Douglas PARTNERS

GROUNDED EXPERTISE

Report on Geotechnical Investigation

Proposed Mixed-Use Development

270 Pacific Hwy, Crows Nest, NSW

Prepared for Silvernight (Crows Nest) Landowner Pty Ltd

Project 214296.02

15 May 2025

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

Signature		Date
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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 mixed-use development at 270 Pacific Hwy, Crows Nest, NSW (the site). The investigation was undertaken in accordance with Douglas' proposal 214296.02.P.001.Rev0 dated 16 December 2024.

The application seeks development consent for the development of a 16 storey mixed use development at 270 Pacific Highway, Crows Nest, comprising 168 build to rent units and non-residential uses in the podium. Specifically, the SSDA seeks development consent for:

- demolition of two existing 5 storey commercial buildings;
- construction of a maximum 16 storey building, including:
  - 2 basement parking levels (with 82 carparks, 8 motorbike spaces and 230 bicycle spaces);
  - 3 podium levels comprising non-residential uses such as medical centre, retail, and residential uses (build to rent units and residential amenity facilities such as a gym and sauna, steam room, outdoor pool, class space, cinema room, coworking space);
  - 13 storeys of residential uses in the tower, comprising build-to-rent units;
  - communal open space;
  - landscaping on ground, level 2 – level 15;
  - rooftop solar panels;
  - internal and external residential amenities space on roof top;
- streetscape upgrades; and
- office and substation along the northwestern boundary.

The geotechnical investigation included the drilling of six rock-cored boreholes, installation of three groundwater monitoring wells in selected boreholes, follow-up measurement of groundwater levels and laboratory testing of selected samples. The details of the geotechnical field work are presented in this report, together with comments and recommendations on geotechnical aspects. Groundwater monitoring is ongoing within the monitoring wells installed on site and the results of the long-term monitoring will be reported separately, together with further details on the hydrogeological conditions encountered on site and applicable groundwater management. The geotechnical investigation was carried out concurrently with a Detailed Site (Contamination) Investigation (DSI, ref: 214296.03.R.001), which is reported separately.

It is understood that the finished floor level of the two-level basement is proposed to be at RL 90.5 m AHD. The site is shown on Drawing 1, Appendix A.

The aim of the investigation was to assess the subsurface soil, rock and groundwater conditions across the site in order to provide comments on geotechnical considerations relevant to the project's planning, design and construction.

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

2. SEARs compliance

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 31 January 2025 and issued for the SSDA (SSD-79658964). Specifically, this report has been prepared to respond to the SEARS requirements for ground and groundwater conditions as listed in Table 1.

Table 1: Summary of SEARS compliance for ground and groundwater conditions

Project Stage Design (D) Construction (C) Operation (O)	Geotechnical Risk	Mitigation Measure	Relevant Section of Report
D/C	Excavation support and stability.	Design parameters for batters slopes, retaining walls and ground anchors based on site-specific investigation / laboratory testing of ground conditions. Geotechnical inspections of batter slopes and ground anchor installation.	Sections 11.4.2, 11.4.3 and 11.4.5
C	Ground vibrations induced by plant and rock excavation.	Use rock saws prior to rock hammering, undertake vibration trials and on-going vibration monitoring.	Section 11.2
D/C	Poor foundations for footings, excessive settlement of footings.	Design parameters for footing design based on site-specific investigation / laboratory testing of ground conditions. Geotechnical inspections of foundations.	Section 11.6
D/C	Poor subgrade for slabs and pavements on-grade.	Design parameters for subgrade and pavements based on site-specific investigation / laboratory testing of ground conditions. Subgrade preparation, earthworks inspection and testing. Installation of drainage.	Section 11.7

Project Stage Design (D) Construction (C) Operation (O)	Geotechnical Risk	Mitigation Measure	Relevant Section of Report
D/C/O	Groundwater levels, seepage inflow to basement excavation, groundwater management.	Groundwater level monitoring for minimum 3 months, inflow assessment, preparation of Groundwater Impact Assessment (GIA), basement drainage system.	Section 11.5, GIA to be reported separately
D/C	Impact on adjacent structures.	Groundwater Impact Assessment (GIA), vibration trials and possibly on-going vibration monitoring induced by construction plant, Dilapidation Surveys, analyse lateral movements of retaining walls, stormwater management.	Sections 11.2, 11.2.4, 11.4.3, 11.5 and GIA to follow
D	Acid sulfate soils and salinity	Assessed as low risk and not applicable.	Section 4.0

3. Site description

The site is located at 270 Pacific Highway, Crows Nest. The site has an approximate area of 3,800 m^2 and includes Lot 22 in Deposited Plan 706776. The site is currently occupied by a pair of five-storey concrete commercial and office buildings with a shared single level basement carpark.

Douglas has been provided with a detailed basement survey plan by RYGATE Surveyors (Ref. 80385, dated 7 November 2023) included Appendix A. These indicate that the existing one level basement on site has a finished level at RL 93.5 m AHD.

The site has an approximate 75 m frontage to Pacific Highway (TfNSW asset) to the north-east. The site is also bounded by a five-storey building and Bruce Street to the south-east, eight residential properties to the south-west and a two-storey commercial building to the north-west. The neighbouring buildings are mostly extended to the common boundaries of the site. At the time of preparing this report, Douglas could not confirm if the adjacent buildings have any basement levels.

Supplied site survey plans (RYGATE Surveyors Ref. 79262, dated 4 May 2020) detail the existing ground level around the site varies between RL 96.0 m AHD at southeast corner and RL 98.4 m AHD at northwest corner of the site. The local topography in the vicinity of the site is shown in Figure 1.

The nearest water body to the site is Balls Head Bay, which is located at about 1.2 km to the south-west of the site.

The site is located at an approximate offset of about 60 m to the Sydney Metro rail tunnel that runs underneath the corner of Falcon Street and Pacific Highway, as shown in Figure 1. It is understood that the site is located outside the second protection reserve (further than 25 m away from the tunnel stratum). This however should be confirmed with TfNSW/Sydney Metro.

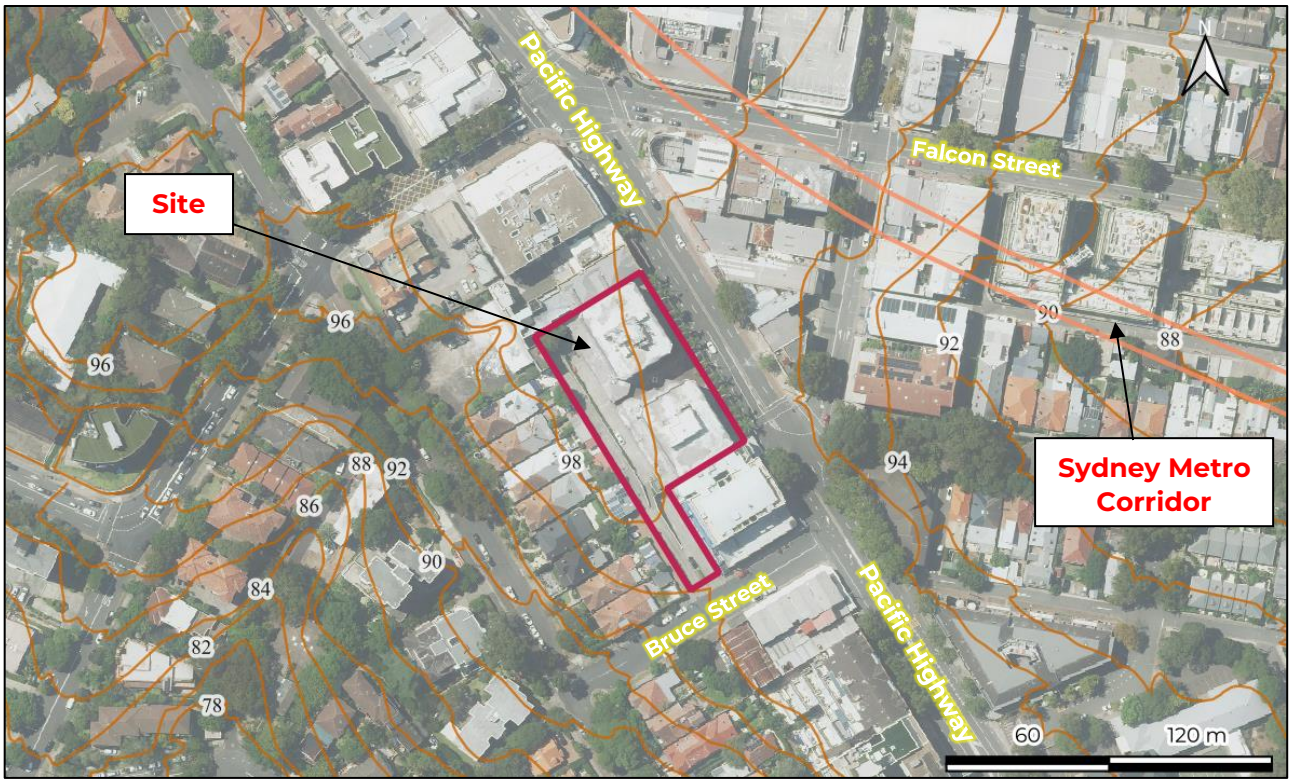


Figure 1: Site overview with 2 m surface contours and Metro rail corridor shown

4. Published data

4.1 Geology

Reference to the Sydney 1:100,000 Geological Series Map indicates that the site is underlain by rock of the lower Ashfield Shale formation, overlying the Mittagong Formation which is a transitional unit between the Ashfield Shale and underlying Hawkesbury Sandstone. The lower Ashfield Shale formation typically comprises shale, siltstone and finely laminated sandstone and siltstone (laminite). The Mittagong formation comprises interbedded shale, laminite and medium grained quartz sandstone. Hawkesbury Sandstone typically comprises medium to coarse grained quartz sandstone with some shale bands and lenses.

4.2 Hydrogeology

The site is situated at the top of a ridge located along Pacific Highway. Groundwater is expected to flow south-west and north-east in each direction from the site, following the natural topography of the area. The closest watercourse to the site is Berrys Creek, located approximately 850 m south (down gradient) of the site.

A search of the NSW groundwater bore database indicated that there are no registered groundwater bores within a 1 km radius of the site.

Based on the site's geology, it is expected that the perennial groundwater table occurs within the Ashfield Shale, predominantly in structures where secondary permeability has been enhanced (e.g. in fractures and cracks). Groundwater has been observed during previous investigations by Douglas nearby at depths of between 2 – 6 m below ground level. Perched seepage water with limited volumes can be expected at levels above the perennial groundwater table.

It is noted that groundwater levels vary over time due to climactic and human influences and will temporarily rise following prolonged rainfall.

4.3 Acid sulfate soils

Reference to the 1:25,000 Acid Sulfate Soils (ASS) Risk map indicates that the site is in an area of no known occurrence of ASS. The nearest mapped occurrence of ASS is bottom sediments of Balls Head Bay at about 1.2 km distance to the southwest of the site.

4.4 Salinity

Reference to the NSW Salinity Risk mapping indicates that the site is not located within an area that is considered likely to have salinity issues.

5. Previous investigations

Douglas carried out a geotechnical investigation for the existing commercial building in 1984. The investigation included four cored boreholes to depths of between 4 – 10 m below ground level at the site. The results of the investigation showed a relatively uniform subsurface conditions, which included residual clay over very low strength weathered shale bedrock at depths of about 3 m grading to 'medium strength' shale at nominal depths of 7-8 m.

No groundwater was recorded during the drilling of the previous boreholes. Long-term monitoring was not done for the previous investigation on the site.

6. Field work methods

The field work for the geotechnical investigation was undertaken between 12 and 25 February 2024 at the locations shown on Drawing 1 in Appendix A. A summary of the geotechnical field work is presented as follows:

- Scanning for underground services at each of the boreholes locations using an accredited services locator;
- Diatube coring of concrete floor slabs prior to borehole drilling;
- Dynamic Cone Penetrometer (DCP) testing of the basement soil sub-grade to assess soil consistency;
- Hand augering in the basement soil sub-grade prior to encountering rock;
- Sampling of soils for engineering and environmental testing purposes;

- Drilling of six boreholes to depths ranging between 10.0 m and 15.9 m using low-clearance, hand-operated portable drilling equipment (Proline). The rock was cored using NMLC-sized diamond core drilling to obtain 50 mm diameter continuous samples of the rock for identification and strength testing purposes;
- Boreholes were logged by Douglas' experienced geotechnical engineer based on visual and tactile observations of the soil cuttings and rock core in accordance with AS1726:2017;
- Installation of three groundwater monitoring wells in BH2, BH4 and BH6. Wells were developed (i.e., purged) immediately after installation and on 5 March 2025 prior to environmental sampling and hydraulic conductivity testing. Installation of data loggers was completed on the day of purging each standpipe; and
- Other boreholes (BH1, BH3 and BH5) were backfilled will drill spoil and topped with pre-mix concrete. The groundwater monitoring wells were capped with a steel gatic cover.

The ground surface elevation at each borehole location was inferred from the survey drawings provided (Appendix A), as Reduced Levels (RL) in metres relative to Australian Height Datum (AHD). The borehole locations were measured from existing site features, with coordinates (in GDA 2020 / MGA Zone 56 format) later estimated from georeferenced aerial imagery. Table 2 summarises the geotechnical borehole information.

Table 2: Summary of borehole information

Borehole	Easting (m)	Northing (m)	Surface RL to AHD (m)	Termination Depth (m bgl)	Termination Strata
BH1	333516	6255426	93.5	10.00	Siltstone
BH2	333536	6255397	93.4	12.37	Sandstone
BH3	333549	6255369	93.2	10.00	Sandstone
BH4	333494	6255412	93.5	15.00	Sandstone
BH5	333510	6255382	93.4	15.89	Sandstone
BH6	333521	6255365	93.3	10.00	Sandstone

Notes: bgl – below ground level

7. Field work results

7.1 Stratigraphy

The subsurface conditions encountered in the geotechnical boreholes (and concurrent environmental boreholes) are presented on the engineering logs in Appendix C, along with standard notes defining the descriptive terms and the classification methods used. The general subsurface profile encountered at the borehole locations (which are from the existing single level basement level) may be summarised as follows:

Concrete slab	Thicknesses of between 110 mm and 230 mm were observed in the basement concrete slab. Note borehole location BH3A initially encountered 0.7 m of concrete before being discontinued and relocated 1.5 m away to BH3;
Fill	At all locations below the slab, to depths ranging between 0.3 m and 0.9 m, except at BH6. The fill varied between sand and clay across locations with variable amounts of ripped sandstone gravel. Drainage gravel was encountered below the slab at BH1 and BH4;
Residual Clay	Below the fill in all boreholes to depths between 0.4 m and 1.2 m, comprising medium to high plasticity clay;
Ashfield Shale	Fractured, highly weathered to fresh, very low to low strength siltstone to depths ranging between 9.8 m and 10.8 m. BH1 was terminated within the Ashfield Shale at 10.0 m;
Mittagong Formation	Excluding BH1, highly to slightly weathered, very low to medium strength Mittagong Formation sandstone and laminite was encountered below the Ashfield Shale. BH2, BH3 and BH6 were terminated within this stratum. The thickness of the Mittagong Formation was observed to vary from about 1.5 m to 4.3 m in BH4 and BH5;
Hawkesbury Sandstone	BH4 and BH5 terminated in slightly weathered to fresh, medium to high strength Hawkesbury sandstone with laminite and siltstone interbeds.

7.2 Observed groundwater

7.2.1 Preliminary groundwater level results

The construction details of the groundwater monitoring wells are shown on the borehole logs in Appendix C. Groundwater levels were measured in the standpipes on 5 March 2025 prior to the commencement of ongoing monitoring. The well screen intervals and initial measurements are summarised below in Table 3. The results of ongoing groundwater monitoring will be reported separately.

