Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Dewatering Management Plan

Fiveways
Falcon Street, Crows Nest

Prepared for
Deicorp Pty Ltd

Project 86645.03
10 January 2025

Douglas Partners
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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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Reviewer		10 January 2025

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

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Report on Dewatering Management Plan
Fiveways
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1. Introduction

This report presents the results of a dewatering management plan (DMP) and hydrogeological assessment undertaken for the proposed Fiveways at Falcon Street, Crows Nest. The DMP was commissioned in an email dated 10 May 2023 by Greg Colbran of Deicorp Pty Ltd and was undertaken in accordance with Douglas Partners' proposal 86645.03.P.003.Rev0 dated 05/05/2023.

It is understood that the proposed development will include the demolition of the existing buildings and construction of a mixed-use structure (residential with retail uses) with a 7-level basement, with a finish floor level at RL 74.8 m.

This DMP is based on the recent geotechnical investigation undertaken by Douglas Partners Pty Ltd (DP) at the site, complemented by additional measurements of groundwater levels, in-situ permeability tests and numerical modelling to estimate seepage inflow rates and drawdown of groundwater levels associated with dewatering of the proposed basement.

Details of the field work and numerical modelling are given in this report. This DMP may be used to accompany an application for a "Water Supply Works Approval" from Water NSW and an application for a permit to discharge groundwater to stormwater system from the Council.

2. Previous Work

Information used to develop the conceptual groundwater model was obtained from the previous investigations undertaken by DP.

- Douglas Partners Pty Ltd: "Report on Geotechnical Investigation: Fiveways, Falcon Street, Pacific Highway and Alexander Street, Crows Nest", dated September 2023 (DP, 2023a);
- Douglas Partners Pty Ltd: "Report on Pre-demolition Detailed Site Investigation (Contamination): Fiveways, Cnr Falcon Street, Pacific Highway and Alexander Street, Crows Nest", dated August 2023 (DP, 2023b); and
- Douglas Partners Pty Ltd: "Report on Due Diligence Geotechnical Desktop Study: Fiveways, Cnr Falcon Street, Pacific Highway and Alexander Street, Crows Nest", dated December 2018 (DP, 2018).

The locations of groundwater monitoring wells (BH103, BH104, BH105) installed as part of the aforementioned works are shown on Drawing 1 in Appendix C.

3. Site Description

The site is a triangular city block and covers approximately 3,300 m^2, located in the suburb of Crows Nest. The site is bounded by Falcon Street, Pacific Highway and Alexander Street. The existing surface slopes gradually from west to east along Falcon Street (from RL 99.1 m to RL 96.7 m) and north to south along Pacific Highway (from RL 99.1 m to RL 96.0 m). Along Alexander Street the existing surface slopes towards the south (from RL 96.7 m to RL 96.0 m).

The site is currently occupied by a number of commercial properties, between 2 and 4 levels high, with some properties having an existing 1 level basement.

4. Geotechnical and Hydrogeological Model

4.1 Subsurface Profile

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site in 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 results of the investigation confirmed the regional mapping with Ashfield Shale being underlain with Mittagong formation and underlain with Hawkesbury Sandstone noted at depth.

The previous investigation identified semi-shallow depths of fill and residual soils over shale bedrock. The shale was generally noted to be extremely to highly weathered to depths of between 3.0 m to 10.0 m before grading to slightly weathered to fresh shale, then fresh sandstone at depth.

The general strata encountered in the boreholes is summarised as follows:

Pavement / Fill:	Generally, clay, gravelly clay and sandy gravel, with building rubble, plastic and sandstone cobbles to depths of 0.9 m to 2.5 m.
Residual Soil:	Mostly apparently firm silty clay, trace ironstone gravel, increasing to apparently very stiff clay to depths of between 2.0 m and 4.9 m.
Shale (Ashfield Shale):	Generally, very low and low strength, extremely weathered to fresh, fragmented to slightly fractured shale to depths of approximately 13.0 m to 17.4 m.
Siltstone / Sandstone (Mittagong Formation):	Generally, very low, low and medium strength, slightly weathered to fresh, slightly fractured to unbroken siltstone and sandstone to depths of approximately 13.8 m to 19.0 m.
Sandstone (Hawkesbury Sandstone):	Medium to high and high strength, fresh, slightly fractured to unbroken sandstone.

