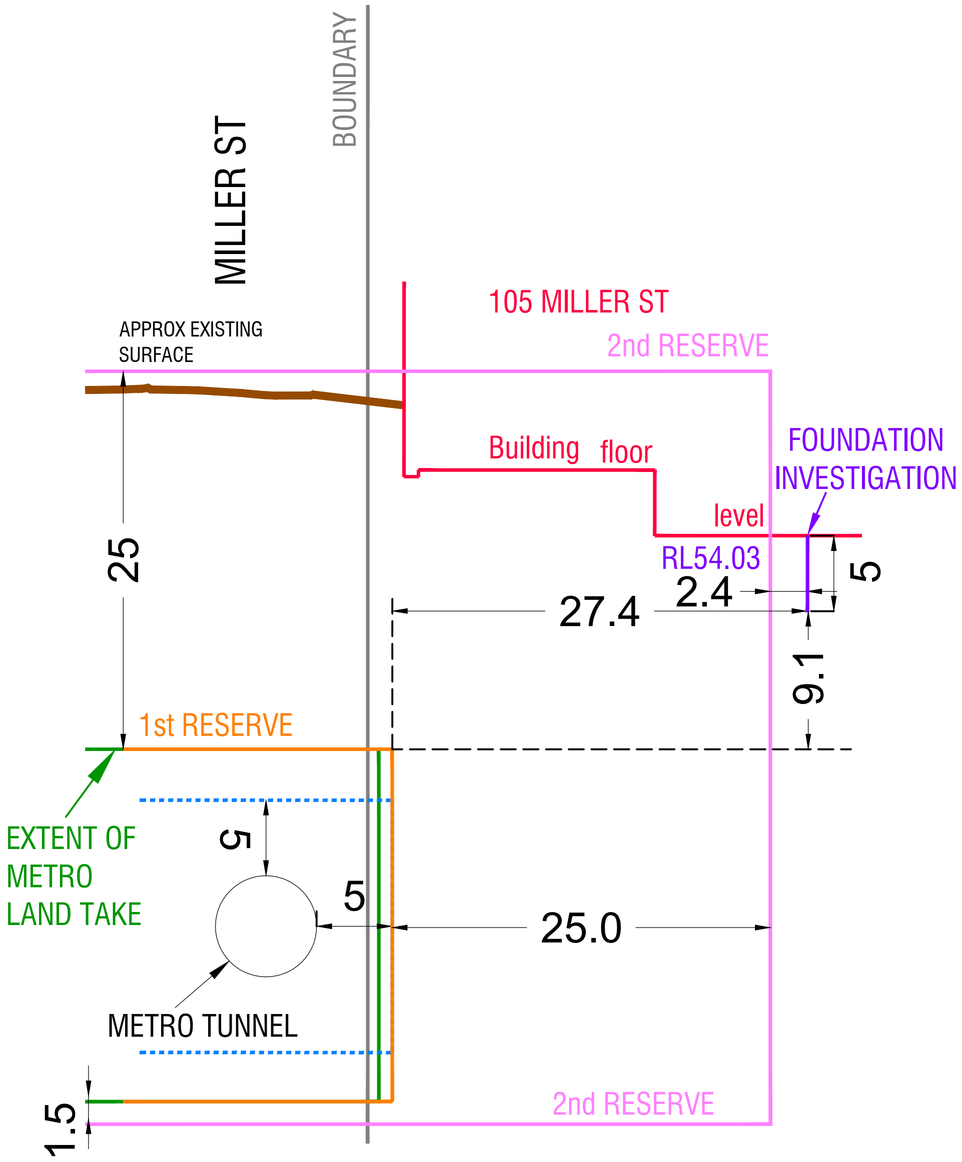

SECTION 'D' - 'D'

GARY SHARP
NSW REGISTERED SURVEYOR
ID NO. SU008841

REVISIONS

| No. | DATE | REVISION DETAILS | DRAWN | CHK | APP |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| A | 14.08.2024 | INITIAL VERSION | HY | GS | GS |

SCALE: 1:500 @ A3
COORDINATES: MGA94
ORIGIN:
DATUM: AHD
ORIGIN:
CROSS SECTION:
V : N/A H : N/A
SCALE BAR: 10 5 0 10 20 30 Metres

CLIENT: enstruct

SURVEY:
DRAWN: HY
DESIGNED: GS
APPROVED: GS

DATE OF SURVEY:
DATE OF PLAN: 14.08.2024
DATE LAST SAVED: 29.08.2024
DATE APPROVED: 14.08.2024

TITLE
Proposed Boreholes 105 Miller St Nth Sydney
DWG No AU2130xxxxxx-001-A-Boreholes-105 MIller St.dwg

JOB No AU213XXXXXX
ISSUE A
SHEET 2 OF 2 SHEETS
SIZE A3

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