Table 3: Manual groundwater measurements

Well No.	Surface RL (m AHD)	Screened Depth (m bgl)	Manual Water Level Measurement (05/03/25)	
			Depth (m bgl)	RL (m AHD)
BH2	93.4	1.5 – 10.5 m	1.14	92.3
BH4	93.5	1.5 – 7.5 m	0.41	93.1
BH6	93.3	1.5 – 7.5 m	2.37	90.1

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

7.2.2 Hydraulic conductivity testing

Rising head hydraulic conductivity tests were carried out in the monitoring wells following well development. The tests were undertaken by using a pump to lower the groundwater level in the wells and monitoring the subsequent recovery (rising head test) using a data logger.

Hydraulic conductivity tests were analysed using Hvorslev (1951) solution for slug testing interpretation. Results are presented in Table 4 and the detailed results of the tests are attached in Appendix C.

Table 4: Interpreted hydraulic conductivity results

Well ID	Screened Depth (m bgl)	Screened Material	Test No.	Test Date	Hydraulic conductivity k (m/sec)
BH2	1.5 – 10.5 m	Siltstone	1	21/02/2025	7.2×10^{-9}
			2	25/02/2025	7.2×10^{-9}
			3	5/03/2025	6.9×10^{-9}
BH4	1.5 – 7.5 m	Siltstone	1	21/02/2025	3.3×10^{-9}
			2	25/02/2025	5.0×10^{-9}
			3	5/03/2025	4.7×10^{-9}
BH6	1.5 – 7.5 m	Siltstone	1	21/02/2025	3.1×10^{-9}
			2	25/02/2025	2.2×10^{-9}
			3	5/03/2025	1.8×10^{-9}

8. Laboratory testing

8.1 Aggressivity

Three rock samples were sent to a NATA accredited analytical laboratory and were analysed to assess the exposure classification to buried steel and concrete elements in accordance with the provisions of AS2159–2009 “Piling – Design and Installation”. The rock sample aggressivity results are summarised with the laboratory test reports included in Appendix D.

Table 5: Laboratory Test Results for Aggressivity to Buried Concrete and Steel.

Borehole	Origin	Sample Depth (m) [1] [RL (m)]	pH	EC [2] (µS/cm)	Chloride (mg/kg)	Sulfate (mg/kg)
BH1	Siltstone	4.9 [88.6]	5.5	34	23	47
BH3	Siltstone	3.0 [90.2]	4.9	42	31	35
BH5	Siltstone	1.0 [92.4]	5.8	35	10	39

Notes: (1) Elevation quoted is for the top of the sample. (2) EC = Electrical Conductivity.
All analysed samples were tested as a 1:5 mixture of soil:water.

8.2 Soil contamination

It is noted that laboratory analysis of soil samples was carried out during the investigation for common contaminants of concern. The contamination results are presented and discussed in the companion DSI report (ref: 214296.03.R.001).

8.3 Rock strength

Point Load Strength Index ($Is_{(50)}$) strength testing was carried out on the recovered core at regular depth intervals. The results are presented on the borehole logs and show $Is_{(50)}$ values generally in the range 0.05 MPa to 1.37 MPa, with the indicative rock strength ranging from very low strength up to high strength. To obtain inferred unconfined compressive strengths (UCS) from $Is_{(50)}$ test results, a conversion factor of 20 is typically suggested. Using this conversion factor, rock strengths in the range of about 1.0 MPa to 27 MPa are indicated in for the encountered rock.

9. Geotechnical model

Table 6 summarises the levels at which different materials were encountered in the boreholes. The rock classifications refer to a system developed by Pells et al (1978) which classifies rock on the basis of strength, fracturing and defects. Class IV rock is typically very low strength and fractured whereas Class I rock is typically medium to high strength and unbroken. It is noted that classifications may contain stronger rock with significant defects and/or fracturing.

Table 6: Summary of reduced level to top of various strata

Stratum	Depth (m) [RL (m, AHD)] to Top of Stratum					
	BH1	BH2	BH3	BH4	BH5	BH6
Ground Surface (Concrete Slab & Fill)	[93.5]	[93.4]	[93.2]	[93.5]	[93.4]	[93.3]
Residual Clay	0.9 [92.6]	0.4 [93.0]	0.3 [92.9]	0.4 [93.1]	0.3 [93.1]	0.2 [93.1]
Class IV Shale	1.2 [92.3]	0.6 [92.8]	0.5 [92.7]	0.5 [93.0]	0.6 [92.8]	0.4 [92.9]
Class III Shale	3.7 [89.8]	-	8.1 [85.1]	4.2 [89.3]	-	7.0 [86.3]
Class V Sandstone	-	10.8 [82.6]	9.8 [83.4]	-	10.8 [82.6]	-
Class IV Sandstone	-	-	-	10.8 [82.7]	11.8 [81.6]	9.7 [83.6]
Class III Sandstone or better	-	-	-	14.5 [79.0]	14.3 [79.1]	-
Base of Borehole	10.0 [83.5]	12.4 [81.0]	10.0 [83.2]	15.0 [78.5]	15.9 [77.5]	10.0 [83.3]

Notes: ' – ' = not encountered;

The development area (below the existing single level basement) comprises variable depths (0 – 0.9 m observed) of fill, underlain by residual clays which are derived from weathering of the Ashfield Shale. These are of very stiff to hard consistency, with medium to high plasticity. The fill and residual clays are underlain by a deeply weathered Ashfield Shale profile which is very low strength (Class IV), increasing to low strength (Class III) shale in BH3, BH4 and BH6.

Underlying the Ashfield Shale is Class V Mittagong sandstone, observed to be about 1.5 m to 4.3 m thick in BH4 and BH5. The site is underlain by Hawkesbury Sandstone bedrock, observed as Class IV sandstone in BH4, BH5 and BH6, improving to Class III or better below 14.3 m to 14.5 m depth in the deeper boreholes BH 4 and BH5 only.

The interpreted geotechnical model is illustrated in Cross-Sections A-A', B-B', C-C' and D-D' in Drawings 2 to 5 in Appendix A.

10. Proposed development

It is understood that the proposed development at the site includes demolition of the existing buildings and construction of a 16-storey mixed-use tower with one and two basement levels. The two-level basement will be in the eastern portion of the site and a single-level basement will be in the western portion of the site.

The current basement finished floor level (FFL) is at an approximate RL of 93.5 m AHD, which is the same level as the proposed single-level basement in the western portion of the site. It is understood that the finished floor level of the new two-level basement in the eastern portion of the site is proposed to be at RL 90.5 m AHD. This would require material across the site to be excavated approximately 3 m below the existing basement level. Deeper isolated excavations for the proposed lift pits, a fuel tank and possible services trenches would also be required.

Based on the provided architectural drawings, it is noted that the proposed basement will be extended to site boundaries with Pacific Highway to the east, adjacent 2 storey building to the north (No. 286 – 290 Pacific Highway) and adjacent multi storey building to the south (No. 258 Pacific Highway).

The geotechnical issues considered relevant to the proposed development include earthworks, groundwater, vibrations during excavation, excavation support particularly considering the possibility of high-level footings supporting the adjacent buildings, and foundations.

11. Comments

11.1 Excavation

It is expected that the two-level basement excavation would be carried out through fill, residual clay, weathered and very low to low strength siltstone. This should be readily achieved using conventional earthmoving equipment such as tracked excavators. It is noted that low, medium and high strength bands of iron indurated siltstone and ironstone were encountered within the weathered bedrock profile across the site, and particularly in the eastern corner at BH3. It is expected that heavy ripping equipment and/or rock hammers may be required for effective removal of low strength or stronger bedrock.

Groundwater seepage into the excavation is likely to occur and will need to be managed. Further comments on groundwater are provided in Section 11.5.

11.2 Ground vibrations

11.2.1 General

During excavation it will be necessary to use appropriate methods and equipment to keep ground vibrations within acceptable limits. The standards listed below are considered appropriate documents on which to base the management of ground vibrations:

- German Standard DIN4150-3-1999 "Structural vibration – effects of vibrations on structures"; and
- Australian Standard AS2670.2-1990 "Evaluation of human exposure to whole-body vibrations – continuous and shock induced vibrations in buildings (1-80 Hz)".

11.2.2 Provisional vibration limit

Generally, adjacent structures can withstand vibration levels higher than those levels required to maintain the comfort of their occupants. Therefore, a human comfort criterion is appropriate, and the vector sum peak particle velocity (VSPPV) is proposed as the control parameter. It is recommended that a provisional vibration limit of 8.0 mm/s (VSPPV) be set during normal working hours, at the ground floor level of potentially affected buildings. A lower vibration limit would be necessary if there are sensitive or heritage structures nearby and may also be imposed by Sydney Water and other asset providers.

11.2.3 Excavation plant

Douglas maintains a database of vibration trial results which can provide guidance for the selection of plant. Trial data is dependent on-site conditions and equipment, hence actual vibration levels may differ from predictions and a specific trial is recommended at the commencement of rock excavation. The database suggests buffer distance ranges, such as those shown for selected plant in Table 7, which should be maintained between excavation plant and adjacent buildings. These estimates should be examined in relation to the distances between adjacent buildings and the proposed excavation footprint, in order to select suitable plant.

Table 7: Approx. Buffer Distances for Selected Plant (Provisional Allowed Limit 8 mm/s)

Excavation Plant	Distance from plant by which vibration normally attenuates to 8 mm/s	
	From DP trial maximum maxima [1]	From DP trial averages
Rock Saw on Excavator [2]	1.1 m	0.6 m
Ripper on 20 t Excavator	3.4 m	1.2 m
Rock Hammer < 500 kg operating	7.4 m	3.0 m
Rock Hammer 501 - 1000 kg	7.5 m	3.3 m
Rock Hammer 1001 - 2000 kg	12.4 m	5.4 m

Excavation Plant	Distance from plant by which vibration normally attenuates to 8 mm/s	
	From DP trial maximum maxima [1]	From DP trial averages
Rock Hammer > 2000 kg operating	7.4 m	4.9 m

Note:
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 reduced by prior saw cutting along, or parallel to, excavation boundaries; and
3. Loading effects from adjacent buildings may reduce vibration levels, to enable boundary saw cuts with few exceedances.

11.2.4 Building condition surveys

It is recommended that building condition (dilapidation) surveys of adjacent buildings be undertaken prior to commencement of excavation and that the adjacent building foundation types and conditions be determined where possible, so as to assess the maximum acceptable vibration level to reduce the likelihood of damage and to provide evidence in the event of any damage claims.

The footings to neighbouring buildings should be established as potential movements may affect the building structure and could require underpinning or additional support, and tis data is required to inform detailed design of shoring.

11.3 Disposal of excavated material

All excavated material will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the Waste Classification Guidelines (EPA, 2014). Further comments on contamination and waste classification are provided in the DSI report (ref: 214296.03.R.001).

11.4 Excavation Support

11.4.1 General

Careful consideration must be given to the planning and design of excavation and excavation retention system(s) to reduce the risk of destabilising and causing damage to the adjacent buildings, services (e.g. Sydney Water assets) and surrounding public footpaths/roads which include Transport for NSW (TfNSW) assets. Sydney Water will require a Specialist Engineering Assessment (SEA) to be undertaken for any buried assets close to the site, to assess the potential impact of the proposed development on the assets. TfNSW will require an assessment and monitoring of the impact of the proposed development on the Pacific Highway to the north-east of the site (refer to Section 11.4.6 for more comments).

As excavation will be required close to the boundaries of the site, battering of the sides of the excavation will not be feasible. Vertical excavation in fill, soils and siltstone will require both temporary and permanent lateral support during excavation and as part of the final construction.

The general comments provided in this section assumes the existing shoring wall will be decommissioned and replaced with a new shoring wall designed to the current Australian Standards. Further detailed investigation and analysis will be required if the existing shoring wall is proposed to be integrated into the new design. If the wall is to be removed this will likely require some form of staged or hit and miss approach to maintain stability of the existing wall while it is being partly demolished and replaced; this will require further geotechnical review and input.

Any basement levels in the neighbouring properties should be confirmed prior to commencing excavation and investigation should be carried out to determine the nature and condition of the foundations and their loads for inclusion in the shoring wall design. The proposed shoring system may need to be modified to ensure support to the adjacent buildings and roads, depending on the findings of the investigation.

11.4.2 Batter slopes

Batter slopes will not be possible for bulk excavation along the boundaries with limited or no setback to the site boundaries. If feasible elsewhere, shallow excavations to 3 m maximum height within the shored excavation could be adopted, using recommended batter slopes in Table 8 below. If surcharge loads are applied near the crest of the slope, then further specific geotechnical review and probably flatter batters or stabilisation using rock bolts or soil nails may be required.

Table 8: Recommended batter slopes for exposed material

Exposed Material	Maximum Temporary Batter Slope (H:V)	Maximum Permanent Batter Slope (H:V)
Fill & Residual Soil	1:1	2:1*
Very Low to Low Strength Rock (Class IV/III Shale)	1:1*	1.5:1*

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

Unsupported excavations are not permitted if located within the influence zone (45 degree line from the bottom of the excavation) of any adjacent footing or underground services.

11.4.3 Retaining/shoring walls

The bulk excavation is expected to be in soil and weathered shale and will require both temporary and permanent lateral support. Support for this type of ground typically comprises anchored soldier piles with shotcrete infill panels.

Bored soldier piles with shotcrete infill panels are considered suitable where there are no movement sensitive structures or footings in close proximity to the excavation. Typically, soldier piles are spaced at a maximum of about 2.4 m centres, however, closer spaced piles may be required to stiffen the wall and reduce the risk of material collapse between piles, particularly where adjacent footings are near the excavation. Contiguous piles are generally used where at rest conditions are to be achieved together with higher anchor capacities. The most appropriate shoring system will depend on the adjacent footing depth, offset, loads and founding conditions.

Shoring piles must be founded in rock below the deepest bulk excavation level in order to provide lateral restraint at the base of the shoring wall.

It is anticipated that single and/or multiple rows of temporary anchors will be required to provide lateral restraint to the shoring piles for the proposed basement, and possibly to the existing basement wall while floor slabs are being demolished to create access for piling equipment. Shoring will need to be designed to support earth pressures and surcharge loads, and should also consider the possibility that 45 degree joints in the shale/siltstone will daylight near the base of the shoring, which may result in rock wedges and lateral loads in excess of that normally allowed for in the shoring design.

It is anticipated that the proposed building will support the shoring over the long term and therefore the ground anchors are expected to be temporary only. The use of permanent anchors would require careful attention to corrosion protection including full column grouting and the use of an internal corrugated sheath over the full length of the anchor. A detailed specification would need to be prepared for the installation and stressing of permanent anchors.

11.4.4 Shoring wall design

It is suggested that preliminary design of cantilevered shoring systems (or shoring with one row of anchors or propping) be based on a triangular earth pressure distribution using the earth pressure coefficients provided in Table 9. 'Active' earth pressure coefficient (K_a) values may be used where some wall movement is acceptable, and 'at rest' earth pressure (K_o) values should be used where the wall movement needs to be reduced (i.e. adjacent to existing structures or utilities).