4.2 Groundwater

Three groundwater monitoring wells were installed during the previous geotechnical investigation. Free groundwater during auguring was only observed in BH103, at 2.0 m depth. The use of water as a drilling fluid during coring of the boreholes precluded any further groundwater observations.

Groundwater monitoring wells were installed in Boreholes BH103, BH104 and BH105. After installation, the groundwater monitoring wells were purged of drilling fluid using a submersible pump and In situ permeability testing was carried out in each of the wells. Digital data loggers were then installed to monitor recharge of the groundwater and for long term groundwater level monitoring. The filter zone depths and groundwater measurements taken following installation of the groundwater wells are presented in Table 1, Table 2 and Table 3 below.

Table 1: Well Construction Details

BH Ref	Ground Surface Level (m AHD)	Filter Zone Depth (m)	Filter Zone Material
BH103	96.0	11.6 - 30.57	Rock
BH104	93.6	5.8 - 18.8	Rock
BH105	98.1	10.3 - 23.31	Rock

Table 2: Summary of Manual Groundwater Measurements

BH Ref	Water Level (m) [RL m AHD)	Date of Reading	Comments
BH103	(7.5) [88.5]	16/05/2023	Day of well installation and after purging.
	(7.5) [88.5]	06/06/2023	21 days after purging.
	(7.2) [88.8]	11/07/2023	1st monthly reading
	(7.3) [88.7]	11/08/2023	2nd monthly reading
	(7.4) [88.6]	12/09/2023	3rd and last monthly reading

Table 3: Continued: Summary of Manual Groundwater Measurements

BH Ref	Water Level (m) [RL m AHD)	Date of Reading	Comments
BH104	(4.5) [89.1]	26/09/22	Day of well installation and after purging.
	(5.0) [88.6]	29/09/22	21 days after purging.
	(4.7) [88.9]	11/07/2023	1st monthly reading
	(4.7) [88.9]	11/08/2023	2nd monthly reading
	(4.6) [89.0]	12/09/2023	3rd and last monthly reading
BH105	(5.0) [93.1]	26/09/22	Day of well installation and after purging.
	(5.1) [93.0]	29/09/22	3 days after purging.
	(5.4) [92.7]	11/07/2023	1st monthly reading
	(5.1) [93.0]	11/08/2023	2nd monthly reading
	(10.0) [51.6]	12/09/2023	3rd and last monthly reading

The continuous ground water level readings captured by the data loggers between 16/05/2023 and 12/09/2023 are presented within Appendix C of this report. The daily rainfall is also included. These readings are summarised in Table 4 below.

Table 4: Summary of Continuous Groundwater Readings (Data-loggers)

Borehole	Groundwater Readings (m) [RL m AHD]			Range (m)
	Shallowest	Deepest	Mean	
BH103	(10.7) [85.3]	(6.2) [89.8]	(6.6) [89.4]	4.5
BH104	(5.3) [88.3]	(4.5) [89.1]	(4.7) [88.9]	0.8
BH105	(6.4) [91.7]	(6.0) [92.1]	(6.2) [91.9]	0.4

Note: Data excluded if interpreted to be influenced by the removal of water as part of the hydraulic conductivity testings

4.3 Permeability Testing

To estimate the rock mass hydraulic conductivity (or "permeability"), rising head permeability tests were carried out in BH103 and BH105 and a water pressure (packer) test was carried out in BH104. The tests were carried out between 18 May 2023 and 8 June 2023.

The rising head permeability test involves removing water and measuring the changes in water level within the well at regular time intervals. The packer test involves pumping water into the rock formation below a packer at various pressure. The results of the permeability tests using Hvorslev's (1951) method (rising head test) and packer tests are summarised in Table 5 below, with the full reports provided in Appendix F.

Table 5: Hydraulic Conductivity Test Results

Borehole	Test Zone Depth (m)	Estimated Hydraulic Conductivity (k) (m/s)	Estimated Hydraulic Conductivity (k) (m/day)
BH103	11.6 - 30.57	1.7×10^{-7}	0.015
BH104*	5.8 - 18.8	3.3×10^{-7}	0.029
BH105	10.3 - 23.31	3.0×10^{-7}	0.026

* upper bound value recorder for packer test in Hawkesbury Sandstone

4.4 Surface Waters, Groundwater Dependent Ecosystems & Groundwater Extraction Bores

The surface water sources in the vicinity of the site include Berry's Creek which is located about 900 m west of the site and Flat Rock Creek with is about 1 km to the north-east. Berry's creek is a tributary to the Lane Cove River which is situated approximately 1400 m southwest of the site. Berry's Creek, which runs into Willoughby Bay, situated approximately 1800 m northeast of the site. No other surface water sources are mapped within 1 km of the site to the north or east.

Reference to the Australian Bureau of Meteorology GDE Atlas indicates that there are no mapped groundwater dependant ecosystems (GDEs) in close proximity to the site.

One groundwater extraction bore was located within 1 km of the site. Details of the bore extracted from the available WaterNSW records are presented within Table 6 below.

Table 6: WaterNSW Groundwater Extraction Bores

Bore Reference	Approximate Location relative to site (m)	Water Bearing Stratum	Approximate Ground surface RL (m AHD) [1]	Standing Water Level	Approximate Water Level RL (m AHD)
GW108224	960 m NW	Sandstone	72	35	37

Note: [1] Ground surface RL inferred from NSW Department of Land 2m contour mapping.

5. Proposed Development

It is understood that the proposed development will include demolition of the existing buildings on site and construction of a mixed-use structure (residential with retail uses) with a 7 level basement, with a finish floor level at RL 74.8 m (refer architectural drawings prepared by Turner attached in Appendix B).

The development is understood to be located partly in the Sydney Metro tunnel second reserve, with the dual tunnels (RT01 and RT02) running beneath the northeastern corner of the site (refer TfNSW "for construction" drawing SMCSWTSE-JAB-TPW-AL-DRG-505123-02 attached in Appendix B). The tunnels are shown to plunge towards the east with the tunnel crown increasing in depth from approximately RL 65 m to RL 63 m. A cross passage is shown between the two tunnels, located just to the north of the site. Both tunnels are shown to be circular with a diameter of approximately 7.05 m (refer sheet 2 to 4 of drawing 3050-01019-001-002-02, prepared by Stantec, attached in Appendix B). It is understood that the tunnel is fully tanked.

6. Groundwater Modelling

6.1 Methodology

A 3-dimensional (3D) numerical groundwater model was developed for the site. The modelling was carried out using the 3D finite element software PLAXIS 3D (V22).

Information from the investigations on the site and surrounding area were used to construct a conceptual hydrogeological model for the site, which was represented in the multi-layered numerical model, prepared for the site.

6.2 Boundary Conditions and Hydraulic Parameters

To limit boundary interference, the model boundaries were set approximately 150 m from the site. The ground surface was modelled to simulate the slope to the southeast.

The proposed development is located within an urban setting, mostly covered by pavements and commercial buildings, with only minor gardens. As such, a net infiltration rate of 2% of the 2 m annual rainfall was assigned.

The constant head far-field boundary conditions (upslope to the west and downslope to the east) were calibrated to generate a hydraulic head matching the measured head of approximate RL 93 m at the upstream end of the basement, and approximately RL 89 m at the downstream end. The pore pressures along the north and south boundary were not fixed (allowed to change – no flow through boundary).

The geological units were subdivided into layers corresponding to the soil and rock units described in the geological model. The permeability for each model unit adopted is summarised in Table 7. The horizontal permeabilities (k_h) of the Hawkesbury Sandstone and shale/siltstone adopted was based on the highest value from the in-situ permeability testing results (consistent with parameters proposed by Bertuzzi and Pells (2002)[1]). Soils permeability was based on published literature.