Table 9: Material and Strength Parameters for Excavation Support Structures

Unit	Material	Bulk Density (kN/m3)	Coefficient of Active Earth Pressure (Ka)	Coefficient of Earth Pressure at Rest (Ko)	Ultimate Passive Earth Pressure (kPa)
1 & 2	Fill, Residual Soil and Extremely Weathered Material	20	0.3	0.45	-
3	Very Low Strength Siltstone (Class IV Shale)	22	0.25	0.40	400[1]
3 & 4	Low strength Siltstone and Laminite (Class III Shale)	23	0.2[2]	0.3[2]	2000[1]

Notes: [1]Only below bulk/detailed excavation level and where jointing is favourable
[2]Provided that adverse jointing is not encountered

Where multiple rows of anchors or propping are used, it is suggested that preliminary design of shoring walls could be based on a trapezoidal earth pressure distribution with a maximum

pressure calculated based on 4H kPa where H is equal to the retained height of soil and very low and low strength rock. The maximum pressure should be increased to 6H where wall movement needs to be reduced. In each case the maximum pressure generally acts over the central 60% of the wall, reducing to zero at the top and base.

The wall design parameters provided above assume the following:

- A level surface behind the top of the excavation;
- Construction traffic and other surcharge loadings (e.g. stacked materials, etc.) are not applied near the crest of the retaining walls, within the zone of influence (otherwise the resultant additional lateral loads need to be considered); and
- Surcharge loads from adjacent footings will be allowed for by the wall designer. The loading, dimensions and types of adjacent footings as well as their founding conditions and levels will need to be determined prior to finalising the retaining / shoring wall design.

Shoring walls should also be designed for hydrostatic pressures (as appropriate) unless drainage of the ground behind impermeable walls can be provided. Drainage could comprise 150 mm wide strip drains pinned to the face at 1 m to 2 m centres behind shotcrete in-fill panels. The base of the strip drains should extend out from the shoring wall to allow any seepage to flow into a perimeter toe drain which is connected to the stormwater drainage system.

Detailed design of retaining walls should be carried out using computer programs capable of modelling soil-structure interaction, such as WALLAP or PLAXIS, which can take due regard of soil-structure interaction as well as buoyancy forces during the progressive stages of wall construction, anchoring / propping and bulk excavation.

Passive resistance for piles founded in rock below the base of the bulk excavation (including allowance for services and/or footings) may be based on the ultimate passive restraint value provided in Table 9. This ultimate value represents the pressure mobilised at high displacements and therefore it will be necessary to incorporate a factor of safety of at least 2 to limit wall movement. The top 0.5 m of the socket should be ignored due to possible disturbance and over-excavation.

11.4.5 Ground anchors

The design of temporary and permanent ground anchors/rock bolts for the support of excavations and/or shoring systems may be carried out on the basis of the maximum bond stresses given in Table 10.

Table 10: Recommended bond stresses for rock anchor design

Material Description	Allowable Bond Stress (kPa)	Ultimate Bond Stress (kPa)
Very low to low strength rock (Class IV/III Shale)	100	200

The parameters given in Table 10 assume that the drilled holes are clean and adequately flushed. The anchors should be bonded behind a line drawn up at 45 degrees from the base of the shoring or the top of free-standing medium strength or stronger rock, and "lift-off" tests should be carried

out to confirm the anchor capacities. It is suggested that ground anchors should be proof loaded to 125% of the design working load and locked-off at no higher than 80% of the working load.

Note that any anchors extending beyond the perimeter of the site will require permission from affected parties prior to installation. (e.g. TfNSW for any anchors along Pacific Highway). Anchors will not be feasible or will need to be lowered where adjacent basement structures or buried services exist, also considering minimum clearances to Sydney Water assets and other assets. DP anticipate that TfNSW may require investigation and analysis following development consent to assess the impact of the proposed construction on their assets.

11.4.6 **Excavation adjacent to TfNSW asset (Pacific Highway)**

Reference should be made to the "TfNSW Technical Direction on Excavation adjacent to Transport for NSW Infrastructure guideline (GTD 2020/001 | Version No. 01 – 2 July 2020)" with regards to excavation/shoring adjacent to Pacific Highway. This document outlines requirements for excavations adjacent to TfNSW infrastructure and includes the level of geotechnical investigation required, dilapidation surveying, instrumentation and monitoring during construction, trigger levels and contingency plans.

Instrumentation (e.g. inclinometers) and monitoring is typically required where the excavation exceeds 3 m in height (for cantilevered shoring walls) or 6 m in height (for anchored or propped shoring walls). A geotechnical monitoring plan will be required by TfNSW prior to construction of the development.

11.5 **Groundwater**

Measurements within the monitoring wells installed on site indicate a groundwater level at depths between 0.4 m to 2.4 m below the existing basement floor level (RL 92.3 m AHD to RL 90.1 m AHD), which is considered consistent with encountered subsurface geology and anticipated perched seepage along bedding planes, joints and other defects with the bedrock. The rate of seepage and seepage level will vary with climatic conditions.

The subsurface conditions encountered in the boreholes and very low permeability values obtained from site testing indicate that seepage can probably be controlled using a sub-floor drainage and collection system in the basement levels. It is noted that, although the permeability testing results indicate very low permeability in the siltstone beneath the site, any inflow assessments should consider the sensitivity of higher permeabilities in the rock mass. Seepage through Wianamatta Group shales usually results in iron precipitates which have the potential to block drainage material and additional precautions (e.g. wash-out points etc.) should be taken to avoid blocking the drains in the medium to longer term.

The permeability of a rock mass is a function of the prevalence of jointing/fracturing in the rock as well as the water levels. Permeability testing and ongoing groundwater monitoring has been undertaken within the groundwater monitoring wells for the assessment of expected inflows into the basement.

Grouting of open joints and partings may be advisable if excessive water ingress is found to be an issue during excavation. A pump will be required to periodically remove stored water from the basement. A pump may also be needed to remove seepage from footing/pile excavations prior to the placement of concrete or, in the case of piles, a tremie used.

11.6 **Foundations**

Assuming a two-level basement design, the bulk excavation for the basement will expose variable and mostly very low and low strength siltstone. The design loads and preliminary footing designs are not available at this early stage, but this foundation material may be suitable to support the building loads on pad footings although pads may be large if column loads are high.

Pads founded on the rock in the base of the excavation may be designed using the end bearing values given in Table 11. If higher structural loads are required, bored piles may be used to achieve shaft adhesion and/or reach stronger rock (e.g. Class III Sandstone or better observed at approximately 14-15 m depth (RL 79 m) in some boreholes). The depth to Class III Sandstone or better rock is not well defined and if this is to be used as the foundation strata then further investigation will be required with extra deep cored boreholes. It is possible that higher bearing pressures of about 6000 kPa could be possible in the deeper Class III or better sandstone but this would be subject to the results of further cored boreholes and assuming consistent medium to high strength sandstone if encountered. Piled foundation may be designed using the same end bearing values in combination with the shaft adhesion values shown in Table 11. Shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the shaft adhesion values for compression.

Foundations proportioned on the basis of the allowable bearing pressures in Table 11 would be expected to experience total settlements of less than 1% of the footing width / pile diameter under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

Table 11: Design parameters for foundation design

Foundation Stratum	Maximum Allowable Pressure (Serviceability)		Maximum Ultimate Pressure (Ultimate)		Young's Modulus, E (MPa)
	End Bearing (kPa)	Shaft Adhesion* (Compression) (kPa)	End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)	
Class IV Shale	1,000	70	3,000	150	100
Class III Shale	2,000	150	6,000	350	200
Class V Sandstone	1,000	100	3,000	150	50
Class IV Sandstone	2,000	200	6,000	350	150
Class III Sandstone	3,500	350	20,000	800	350

Note: * Shaft adhesion applies to pile foundations for which the socket sidewalls are adequately cleaned and roughened to "R2" standard (or better) as defined in Pells et. al. (1998)

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

11.7 Ground Slabs and Pavements

The floor at basement level can be designed as a slab on ground, assuming proper compaction is given to the subgrade (if not on rock) on which the slabs are cast. It will be necessary to provide under-floor drainage to safeguard against uplift pressures if the basement is designed as drained. This could comprise a minimum 100 mm thick layer of durable open graded crushed rock with subsoil drains and sumps, but subject to the civil/drainage consultants design and specification.

Any existing fill that is required to support pavements, e.g. for a driveway or upgrades to surrounding pavements/footpaths, will need to be reworked to reduce the potential for unacceptable settlements associated with poorly or variably compacted fill. New fill should also be placed in accordance with the following specification.

The following procedure should be followed during any earthworks activities:

- Excavate existing fill from areas in which new engineered fill or pavements are proposed;
- Compact the exposed surface and proof-roll in the presence of a geotechnical engineer. Any areas exhibiting unacceptable movements (e.g. heave or deflection) during the proof-roll may require further rectification;
- Place fill in maximum 250 mm thick loose layers and compact to achieve a dry density ratio of between 98% and 102% relative to Standard compaction. The upper 0.5 m of pavement subgrade areas should be compacted to achieve a dry density ratio of between 100% and 102% relative to Standard compaction, with moisture contents maintained within 2% of Standard optimum moisture content; and
- Density testing should be undertaken in accordance with the requirements of AS3798–2007 “Guidelines on earthworks for commercial and residential developments”.

On the basis of the subsurface conditions encountered on the site and our previous experience in the area, it is recommended that a design subgrade CBR of 3% be provisionally adopted for the clays at the site, assuming that the site preparation recommendations, above, are adopted.

11.8 Aggressivity

The laboratory test results indicate that the samples are generally ‘mildly’ aggressive to buried concrete and ‘non-aggressive’ to buried steel elements in accordance with the provisions of AS2159–2009 “Piling – Design and Installation”.

11.9 Seismic classification

A Hazard Factor (Z) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2024 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class of Class C_e (shallow soil site) is considered to be appropriate for the site. It is noted that the soil and weak rock depth marginally exceeds the 3 m limit stated in AS 1170.4 (when considering the existing basement depth) and it is possible that additional boreholes drilled from the ground surface, and further geotechnical review and analysis may be used to rationalise an improved site sub-soil class to a B_e.

12. Conclusion

From a geotechnical perspective, the site is considered to be suitable and stable for the proposed development, provided that the comments and recommendations in Section 11 are followed during design and construction.

13. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 270 Pacific Hwy, Crows Nest NSW in line with Douglas' proposal dated 16 December 2024 and acceptance received from Steven Papadopoulos of Silvernight (Crows Nest) Landowner Pty Ltd dated 17 December 2024. The work was carried out under the standing agreement between Stockland and Douglas. This report is provided for the exclusive use of Silvernight (Crows Nest) Landowner Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and / or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and 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 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 and 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.

The scope of work for this report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill

of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials, refer to the DSI (Douglas, 2025) for further details.

Appendix A

Drawings

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	07.03.2025	JM

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

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

CLIENT:
Silvernight (Crows Nest) Landowner Pty Ltd

NOTE:
1: Basemap from Metromap Dated (27.01.2025)

COORDINATE REFERENCE SYSTEM: GDA2020 / MDA zone 56

PROJECT NAME:
Proposed Mixed-Use Development

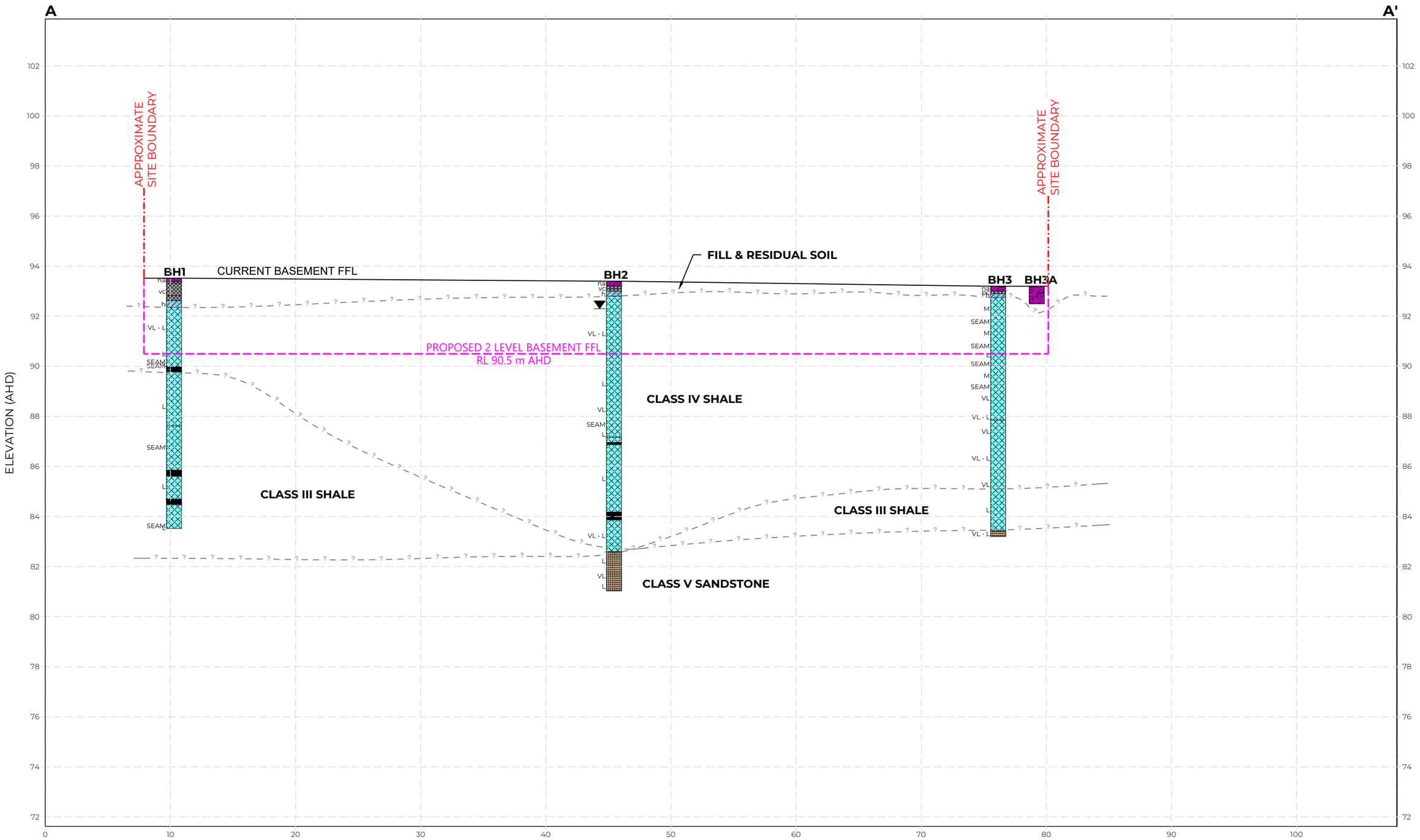
PROJECT ADDRESS:
270-272 Pacific Hwy, Crows Nest

DRAWING TITLE:
Borehole Location Plan

PROJECT NO: **214296.02**

DRAWING NO: **1**

REVISION: **0**



LEGEND

- CI-CH - Medium to High Plasticity CLAY
- CONCRETE
- NO CORE
- FILL
- SANDSTONE
- SILTSTONE
- Water Level

TESTS / OTHER

— ? — — - Interpreted geotechnical boundary

ROCK STRENGTH

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

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	02.05.2025	EC

SCALE: 0 1 2 4 6 8 10 15
1:300 @ A3
Vertical Exaggeration = 2.0

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

CLIENT:
Silvernight (Crows Nest) Landowner Pty Ltd

NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:
Proposed Mixed-Use Development
PROJECT ADDRESS:
270-272 Pacific Hwy, Crows Nest

DRAWING TITLE:
INTERPRETED GEOTECHNICAL CROSS SECTION A-A'

PROJECT No: **214296.02**
DRAWING No: **2**
REVISION: **0**

B

B'

APPROXIMATE SITE BOUNDARY

APPROXIMATE SITE BOUNDARY

BH4

BH5

BH6

CURRENT BASEMENT FFL

PROPOSED 1 LEVEL BASEMENT FFL
RL 93.5 m AHD

FILL & RESIDUAL SOIL

BRUCE STREET ENTRANCE

CLASS IV SHALE

CLASS III SHALE

CLASS V SANDSTONE

CLASS IV SANDSTONE

CLASS III SANDSTONE OR BETTER

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

LEGEND

- CI-CH - Medium to High Plasticity CLAY
- FILL
- Water Level
- CONCRETE
- SANDSTONE
- NO CORE
- SILTSTONE

TESTS / OTHER

- Interpreted geotechnical boundary

ROCK STRENGTH

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

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	02.05.2025	EC

SCALE: 0 1 2 4 6 8 10 15
1:300 @ A3
Vertical Exaggeration = 2.0

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

CLIENT:
Silvernight (Crows Nest) Landowner Pty Ltd

NOTES
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2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:
Proposed Mixed-Use Development

PROJECT ADDRESS:
270-272 Pacific Hwy, Crows Nest

DRAWING TITLE:
INTERPRETED GEOTECHNICAL CROSS SECTION B-B'

PROJECT No: **214296.02**

DRAWING No: **3**

REVISION: **0**

C

C'

APPROXIMATE SITE BOUNDARY

APPROXIMATE SITE BOUNDARY

BASEMENT WALL

PROPOSED 1 LEVEL BASEMENT FFL RL 93.5 m AHD

CURRENT BASEMENT FFL

PROPOSED 2 LEVEL BASEMENT FFL RL 90.5 m AHD

BH4

BH1

FILL & RESIDUAL SOIL

CLASS IV SHALE

CLASS III SHALE

CLASS IV SANDSTONE

CLASS III SANDSTONE OR BETTER

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

LEGEND

- CI-CH - Medium to High Plasticity CLAY
- CONCRETE
- NO CORE
- FILL
- SANDSTONE
- SILTSTONE
- Water Level

TESTS / OTHER

- Interpreted geotechnical boundary

ROCK STRENGTH

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

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	02.05.2025	EC

SCALE: 0 1 2 4 6 8 10 15

1:300 @ A3
Vertical Exaggeration = 2.0

Douglas PARTNERS
OFFICE: SYDNEY
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(02) 9809 0666

CLIENT:
Silvernight (Crows Nest) Landowner Pty Ltd

NOTES
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2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:
Proposed Mixed-Use Development

PROJECT ADDRESS:
270-272 Pacific Hwy, Crows Nest

DRAWING TITLE:
INTERPRETED GEOTECHNICAL CROSS SECTION C-C'

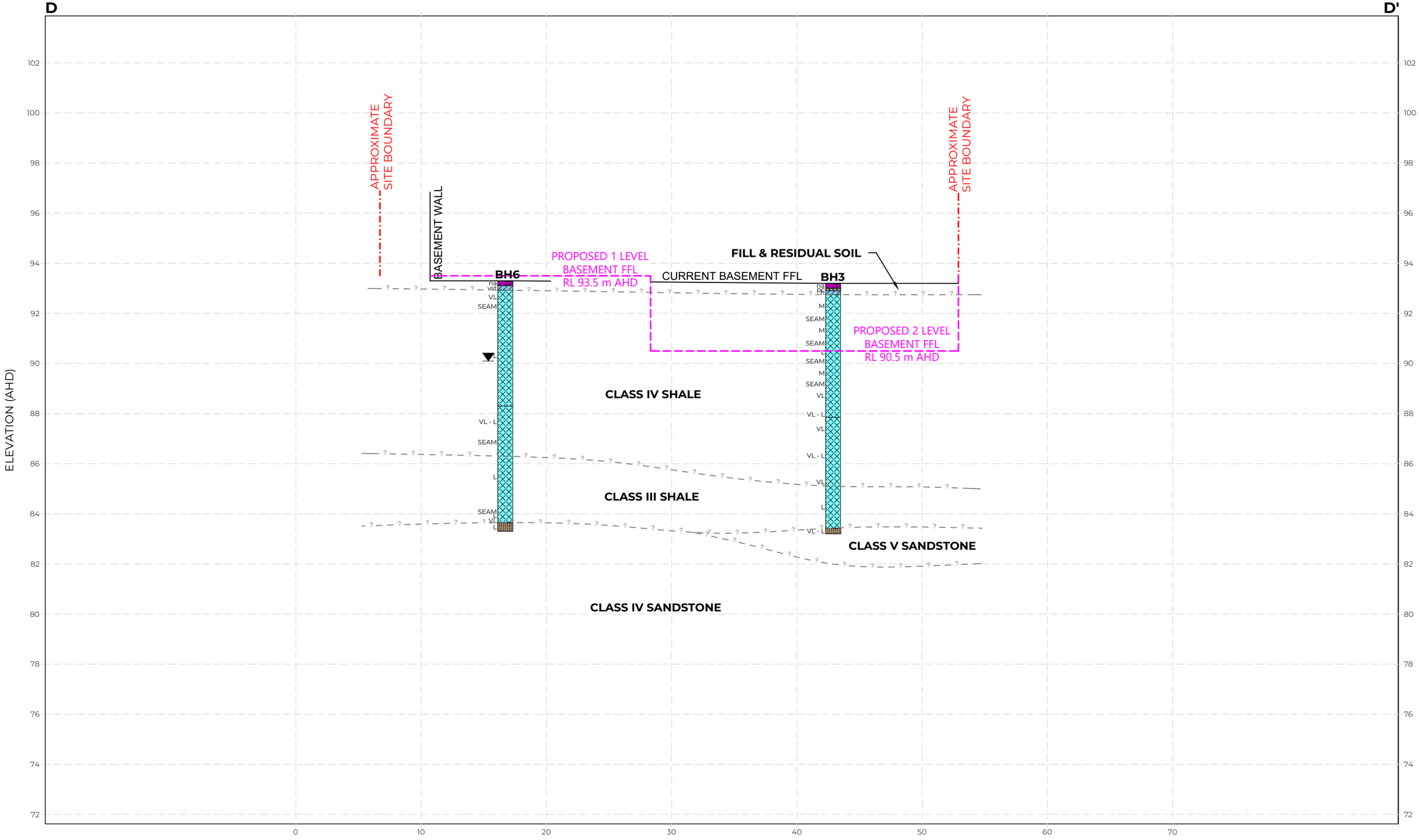
PROJECT No: **214296.02**

DRAWING No: **4**

REVISION: **0**

D

D'



LEGEND

- CI-CH - Medium to High Plasticity CLAY
- CONCRETE
- FILL
- SANDSTONE
- SILTSTONE
- Water Level

TESTS / OTHER

— ? — — - Interpreted geotechnical boundary

ROCK STRENGTH

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

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	02.05.2025	EC

SCALE: 0 1 2 4 6 8 10 15

1:300 @ A3
Vertical Exaggeration = 2.0

Douglas PARTNERS
OFFICE: SYDNEY
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(02) 9809 0666

CLIENT:
Silvernight (Crows Nest) Landowner Pty Ltd

NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:
Proposed Mixed-Use Development

PROJECT ADDRESS:
270-272 Pacific Hwy, Crows Nest

DRAWING TITLE:
INTERPRETED GEOTECHNICAL CROSS SECTION D-D'

PROJECT No: **214296.02**

DRAWING No: **5**

REVISION: **0**

Appendix B

About this Report

Terminology, Symbols and Abbreviations

Soil & Rock Descriptions

Sampling, Testing and Excavation Methodology

About this Report

November 2023

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

continued next page

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

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Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

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

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

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

Abbreviation Codes

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

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

Data Integrity Codes

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

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

Graphic Symbols

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

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Soil Descriptions

Terminology
Symbols
Abbreviations

November 2023

Introduction

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

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

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

Particle size designation and Behaviour Model

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

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

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

[1] – refer grain size subdivision descriptions below

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

Component proportions

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

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

[1] As defined in AS1726-2017 6.1.4.4

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

Composite Materials

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

Classification

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

Soil Name

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

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

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

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

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

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

Identification of minor components

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

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

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

Soil Composition

Plasticity

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

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

Grain Size

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

Grading

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

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

Soil Condition

Moisture

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

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

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

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

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

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

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

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

Consistency (fine grained soils)

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

Relative Density (coarse grained soils)

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

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

Compaction (anthropogenically modified soil)

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

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

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

Soil Origin

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

Cobbles and Boulders

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

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

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Rock Strength

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

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

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

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

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

Degree of Alteration

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

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

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Infilled seam	IS
Cleavage	CV
Crushed zone	CZ
Decomposed seam	DS
Fault	F
Joint	JT
Lamination	LAM
Parting	P
Shear zone	SZ
Vein	VN
Drilling/handling break	DB , HB
Fracture	FC

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

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Rock Defect Shape/Planarity

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

Rock Defect Roughness

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

Defect Orientation

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

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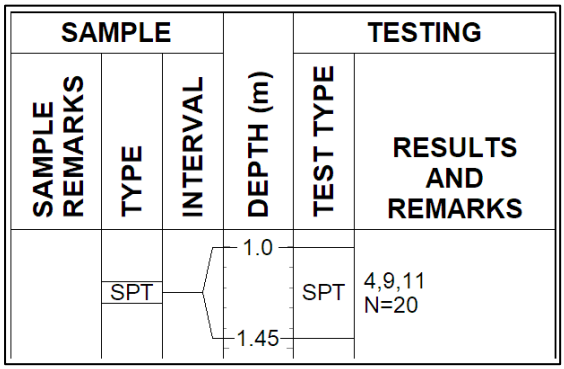
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

November 2023

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

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

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

Field and Laboratory Testing

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

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

Field and laboratory testing (continued)

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

Groundwater Observations

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

Drilling or Excavation Methods/Tools

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

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

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

Douglas PARTNERS

Appendix C

Field Work Results

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.5 AHD
COORDINATE: E:333516.0, N:6255426.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH1
PROJECT No: 214296.02
DATE: 24/02/25
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	ROCK FRACTURE SPACING (m)	ROCK DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
18/02/25 NFGWO whilst augering	93	0.14	CONCRETE SLAB			NA	NA									A/ES		0.14	PID	0.3ppm
		0.20	FILL / Gravelly SAND: dark grey-brown; fine to coarse.		FILL													0.20		(B) 25/90mm
			FILL / Clayey GRAVEL, with sand: grey-brown; fine to coarse, rounded, river stone.		FILL	(VC)	M									A/ES		0.40	PID	0.1ppm
		0.70	FILL / Sandy CLAY: pink-brown with dark grey mottling; medium to high plasticity.		FILL		w=PL									A		0.70	PID	0.1ppm
		0.90			RS	(H)	w<PL									A/ES		0.80	PID	0.0ppm
	92	1																0.90		
		1.17	CLAY (CI-CH), trace sand: brown; medium to high plasticity.						1.17							A		1.00	PID	0.0ppm
			SILTSTONE: grey-brown; 5-10% fine sandstone laminations, distinct bedding at 0-5°. Ashfield Shale					MW		VL - L	100	0		1.58m: JT, 45°, PR, CN, SM				1.10		
	91	2												2.16m: JT, 45°, PR, SN Fe, RF 2.25m: JT, 20°, PR, SN Fe, RF 2.41m: JT, 30°, PR, SN Fe, RF 2.51-2.75m: JT, 90°, PR, SN Fe, SM				2	PLT	PL(A)=0.09MPa
		3						SW	2.80	L	90	48		3.02m: JT, 45°, PR, VNR Clay, SM 3.18m: JT, 45°, PR, VNR Clay, SM				3	PLT	PL(A)=0.12MPa
	90	3.53	CORE LOSS: 210 mm						3.27 3.43 3.48 3.53	SEAM			SEAM	3.27-3.53m: JT, 90°, PR, CT Clay 5mm, SM						
		3.74	SILTSTONE: dark grey; 5-10% fine sandstone laminations, distinct bedding at 0-5°. Ashfield Shale					SW	3.74									4	PLT	PL(A)=0.15MPa
	89	4							4.10		100	100								
		5						FR		L				5.25-5.35m: JT, 80-90°, CU, CN, SM 5.35m: DS, 40mm 5.42m: JT, 45°, PR, CN, SM				5	PLT	PL(A)=0.13MPa
	88	5.90	SILTSTONE: dark grey; indistinct bedding. Ashfield Shale								100	76		5.93-6.11m: JT, 70-90°, CU, CN, SM 6.25m: JT, 30°, CU, CN, SM 6.44m: JT, 0-30°, CU, CN, SM 6.53m: B, 0°, PR, CT Clay 2mm, SM 6.58m: JT, 20°, PR, CN, SM 6.60-6.69m: JT, 70°, PR, CN, SM 6.72m: DS, 90mm 7.01-7.34m: JT, 80°, PR, CN, SM				6	PLT	PL(A)=0.10MPa
	87	6							6.72 6.81	SEAM			SEAM							
		7						SW		L	82	73		7.22m: B, 0°, PR, CT Clay 5mm, SM 7.42m: F, 50mm 7.47-7.67m: JT, 90°, PR, CN, SM				7	PLT	PL(A)=0.15MPa
	86	7.67	CORE LOSS: 250 mm																	
		7.92							7.92		93	77							PLT	PL(A)=0.13MPa

DCP97-150

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

Generated with CORE-GS by Geroc - Combined Log

PLANT: Hand tools and proline
OPERATOR: TightSite (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.14 m, HA to 1.17 m, NMLC to 10.00 m
CASING: PVC to 0.45m
REMARKS: BH backfilled with drilling spoil. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.5 AHD
COORDINATE: E:333516.0, N:6255426.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH1
PROJECT No: 214296.02
DATE: 24/02/25
SHEET: 2 of 2

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) 0.05 0.06 0.18 0.60 0.60 s.00	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	85	8.83	SILTSTONE: dark grey; indistinct bedding. Ashfield Shale					SW			93	77		8.03m: JT, 60-80°, CU, CN, SM 8.05m: F, 10mm 8.20m: JT, 80°, PR, CN, SM 8.47m: JT, 10°, PR, CN, SM 8.55m: DS, 50mm				9	PLT	PL(A)=0.11MPa
		9	CORE LOSS: 220 mm						9.05											
	84	9.05	SILTSTONE: dark grey; indistinct bedding. Ashfield Shale					SW			81	55		9.22m: JT, 30°, PR, CN, SM 9.46m: JT, 40°, PR, CN, SM 9.58m: JT, 60°, PR, CN, SM 9.61m: JT, 60°, PR, CN, SM 9.68m: DS, 20mm 9.73-9.84m: JT, 60°, PR, CN, SM 9.84m: DS, 100mm					PLT	PL(A)=0.16MPa
		9.84							9.84	SEAM			SEAM							
		9.94								L										
		10	Borehole discontinued at 10.00m depth. Target depth reached.																	