Considering the nature of horizontally bedded massive sandstone, the ratio of vertical to horizontal permeability (k_v/k_h) of the Hawkesbury Sandstone was assigned to be 0.2. For the more fractured shale and siltstone, however, a ratio of 0.5 was used.

Table 7: Model Layer Summary

Model Layer	Geological Unit	Base of Layer (RL m)	Porosity	Typical Horizontal Hydraulic Conductivity k_h (m/sec)	k_v/k_h
1	Fill/Residual Soil	95-88*	0.5	1.0×10^{-6}	1.0
2	Shale/Siltstone	81	0.2	3×10^{-7}	0.5
3	Hawkesbury Sandstone	50**	0.05	3.3×10^{-7}	0.2

Note: * range provided – base of the layer follows topography

** base of model

6.3 Basement Shoring Wall and Dewatering

No detailed on the shoring design were available at the time of preparing this report. It is assumed that the basement shoring wall will comprise 'non-watertight' soldier piles with shotcrete infill panels. The strip drains to be installed behind the shotcrete will essentially direct all groundwater, through the basement subfloor drainage system, to the sump (i.e., the basement is assumed to be drained in the long term).

[1] Bertuzzi, R. and Pells, P.J.N (2002), Geotechnical Parameters of Sydney Sandstone and Shale. Australian Geomechanics, Vol 37, No 5, December 2002.

To allow the construction works, a proposed bulk excavation level at RL 74 m was assumed. This level corresponds to a depth of approximately 0.8 m below the lowest finished floor level, taking into account slab thickness, locally deepened excavations for a sump and pump system, footings, etc.

The subsurface strata intersected by the basement excavation is shown in Figure 1 below.