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

PLANT: Hand tools and proline
OPERATOR: TightSite (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.14 m, HA to 1.17 m, NMLC to 10.00 m
CASING: PVC to 0.45m
REMARKS: BH backfilled with drilling spoil. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

CORE PHOTO LOG

CLIENT:	Silvernight (Crows Nest) Landowner Pty Ltd	**SURFACE LEVEL:**	93.5 AHD	**LOCATION ID:**	BH1
PROJECT:	Proposed Mixed-Use Development	**COORDINATE:**	E:333516.0, N:6255426.0	**PROJECT No:**	214296.02
LOCATION:	270-272 Pacific Hwy, Crows Nest, NSW	**DATUM/GRID:**	MGA2020 Zone 56	**DATE:**	24/02/25
		DIP/AZIMUTH:	90°/---°	**SHEET:**	1 of 1

1.17-5.00 m depth

5.00-10.00 m depth

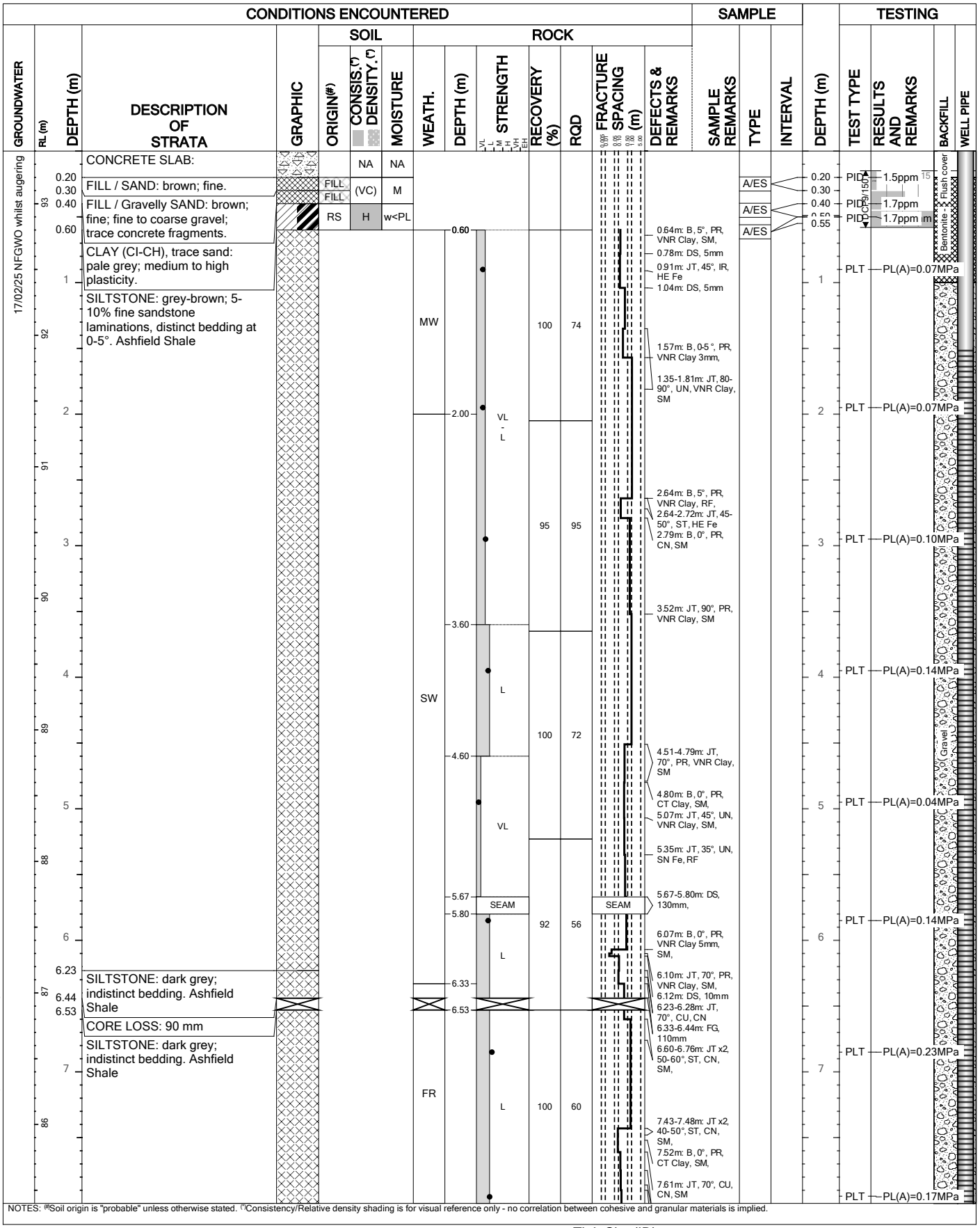
Douglas PARTNERS

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333536.0, N:6255397.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 214296.02
DATE: 17/02/25
SHEET: 1 of 2



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 (ID)
LOGGED: D. Pham/J. Miller
METHOD: 150 mm Ø DT to 0.20 m, HA to 0.60 m, NMLC to 12.37 m
CASING: PVC to 0.55m
REMARKS: 7.5 m monitoring well installed. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333536.0, N:6255397.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 214296.02
DATE: 17/02/25
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	ROCK FRACTURE SPACING (m)	ROCK DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	TESTING DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	85	9	[CONT] SILTSTONE: dark grey; indistinct bedding. Ashfield Shale					FR		L	100 77	60 55		7.75-7.86m: B x3, 10-30°, PR, CN, SM, 7.90m: B, 25°, CU, CN, RF, 8.07m: JT, 70°, CU, CN, SM, 8.24m: JT, 60°, CN, SM 8.40-8.68m: JT, 90°, SN, SM 8.90-9.15m: FG, 250mm				9	PLT	PL(A)=0.18MPa	Gravel	
	84	9.23	CORE LOSS: 310 mm											9.15-9.23m: DS, 88 mm								
		9.54							9.54													
	83	10	SILTSTONE: dark grey; indistinct bedding. Ashfield Shale							VL - L	100	56		9.69m: B, 10°, CU, VNR Clay, SM 9.87m: B, 10°, PR, CT Clay 1mm, SM 9.90m: DS, 20mm 9.94-10.27m: JT x5, 40°, PR, CN, SM 10.15m: DS, 20mm 10.33-10.44m: JT, 90°, ST, CT Clay 5mm, SM 10.44m: DS, 20mm 10.54-10.90m: FG, 360mm				10	PLT	PL(A)=0.08MPa		
		10.80							10.80													
	82	11	SANDSTONE: grey, fine to medium grained; indistinct to distinct bedding at 0-10°. Mittagong Formation					SW		L	100	90		10.67-10.77m: DS, 100mm 11.55m: B, 5°, PR, CT Clay 5mm, SM 11.90-11.91m: DS, 10mm				11	PLT	PL(A)=0.16MPa	Bentonite	
		12							11.55	VL												
									12.00	L				12.30-12.37m: DS, 70mm				12	PLT	PL(A)=0.06MPa		
		13	Borehole discontinued at 12.37m depth. Target depth reached.																			
		14																				
		15																				

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

PLANT: Hand tools and proline
OPERATOR: TightSite (ID)
LOGGED: D. Pham/J. Miller
METHOD: 150 mm Ø DT to 0.20 m, HA to 0.60 m, NMLC to 12.37 m
CASING: PVC to 0.55m
REMARKS: 7.5 m monitoring well installed. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333536.0, N:6255397.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 214296.02
DATE: 17/02/25
SHEET: 1 of 2

0.60-5.00 m depth

5.00-10.00 m depth

CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333536.0, N:6255397.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 214296.02
DATE: 17/02/25
SHEET: 2 of 2

10.00-12.37 m depth

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.2 AHD
COORDINATE: E:333549.0, N:6255369.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 214296.02
DATE: 18/02/25
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
21/02/25 NFGWO whilst augering	93	0.20	CONCRETE SLAB			NA	NA											0.20	PID	2.9ppm
		0.30	FILL / Sandy CLAY, with gravel: yellow-brown; medium to high plasticity; fine to medium, sandstone gravel.		FILL	(PC)	w<PL									A/ES		0.30	PID	2.3ppm
		0.45			RS	H			0.45	M				0.59m: B, 0-5 °, PR, CT Clay 1mm, RF		A/ES		0.40		
			CLAY (CI-CH), trace gravel: purple-brown; medium to high plasticity; fine, angular, ironstone gravel.											0.81m: B, 0-5 °, PR, CT Clay 1mm, RF					PLT	PL(A)=0.69MPa
	92	1	SILTSTONE: purple and pale grey; Iron indurated through shrink/swell fractures , 5-10% fine to medium disaggregated shale. Ashfield Shale											0.83m: DS, 40mm 0.90m: JT, 45°, ST, SN Fe, RF 1.03m: B, 20°, PR, VNR Clay, RF 1.19m: JT, 30°, CU, CT Clay 3mm, RF 1.28m: JT, 40°, PR, CT Clay 5mm, RF 1.36m: DS, 100mm 1.64m: B, 0°, PR, CT Clay 1mm, RF						
									1.36	SEAM	100	76	SEAM							
									1.46	M										
	91	2												2.12m: , 27mm, clast 2.28m: DS, 210mm				1	PLT	PL(A)=0.40MPa
									2.28	SEAM			SEAM							
									2.49	L	100	60		2.67m: B, 5°, PR, CT Clay 2mm, RF 2.75m: 70mm, clast 2.93m: B, 20°, IR, SN Fe, RF						
								HW	3.00	SEAM			SEAM	3.00m: DS, 200mm						
	90	3							3.20	M				3.20m: FG, 40mm 3.33m: B, 0-10°, CU, CT Clay 5mm, RF 3.48m: 60mm, clast 3.63m: DS, 50mm				2	PLT	PL(A)=0.19MPa
														3.84m: , 8mm, clast						
		4							3.97	SEAM			SEAM	3.97m: DS, 90mm					PLT	PL(A)=0.40MPa
	89								4.08	VL	100	46		4.18m: DS, 80mm 4.40m: JT, 50°, PR, SN Fe, RF 4.75m: JT, 60°, PR, CT Clay 5mm, SM				3		
									4.85	VL - L										
		5						MW	5.59	VL	100	99		5.59m: B, 0-5 °, PR, CT Clay 3mm, SM 5.90m: JT, 60°, PR, CN, RF				4	PLT	PL(A)=0.11MPa
	88							SW												
		5.35	SILTSTONE: dark grey; indistinct bedding. Ashfield Shale						6.00	VL - L				6.11m: B, 0-5 °, PR, CT Clay 3mm, SM 6.22m: DS, 20mm 6.36-6.51m: JT, 70°, CU, INF Clay 5mm, SM 6.51m: B, 5°, PR, CT Clay 5mm, SM 6.85m: B, 5°, PR, CT Clay 5mm, SM				5	PLT	PL(A)=0.06MPa
		6																	PLT	PL(A)=0.11MPa
	87																	6		
								FR			100	98								
		7							7.74	VL				7.59m: JT, 60°, PR, CN, SM 7.74m: FG, 30mm 7.86m: B, 0-5 °, PR, CT Clay 5mm, SM				7	PLT	PL(A)=0.06MPa
	86																			

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.

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PLANT: Hand tools and proline
OPERATOR: TightSite (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.20 m, HA to 0.45 m, NMLC to 10.00 m
CASING: PVC to 0.44m
REMARKS: BH backfilled with drilling spoil. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.2 AHD
COORDINATE: E:333549.0, N:6255369.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 214296.02
DATE: 18/02/25
SHEET: 2 of 2

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) (0.05 0.06 0.10 0.60 5.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	85		[CONT] SILTSTONE: dark grey; indistinct bedding. Ashfield Shale					FR	8.10	VL	100	98		8.20-8.42m: JT, 70°, ST, VNR Clay, SM						
								MW	8.47		100	83		8.52m: DS, 30mm 8.60m: DS, 20mm 8.69m: DS, 10mm						
		9						SW	8.69	L	100	81		9.55-9.64m: JT, 90°, PR, CN, SM				9	PLT	PL(A)=0.16MPa
	84																			
		9.77	SANDSTONE: grey, fine grained; indistinct to distinct bedding at 0-10°. Mittagong Formation					HW	9.77	VL - L				9.95m: DS, 50mm					PLT	PL(A)=0.07MPa
		10	Borehole discontinued at 10.00m depth. Target depth reached.																	
		11																		
		12																		
		13																		
		14																		
		15																		

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

PLANT: Hand tools and proline
OPERATOR: TightSite (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.20 m, HA to 0.45 m, NMLC to 10.00 m
CASING: PVC to 0.44m
REMARKS: BH backfilled with drilling spoil. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.2 AHD
COORDINATE: E:333549.0, N:6255369.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 214296.02
DATE: 18/02/25
SHEET: 1 of 1

0.45-5.00 m depth

5.00-10.00 m depth

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.2 AHD
COORDINATE: E:333550.0, N:6255366.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3A
PROJECT No: 214296.02
DATE: 12/02/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	93	0	CONCRETE: 30-40% 20 mm angular to sub-angular aggregate, 3 mm voids 0.32m: 30 mm Ø rebar 0.45m: 30 mm Ø rebar										
	92	1	Borehole discontinued at 0.70m depth.										
	91	2											
	90	3											
	89	4											

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

PLANT: Hand tools
METHOD: 150 mm Ø DT to 0.70 m
REMARKS: BH discontinued due to depth of concrete. Located 1.5 m SE of BH3

OPERATOR: Douglas (IH)

LOGGED: I. Howsam
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.5 AHD
COORDINATE: E:333494.0, N:6255412.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH4
PROJECT No: 214296.02
DATE: 20/02/25
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
20/02/25 NFGWO whilst augering	93	0.11	CONCRETE SLAB			NA	NA											0.15	PID	0.1ppm	Bentonite	
		0.40	FILL / Gravelly SAND, with silt: grey-brown; fine to coarse; fine to medium, drainage gravel.		FILL	(VC)	M									A/ES						
		0.47	CLAY (CI-CH): dark grey; medium to high plasticity.		RS	H	w<PL									A/ES		0.45	PID	0.3ppm	Flush cover	
	92	1	SILTSTONE: grey-brown; 5-10% fine sandstone laminations, distinct bedding at 0-5°. Ashfield Shale					MW	0.47					0.60-0.66m: B, 5°, PR, SN Fe, RF, x4				1	PLT	PL(A)=0.07MPa		
								SW	0.90	VL	100	28		1.08m: JT, 45°, PR, CT Clay 1mm, SM								
														1.27-1.45m: JT, 70°, PR, VNR Clay, SM								
									1.60					1.52-1.61m: JT, 60°, IR, VNR Clay, SM								
		2												1.89m: B, 0°, PR, CT Clay 3mm, SM				2	PLT	PL(A)=0.17MPa		
	91													2.13m: JT, 20°, CU, VNR Clay, SM								
										L	100	98		2.56m: B, 5°, PR, CT Clay 1mm, SM								
		3	3.10m: becoming dark grey											3.04m: JT, 45°, PR, CN, SM				3	PLT	PL(A)=0.18MPa		
														3.14m: JT, 40°, PR, CN, SM								
														3.16m: JT, 30°, PR, CN, SM								
	90													3.27m: B, 0-5°, PR, CT Clay 1mm, SM								
														3.37m: FG, 10mm								
								FR	3.50					3.51m: JT, 10°, PR, CN, SM								
		4								VL - L								4	PLT	PL(A)=0.09MPa		
									4.18					4.18m: JT, 40°, PR, CT Clay 1mm, SM								
	89										100	95										
		4.90												4.79-4.86m: JT, 70-80°, CU, CN, SM								
		5	SILTSTONE: dark grey; indistinct bedding. Ashfield Shale											4.87m: JT, 30°, PR, CN, SM				5	PLT	PL(A)=0.12MPa		
														5.29-5.53m: JT, 70-90°, CU, CN, SM								
	88								5.60		100	79		5.55m: JT, 30°, PR, CN, SM								
														5.62m: JT, 30°, PR, CN, SM								
														5.66m: DS, 10mm								
														5.82m: FG, 20mm								
		6								L	100	64		5.86m: JT, 20°, PR, CN, SM				6	PLT	PL(A)=0.14MPa		
														5.89m: FG, 50mm								
														6.14m: JT, 45°, PR, CN, SM								
	87													6.17-6.21m: JT, 70°, PR, VNR Clay, SM								
								SW						6.22m: DS, 10mm								
														6.24m: DS, 10mm								
														6.29m: DS, 10mm								
		7									100	84		6.61m: JT, 45°, PR, CN, SM				7	PLT	PL(A)=0.15MPa		
														6.79m: JT, 45°, PR, CN, SM								
	86													6.87-7.10m: JT, 80°, PR, CN, SM								
														7.10m: B, 5°, PR, CT Clay 3mm, SM								
														7.27m: FG, 30mm								
									7.70					7.35-7.42m: JT, 90°, ST, CN, SM								
								FR			100	100		7.57m: B, 0°, PR,								

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 (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.11 m, HA to 0.47 m, NMLC to 15.00 m
CASING: PVC to 0.47m
REMARKS: 7.5 m monitoring well installed. Elevations interpolated from provided survey plan.. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Combined Log

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.5 AHD
COORDINATE: E:333494.0, N:6255412.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH4
PROJECT No: 214296.02
DATE: 20/02/25
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS	BACKFILL	WELL PIPE
	85	9	[CONT] SILTSTONE: dark grey; indistinct bedding. Ashfield Shale					FR			100	100		CT Clay 3mm, SM 7.64m: DS, 10mm 8.37m: JT, 50°, PR, CN, SM 8.64m: JT, 20°, PR, CN, SM 8.86m: JT, 20°, PR, CN, SM 8.96m: B, 0-5 °, PR, CT Clay 2mm, SM 9.07m: JT, 30°, PR, CN, SM				9	PLT	PL(A)=0.15MPa		
	84	10								L	100	86		9.38m: JT, 30°, PR, CN, SM 9.47m: JT, 40°, PR, CN, SM 9.48-9.50m: JT, 80°, PR, CN, SM 9.66m: JT, 40°, PR, CN, SM 9.78m: JT, 20°, PR, CN, SM				10	PLT	PL(A)=0.11MPa		
	83	10.79							10.79					10.36m: JT, 45°, PR, CN, SM 10.39m: B, 0°, PR, VNR Clay, SM 10.45-10.51m: JT, 90°, IR, CT Clay 5mm, SM								
	82	11	SANDSTONE: grey, fine to medium grained; 5-10 % brown siltstone clasts and laminations, indistinct to distinct bedding at 0-10°. Mittagong Formation								100	92		11.39m: B, 0°, PR, VNR Clay, RF 11.41m: B, 5°, PR, VNR Clay, RF 11.70m: DS, 10mm				11	PLT	PL(A)=0.11MPa	Bentonite	
	81	12							11.80					12.19m: B, 0°, PR, SN Fe, RF				12	PLT	PL(A)=0.42MPa		
	80	13						SW		M	100	91		12.70m: DS, 10mm 12.75m: DS, 20mm 12.79m: DS, 10mm 12.91m: DS, 10mm				13	PLT	PL(A)=0.46MPa		
	79	14							13.95	L - M	100	100						14	PLT	PL(A)=0.26MPa		
		14.50	SANDSTONE: grey and pale grey, fine to coarse grained; 5-10 % siltstone clasts and laminations, indistinct to distinct bedding at 0-10°. Hawkesbury Sandstone						14.50	M									PLT	PL(A)=0.63MPa		
		15	Borehole discontinued at 15.00m depth. Target depth reached.																			

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

PLANT: Hand tools and proline
OPERATOR: TightSite (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.11 m, HA to 0.47 m, NMLC to 15.00 m
CASING: PVC to 0.47m
REMARKS: 7.5 m monitoring well installed. Elevations interpolated from provided survey plan.. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Combined Log

CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.5 AHD
COORDINATE: E:333494.0, N:6255412.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH4
PROJECT No: 214296.02
DATE: 20/02/25
SHEET: 1 of 2

0.47-5.00 m depth

5.00-10.00 m depth

CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.5 AHD
COORDINATE: E:333494.0, N:6255412.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH4
PROJECT No: 214296.02
DATE: 20/02/25
SHEET: 2 of 2

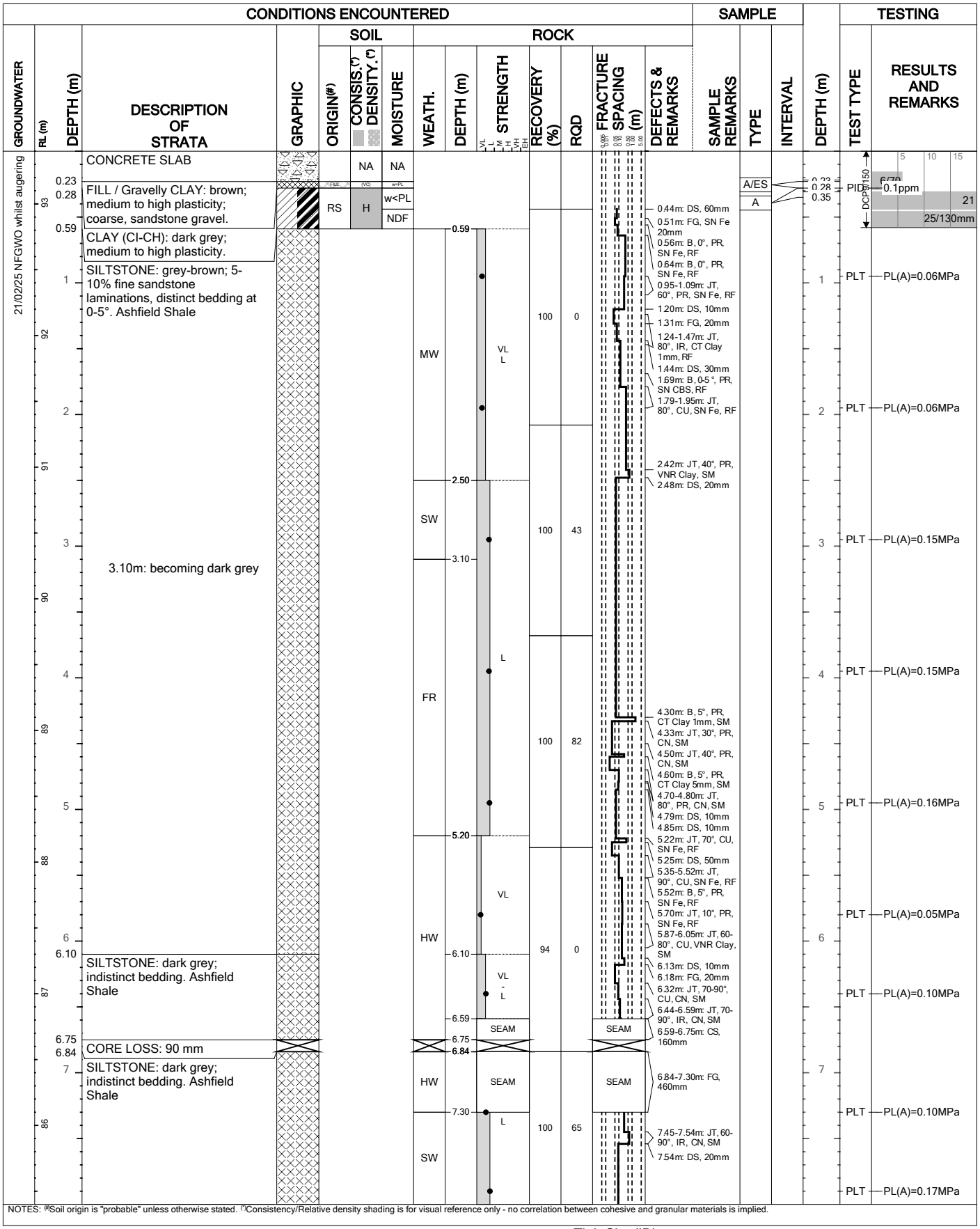
10.00-15.00 m depth

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333510.0, N:6255382.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH5
PROJECT No: 214296.02
DATE: 21/02/25
SHEET: 1 of 2



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 (ID)
LOGGED: J. Miller

METHOD: 150 mm Ø DT to 0.23 m, HA to 0.44 m, NMLC to 15.89 m
CASING: PVC to 0.44m

REMARKS: BH backfilled with drilling spoil. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333510.0, N:6255382.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH5
PROJECT No: 214296.02
DATE: 21/02/25
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL: ORIGIN(#)	SOIL: CONSIS.(*) DENSITY.(*)	SOIL: MOISTURE	ROCK: WEATH.	ROCK: DEPTH (m)	ROCK: STRENGTH	ROCK: RECOVERY (%)	ROCK: RQD	ROCK: FRACTURE SPACING (m)	ROCK: DEFECTS & REMARKS	SAMPLE: SAMPLE REMARKS	SAMPLE: TYPE	SAMPLE: INTERVAL	DEPTH (m)	TESTING: TEST TYPE	TESTING: RESULTS AND REMARKS
	85		[CONT] SILTSTONE: dark grey; indistinct bedding. Ashfield Shale																	
	84	9						SW		L	100	65		8.68m: DS, 10mm 8.22-9.18m: JT, 70-90°, CU, CN, SM				9	PLT	PL(A)=0.13MPa
	83	10							9.80		100	83		8.76m: B, 5°, ST, CN, SM 9.25m: DS, 10mm 9.26-9.35m: JT, 80-°, IR, CN, SM 9.51m: DS, 10mm 9.52-9.76m: JT, 60-90°, IR, CN, SM 9.84m: FG, 50mm 9.89-10.13m: JT, 90°, IR, CN, SM				10	PLT	PL(A)=0.09MPa
								HW		VL	100	0		10.27m: JT, 30°, PR, CT Clay 1mm, SM 10.40m: DS, 50mm					PLT	PL(A)=0.07MPa
	82	11	10.80 SANDSTONE: grey, fine to medium grained; indistinct to distinct bedding at 0-10°. Mittagong Formation											10.79m: DS, 40mm 10.91m: FG, 40mm				11	PLT	PL(A)=0.08MPa
									11.60											
	81	12	12.29 SANDSTONE: pale grey, medium to coarse grained; indistinct to distinct bedding at 0-10°. Hawkesbury Sandstone								100	69		11.61m: JT, 30°, CU, CT Clay 1mm, SM 11.64m: B, 0-5°, PR, SN CBS, RF 11.69m: B, 0-5°, PR, SN CBS, RF 11.74m: B, 0-5°, PR, SN CBS, RF 11.78m: B, 0-5°, PR, SN CBS, RF 12.10m: DS, 40mm 12.18m: DS, 100 mm				12	PLT	PL(A)=0.13MPa
								SW		L				12.53m: DS, 40mm 12.59m: DS, 30mm 12.71m: B, 0°, PR, CT Clay 3mm, RF 12.81m: B, 0°, PR, CT Clay 3mm, RF 13.05m: DS, 10mm 13.06-13.12m: JT, 90°, PR, CN Clay, RF 13.12m: B, 0°, PR, CT Clay 1mm, RF 13.23m: DS, 90mm 13.43m: DS, 20mm 13.70m: B, 5°, PR, CT Clay 1mm, RF 13.78m: DS, 10mm 13.90m: B, 0°, PR, CN, RF 14.00m: DS, 20mm 14.02m: B, 0°, PR, CN, RF 14.02-14.10m: JT, 90°, PR, CN, RF 14.06m: B, 0°, PR, CN, RF 14.62m: B, 5-10°, CU, VNR Clay, RF				13	PLT	PL(A)=0.25MPa
	80	13	13.70m-13.78m: siltstone bed, dark grey						13.35											
										M	100	53								
	79	14	14.50m: becoming distinctly cross bedded at 0-30°						14.03									14	PLT	PL(A)=0.76MPa
	78	15						FR		H	100	99		15.12m: JT, 40°, PR, CN, RF 15.13m: JT, 30°, PR, CN, RF 15.34m: B, 0-5°, UN, CT Clay 1mm, RF 15.64m: B, 5°, PR, SN CBS, RF				15	PLT	PL(A)=1.5MPa
			Borehole discontinued at 15.89m depth. Target depth reached.																PLT	PL(A)=1.1MPa

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 (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.23 m, HA to 0.44 m, NMLC to 15.89 m
CASING: PVC to 0.44m
REMARKS: BH backfilled with drilling spoil. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Combined Log

CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333510.0, N:6255382.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH5
PROJECT No: 214296.02
DATE: 21/02/25
SHEET: 1 of 2

0.44-5.00 m depth

5.00-10.00 m depth

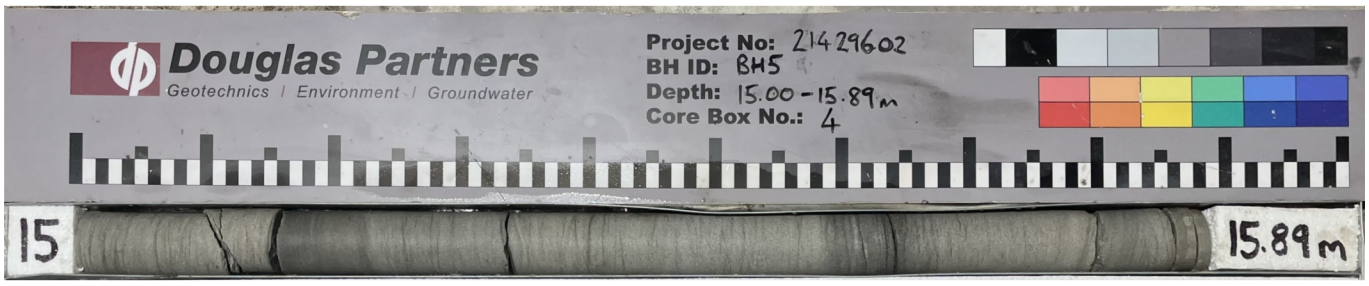
CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.4 AHD
COORDINATE: E:333510.0, N:6255382.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH5
PROJECT No: 214296.02
DATE: 21/02/25
SHEET: 2 of 2

10.00-15.00 m depth



15.00-15.89 m depth

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.3 AHD
COORDINATE: E:333521.0, N:6255365.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH6
PROJECT No: 214296.02
DATE: 19/02/25
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	ROCK FRACTURE SPACING (m)	ROCK DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
18/02/25 NFGWO whilst augering	93	0.20	CONCRETE SLAB			NA	NA									A/ES		0.30	PID	0.2ppm	Bentonite, Flush cover	
		0.37	CLAY (CI-CH): purple-brown; medium to high plasticity.		RS	VSt	w<PL		0.37	VL				0.47m: DS, 10mm 0.62m: B, 5-10°, PR, CT Clay 5mm, SM 0.64m: DS, 50mm		A			DCP 5/150			
	92	1	SILTSTONE: grey-brown; 5-10% fine sandstone laminations, distinct bedding at 0-5°. Ashfield Shale					MW	0.91	SEAM	100	0	SEAM	0.91-1.13m: DS, 220mm				1	PLT	PL(A)=0.05MPa		
									1.13					1.38-1.52m: JT, 70°, IR, CT Clay 2mm, SM								
	91	2	2.25m: becoming dark grey						2.25		100	0		2.24m: B, 5°, PR, CT Clay, SM 2.36m: B, 5°, PR, CT Clay 1mm, SM				2	PLT	PL(A)=0.08MPa		
	90	3								VL				2.92m: B, 10°, PR, CN Clay 1mm, SM				3	PLT	PL(A)=0.07MPa		
														3.39m: DS, 10mm								
	89	4									100	0						4	PLT	PL(A)=0.07MPa	Gravel	
		5.00	SILTSTONE: dark grey; indistinct bedding. Ashfield Shale					SW	4.83					4.83-4.93m: JT, 60°, PR, CN, SM				5	PLT	PL(A)=0.09MPa		
	88									VL - L	100	8		5.28m: B, 0°, PR, CT Clay 2mm, SM 5.29m: B, 0°, PR, CT Clay 2mm, SM 5.30m: B, 0°, PR, CT Clay 2mm, SM 5.78m: JT, 45°, PR, CT Clay 3mm, SM								
	87	6							6.40	SEAM			SEAM	6.35m: DS, 50mm 6.40m: FG, 80mm				6	PLT	PL(A)=0.09MPa		
									6.48													
	86	7								L	100	99		7.11-7.66m: JT, 60°, PR, CN, SM				7	PLT	PL(A)=0.15MPa		
														7.59m: DS, 10mm							Bentonite	
											100	97							PLT	PL(A)=0.16MPa		