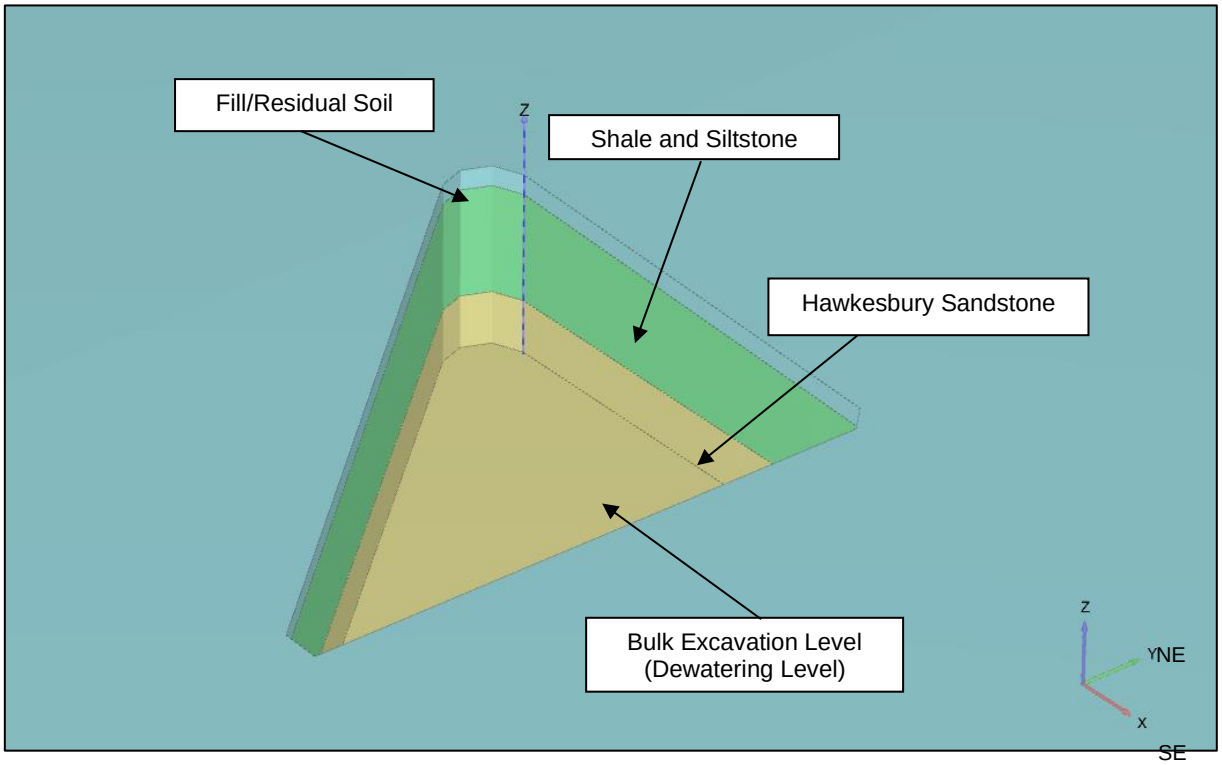

Figure 1: View of Model Ground Conditions

It has been assumed in the model that any seepage into the basement will be collected and pumped out of the basement.

6.4 Groundwater Modelling Simulations

To simulate temporary dewatering required during construction, the transient flows over time were modelled. For the purpose of the analysis, excavation was undertaken in a single stage (i.e., "whished into place"). The subsequent temporary dewatering period was assumed to be one year, subdivided into multiple time intervals. The analysis was also run under 'steady state' conditions for the long term (i.e., fully drained basement).

Sensitivity analyses were undertaken to assess the impact of higher permeabilities for the shale and siltstone (refer Table 9 for values of k_h used). The sensitivity analysis also included the effect of the basement excavation intersecting a high permeability seam.

6.5 Groundwater Modelling Results

The inflow rates provided in this report represent the estimated total rate of groundwater flowing into the excavation and the volume (per unit time) requiring extraction via the dewatering system in order to dewater the basement excavation during construction and in the long term.

The estimated inflows from the analysis for the first year (i.e., during construction) and in the long term are summarised in:

- Table 8, for the baseline case as detailed in previous sections; and
- Table 9, for the sensitivity cases considering higher permeability for the shale and siltstone.

Table 8: Simulated Inflow Results for Baseline Case

Elapsed Time	Baseline Case		
	L/min	m^3/day	Cumulative Inflow (ML)
1 day	91	131	0.1
3 days	89	128	0.4
7 days	88	126	0.9
14 days	86	124	1.8
30 days	83	120	3.7
60 days	79	113	7.2
120 days	70	101	13.7
240 days	61	87	25.0
365 days	55	79	35.4
Long term	L/min	m3/day	Annual Inflow (ML)
	37	53	19.2

Table 9: Simulated Inflow Results for Sensitivity Cases

Case	k_h (m/sec)	Maximum Inflow (L/min) *	Long Term Inflow (L/min)	Annual Inflow (ML)
	Shale and Siltstone			
Baseline	3×10^{-7}	91	37	19.2
Higher Permeability for Shale and Siltstone	1×10^{-6}	162	58	30.3

Note: * simulation results at the 1st day.

The results of the baseline groundwater inflow analysis indicate that inflow of about 35 ML in the first year of construction is predicted, which reduces to about 19 ML/year in the long term.

The inflow rate presented above is a prediction only and may vary significantly depending on the assumptions presented. The actual flow rate will only be known once the excavation has been completed and the inflow measured. Appropriate planning should be in place to monitor and compensate for inflows different to than that predicted by the assessment.

It should be noted that the predictions obtained from the PLAXIS 3D analysis is based on permeability estimates obtained from testing in the boreholes. The permeability test results can vary significantly between the boreholes. Also, the results are only indicative of the rock mass around the borehole. For inflow analysis conservative permeability values are used (highest permeability). Therefore, actual inflows can be substantially less than those predicted in the analysis, especially if the underlying Hawkesbury sandstone is of lower permeability than used in the model.