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 (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.20 m, HA to 0.37 m, NMLC to 10.00 m
CASING: PVC to 0.37m
REMARKS: 7.5 m monitoring well installed. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Combined Log

BOREHOLE LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.3 AHD
COORDINATE: E:333521.0, N:6255365.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH6
PROJECT No: 214296.02
DATE: 19/02/25
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL: ORIGIN(#)	SOIL: CONSIS.(*) DENSITY.(*)	SOIL: MOISTURE	ROCK: WEATH.	ROCK: DEPTH (m)	ROCK: STRENGTH (VL L M H VH EH)	ROCK: RECOVERY (%)	ROCK: RQD	ROCK: FRACTURE SPACING (m)	ROCK: DEFECTS & REMARKS	SAMPLE: SAMPLE REMARKS	SAMPLE: TYPE	SAMPLE: INTERVAL	DEPTH (m)	TESTING: TEST TYPE	TESTING: RESULTS AND REMARKS	BACKFILL	WELL PIPE
	85		[CONT] SILTSTONE: dark grey; indistinct bedding. Ashfield Shale					SW		L	100	97		8.68m: JT, 45°, PR, CN, SM								
		9							9.18	SEAM			SEAM	9.18m: DS, 90mm				9	PLT	PL(A)=0.13MPa	Bentonite	
	84							HW	9.27	L												
									9.48	VL	100	70		9.50m: DS, 50mm								
		9.65	SANDSTONE: grey, fine to medium grained; indistinct to distinct bedding at 0-10°. Mittagong Formation						9.65					9.62m: DS, 30mm								
		10						MW		L				9.85m: DS, 20mm					PLT	PL(A)=0.16MPa		
			Borehole discontinued at 10.00m depth. Target depth reached.																			
		11																				
		12																				
		13																				
		14																				
		15																				

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

PLANT: Hand tools and proline
OPERATOR: TightSite (ID)
LOGGED: J. Miller
METHOD: 150 mm Ø DT to 0.20 m, HA to 0.37 m, NMLC to 10.00 m
CASING: PVC to 0.37m
REMARKS: 7.5 m monitoring well installed. Elevations interpolated from provided survey plan. Coordinates inferred from georeferenced aerial imagery.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: Silvernight (Crows Nest) Landowner Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 270-272 Pacific Hwy, Crows Nest, NSW

SURFACE LEVEL: 93.3 AHD
COORDINATE: E:333521.0, N:6255365.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH6
PROJECT No: 214296.02
DATE: 19/02/25
SHEET: 1 of 1

0.37-5.00 m depth

5.00-10.00 m depth

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	21-Feb-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

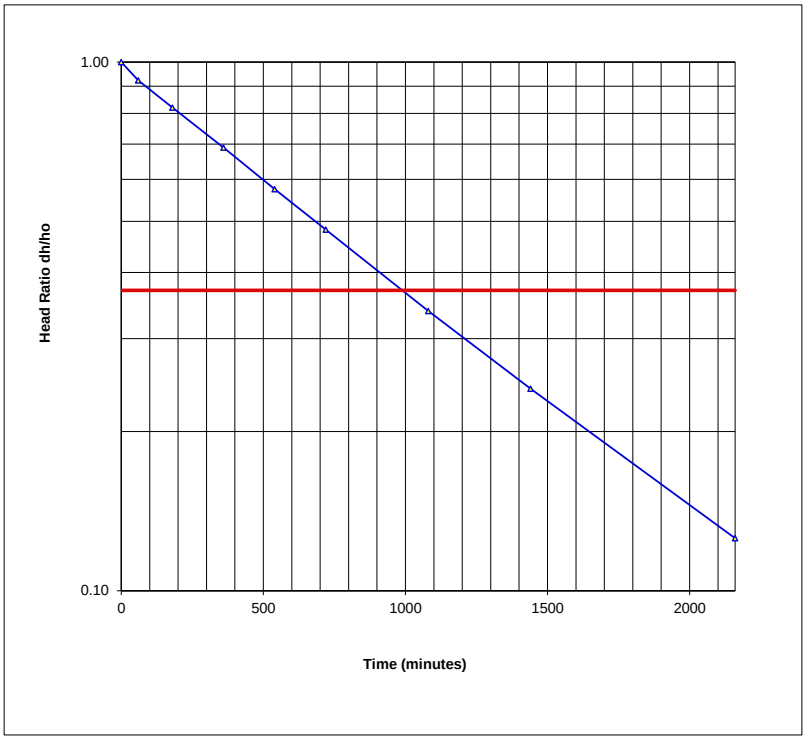
Test Location	BH2	**Test No.**	1	
Description:	Standpipe in borehole	Easting:	333536	m
Material type:	Siltstone	Northing	6255397	m
		Surface Level:	93.4	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	1.14	m
Borehole diameter (2R)	76	mm	Depth to water at start of test	9.89	m
Effective well screen length (Le)	9.36	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	10.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	9.89	8.75	1.000
60.0	9.22	8.08	0.923
180.0	8.32	7.18	0.821
360.0	7.17	6.03	0.689
540.0	6.17	5.03	0.575
720.0	5.36	4.22	0.482
1080.0	4.10	2.96	0.338
1440.0	3.25	2.11	0.241
2160.0	2.24	1.10	0.126



To = 980 min
58800 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**7.2E-09**	m/sec
	=	**0.00062**	m/day

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	25-Feb-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

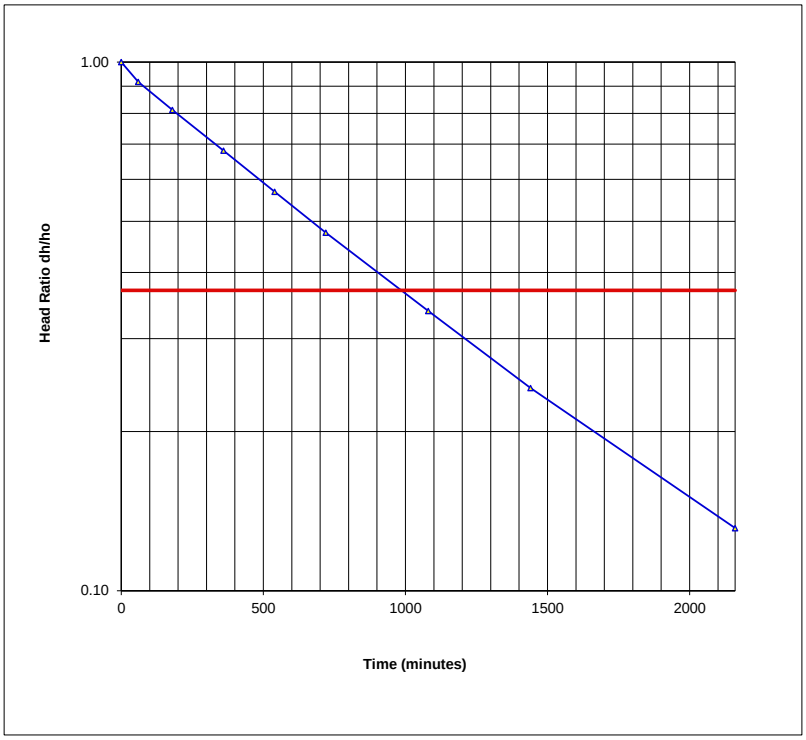
Test Location	BH2	**Test No.**	2	
Description:	Standpipe in borehole	Easting:	333536	m
Material type:	Siltstone	Northing	6255397	m
		Surface Level:	93.4	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	1.14	m
Borehole diameter (2R)	76	mm	Depth to water at start of test	9.74	m
Effective well screen length (Le)	9.36	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	10.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	9.74	8.60	1.000
60.0	9.03	7.89	0.917
180.0	8.12	6.98	0.812
360.0	6.99	5.85	0.680
540.0	6.03	4.89	0.569
720.0	5.23	4.09	0.476
1080.0	4.05	2.91	0.338
1440.0	3.22	2.08	0.242
2160.0	2.27	1.13	0.131



To = 980 min
58800 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**7.2E-09**	m/sec
	=	**0.00062**	m/day

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	5-Mar-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

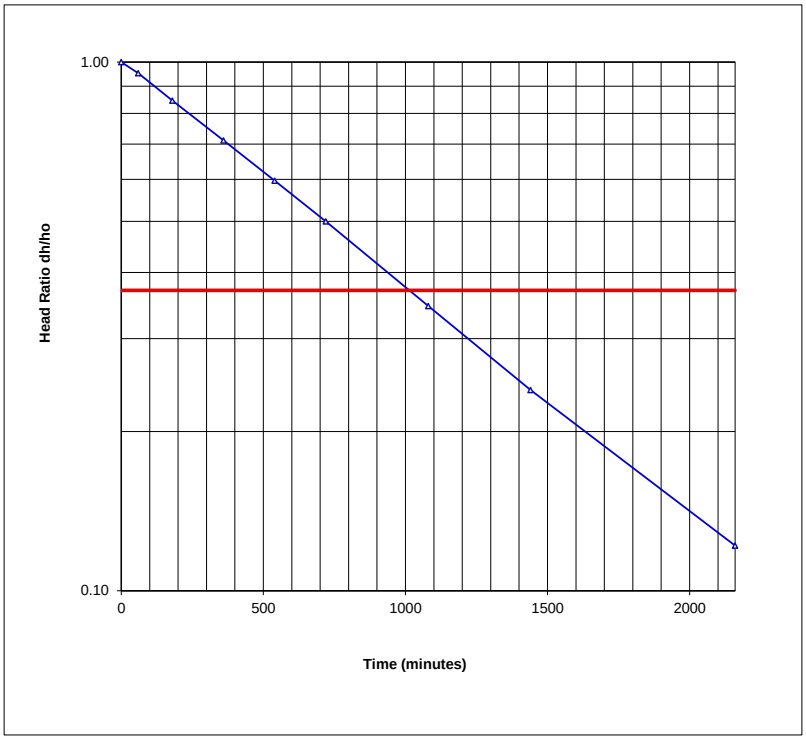
Test Location	BH2	**Test No.**	3	
Description:	Standpipe in borehole	Easting:	333536	m
Material type:	Siltstone	Northing	6255397	m
		Surface Level:	93.4	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	0.97	m
borehole diameter (2R)	76	mm	Depth to water at start of test	10.19	m
Effective well screen length (Le)	9.50	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	10.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	10.19	9.22	1.000
60.0	9.75	8.78	0.953
180.0	8.77	7.80	0.846
360.0	7.52	6.55	0.711
540.0	6.47	5.50	0.597
720.0	5.58	4.61	0.500
1080.0	4.16	3.19	0.346
1440.0	3.18	2.21	0.240
2160.0	2.09	1.12	0.122



To = 1015 min
60900 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev
$k = [r^2 \ln(Le/R)]/2Le\ To$
where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**6.9E-09**	m/sec
	=	**0.001**	m/day

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	21-Feb-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

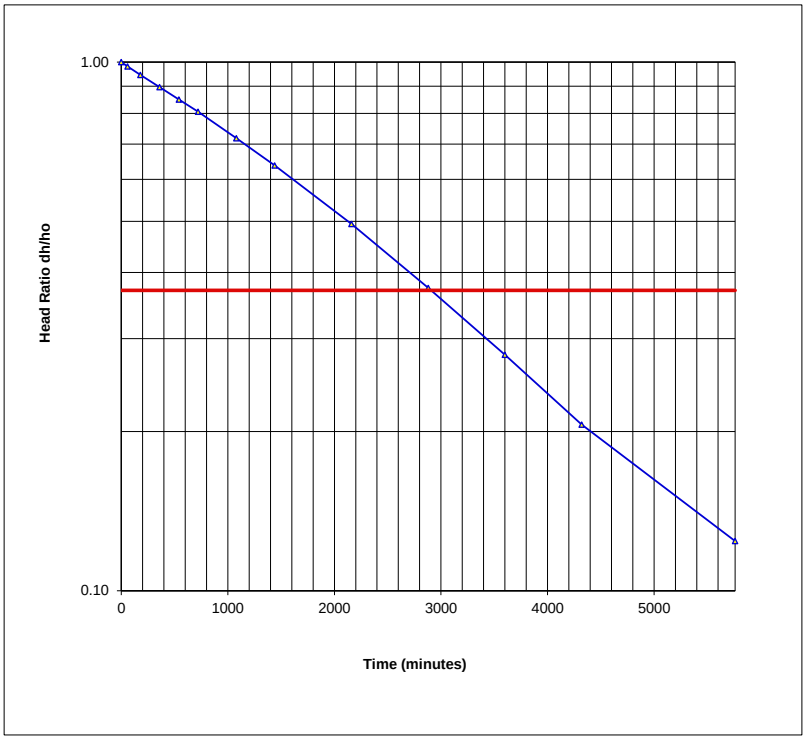
Test Location	BH4	**Test No.**	1	
Description:	Standpipe in borehole	Easting:	333494	m
Material type:	Siltstone	Northing	6255412	m
		Surface Level:	93.5	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	0.41	m
borehole diameter (2R)	76	mm	Depth to water at start of test	7.18	m
Effective well screen length (Le)	6.50	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	7.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	7.18	6.77	1.000
60.0	7.05	6.64	0.981
180.0	6.81	6.40	0.946
360.0	6.48	6.07	0.897
540.0	6.16	5.75	0.850
720.0	5.86	5.45	0.806
1080.0	5.27	4.86	0.718
1440.0	4.73	4.32	0.638
2160.0	3.75	3.34	0.494
2880	2.94	2.53	0.374
3600	2.30	1.89	0.280
4320	1.80	1.39	0.206
5760	1.25	0.84	0.124



To = 2900 min
1.7E+05 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**3.3E-09**	m/sec
	=	**0.00028**	m/day

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Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	25-Feb-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

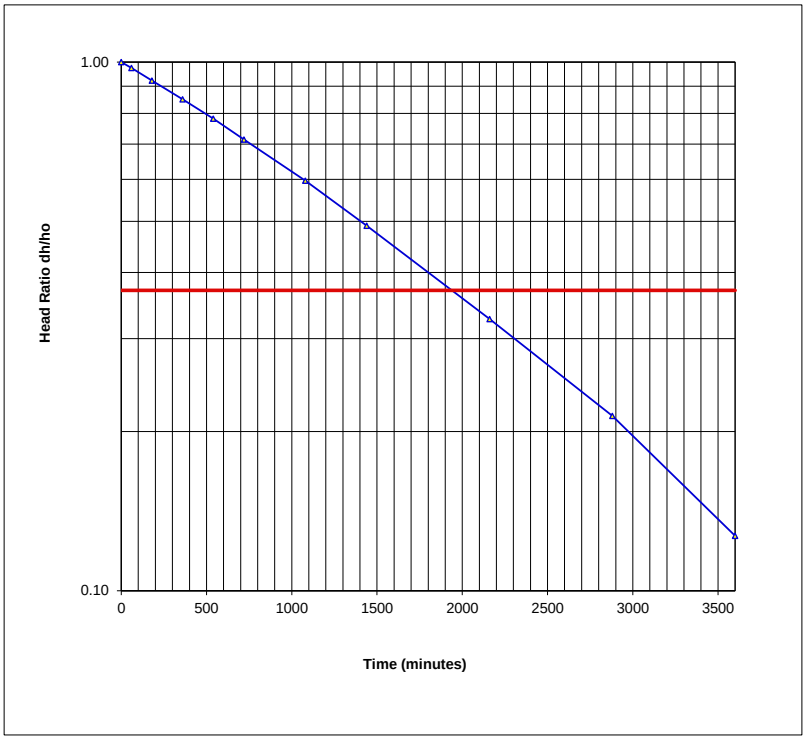
Test Location	BH4	**Test No.**	2	
Description:	Standpipe in borehole	Easting:	333494	m
Material type:	Siltstone	Northing	6255412	m
		Surface Level:	93.5	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	0.41	m
borehole diameter (2R)	76	mm	Depth to water at start of test	7.18	m
Effective well screen length (Le)	6.50	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	7.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	7.18	6.77	1.000
60.0	7.01	6.60	0.975
180.0	6.66	6.25	0.923
360.0	6.17	5.76	0.851
540.0	5.70	5.29	0.781
720.0	5.24	4.83	0.713
1080.0	4.45	4.04	0.597
1440.0	3.73	3.32	0.490
2160.0	2.62	2.21	0.326
2880	1.86	1.45	0.214
3600	1.27	0.86	0.127



To = 1920 min
115200 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev
$k = [r^2 \ln(Le/R)]/2Le\ To$
where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**5.0E-09**	m/sec
	=	**0.00043**	m/day

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Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	5-Mar-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

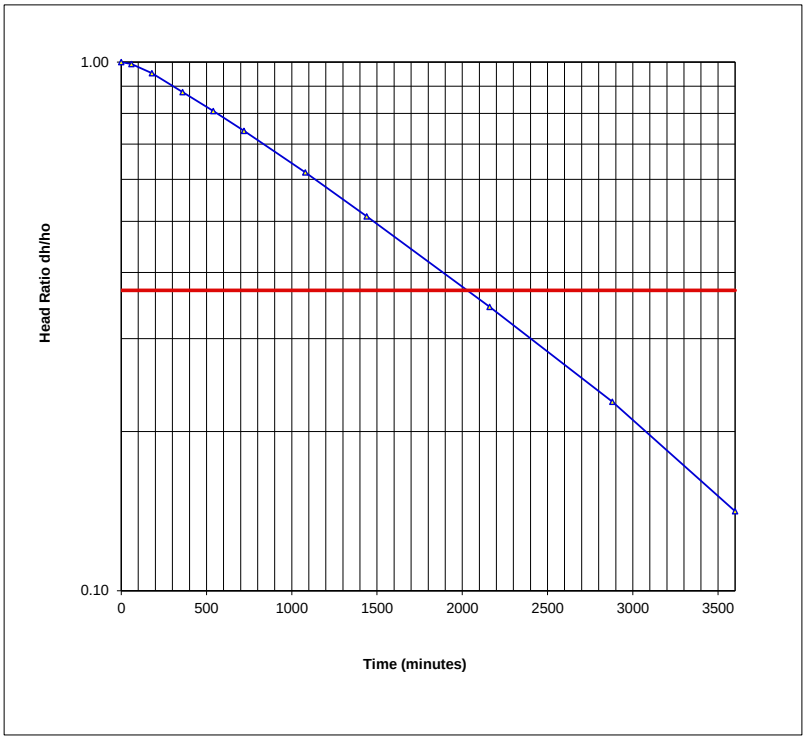
Test Location	BH4	**Test No.**	3	
Description:	Standpipe in borehole	Easting:	333494	m
Material type:	Siltstone	Northing	6255412	m
		Surface Level:	93.5	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	0.35	m
borehole diameter (2R)	76	mm	Depth to water at start of test	7.19	m
Effective well screen length (Le)	6.50	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	7.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	7.19	6.84	1.000
60.0	7.13	6.78	0.992
180.0	6.86	6.51	0.953
360.0	6.35	6.00	0.877
540.0	5.87	5.52	0.808
720.0	5.42	5.07	0.742
1080.0	4.58	4.23	0.619
1440.0	3.84	3.49	0.511
2160.0	2.70	2.35	0.344
2880	1.91	1.56	0.228
3600	1.32	0.97	0.141



To = 2030 min
121800 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**4.7E-09**	m/sec
	=	**0.000**	m/day

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Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	21-Feb-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

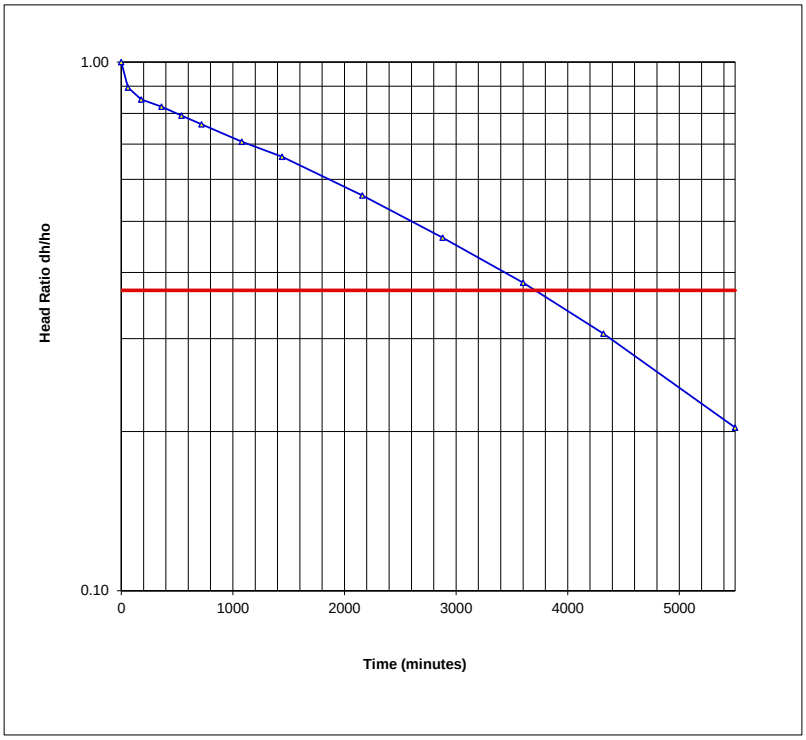
Test Location	BH6	**Test No.**	1	
Description:	Standpipe in borehole	Easting:	333521	m
Material type:	Siltstone	Northing	6255365	m
		Surface Level:	93.3	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	2.37	m
borehole diameter (2R)	76	mm	Depth to water at start of test	6.84	m
Effective well screen length (Le)	5.13	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	7.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	6.84	4.47	1.000
60.0	6.37	4.00	0.895
180.0	6.17	3.80	0.850
360.0	6.05	3.68	0.823
540.0	5.91	3.54	0.792
720.0	5.78	3.41	0.763
1080.0	5.53	3.16	0.707
1440.0	5.33	2.96	0.662
2160.0	4.87	2.50	0.559
2880	4.45	2.08	0.465
3600	4.08	1.71	0.383
4320	3.74	1.37	0.306
5500	3.28	0.91	0.204



To = 3700 min
222000 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev
$k = [r^2 \ln(Le/R)]/2Le\ To$
where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**3.1E-09**	m/sec
	=	**0.00027**	m/day

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Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	25-Feb-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

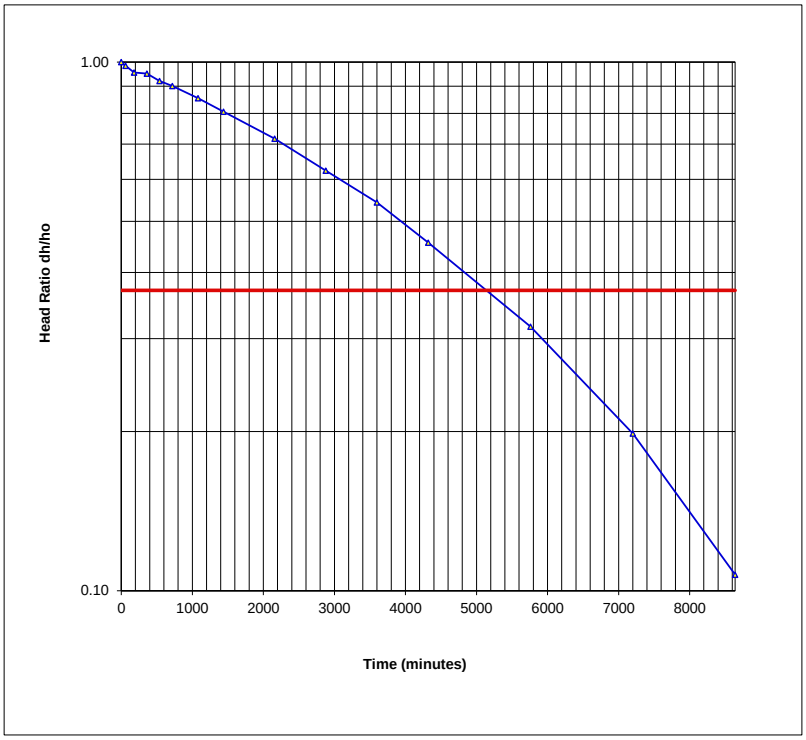
Test Location	BH6	**Test No.**	2	
Description:	Standpipe in borehole	Easting:	333521	m
Material type:	Siltstone	Northing	6255365	m
		Surface Level:	93.3	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	2.37	m
borehole diameter (2R)	76	mm	Depth to water at start of test	7.31	m
Effective well screen length (Le)	5.13	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	7.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	7.31	4.94	1.000
60.0	7.23	4.86	0.984
180.0	7.09	4.72	0.955
360.0	7.07	4.70	0.951
540.0	6.92	4.55	0.921
720.0	6.82	4.45	0.901
1080.0	6.59	4.22	0.854
1440.0	6.35	3.98	0.806
2160.0	5.91	3.54	0.717
2880	5.45	3.08	0.623
3600	5.05	2.68	0.543
4320	4.62	2.25	0.455
5760	3.93	1.56	0.316
7200	3.35	0.98	0.198
8640	2.90	0.53	0.107



To = 5150 min
309000 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**2.2E-09**	m/sec
	=	**0.00019**	m/day

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Permeability Testing - Rising Head Test Report

Client:	Silvernight (Crows Nest) Landowner Pty Ltd	Project No:	214296.02
Project:	Proposed Mixed-Use Development	Test date:	5-Mar-25
Location:	270-272 Pacific Hwy, Crows Nest NSW	Tested by:	JM

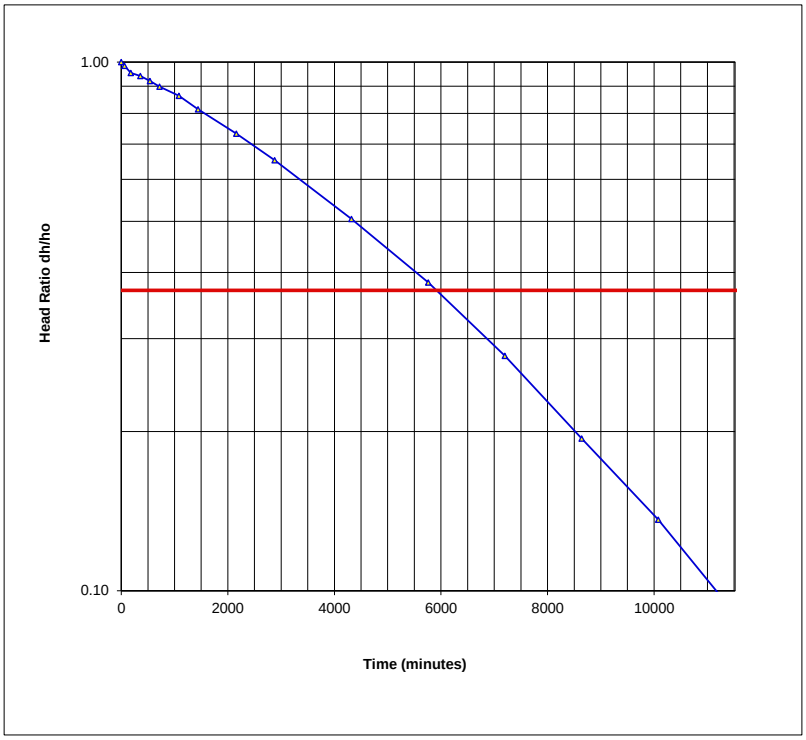
Test Location	BH6	**Test No.**	3	
Description:	Standpipe in borehole	Easting:	333521	m
Material type:	Siltstone	Northing	6255365	m
		Surface Level:	93.3	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	1.72	m
borehole diameter (2R)	76	mm	Depth to water at start of test	7.10	m
Effective well screen length (Le)	5.78	m	Depth of top of gravel pack	1.00	m
			Depth of base of PVC standpipe	7.50	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	7.10	5.38	1.000
60.0	7.01	5.29	0.984
180.0	6.85	5.13	0.954
360.0	6.78	5.06	0.941
540.0	6.67	4.95	0.921
720.0	6.55	4.83	0.899
1080.0	6.36	4.64	0.863
1440.0	6.10	4.38	0.814
2160.0	5.66	3.94	0.732
2880	5.23	3.51	0.652
4320	4.44	2.72	0.505
5760	3.78	2.06	0.383
7200	3.22	1.50	0.278
8640	2.76	1.04	0.194
10080	2.45	0.73	0.136
11520	2.21	0.49	0.090
12960	2.04	0.32	0.060
14400	1.94	0.22	0.041
15840	1.85	0.13	0.024
17280	1.79	0.07	0.014



To = 5900 min
354000 seconds (4.1 days)

Theory: Falling Head Permeability calculated using equation by Hvorslev
$k = [r^2 \ln(Le/R)]/2Le\ To$ where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity	**k =**	**1.8E-09**	m/sec
	=	**0.00015**	m/day

Appendix D

Laboratory Results

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 374393

Client Details

Client	Douglas Partners Pty Ltd
Attention	Matthew Bennett
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**214296.02 Crows Nest**
Number of Samples	3 Soil
Date samples received	28/02/2025
Date completed instructions received	28/02/2025

Analysis Details

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

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

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

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

Report Details

Date results requested by	07/03/2025
Date of Issue	07/03/2025

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

Results Approved By
Diego Bigolin, Inorganics Supervisor

Authorised By
Nancy Zhang, Laboratory Manager

Soil Aggressivity				
Our Reference		374393-1	374393-2	374393-3
Your Reference	UNITS	BH1	BH3	BH5
Depth		4.9-5.0	3.0-3.1	1.0-1.1
Date Sampled		24/02/2025	18/02/2025	21/02/2025
Type of sample		Soil	Soil	Soil
Date prepared	-	28/02/2025	28/02/2025	28/02/2025
Date analysed	-	03/03/2025	03/03/2025	03/03/2025
pH 1:5 soil:water	pH Units	5.5	4.9	5.8
Electrical Conductivity 1:5 soil:water	µS/cm	34	42	35
Chloride, Cl 1:5 soil:water	mg/kg	23	31	10
Sulphate, SO4 1:5 soil:water	mg/kg	47	35	39

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

QUALITY CONTROL: Soil Aggressivity						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	374393-2
Date prepared	-			28/02/2025	1	28/02/2025	28/02/2025		28/02/2025	28/02/2025
Date analysed	-			03/03/2025	1	03/03/2025	03/03/2025		03/03/2025	03/03/2025
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	5.5	5.4	2	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	34	36	6	99	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	23	25	8	107	95
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	47	50	6	109	#

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

AGGRESSIVITY: pH/EC Samples #2 was out of the recommended holding time for this analysis.
AGGRESSIVITY: # Percent recovery not reported due to matrix interferences. However, an acceptable recovery was obtained for the LCS.