6.6 Drawdown Estimates

The simulated lowered groundwater levels, or impact to the water table, outside the excavation are shown in Figure 2 and Figure 3.

The model results indicate a maximum drawdown of about 14 m adjacent to the excavation, which reduces and extends to the model boundary (i.e., 150 m from the excavation).

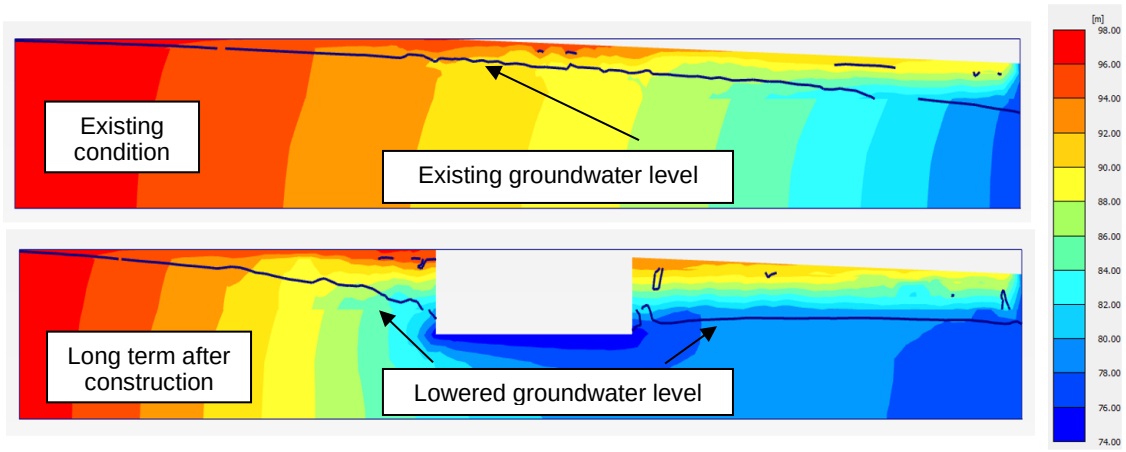

Figure 2: Groundwater Head Contour through Excavation in Northwest-Southeast Direction

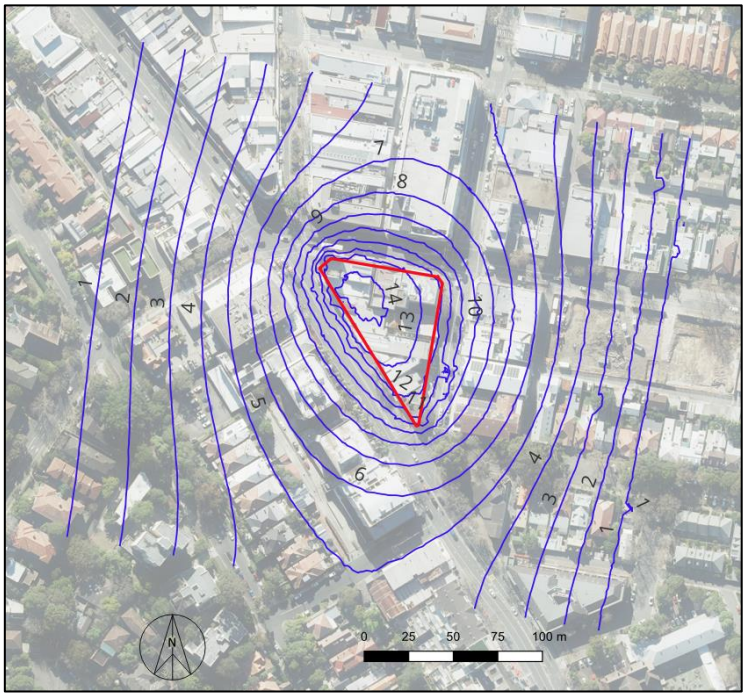

Figure 3: Simulated Groundwater Drawdown Levels

Based on the investigation results, groundwater drawdown occurs within the rock units around the perimeter of the site. Accordingly, the drawdown is not expected to impact any surrounding sites.

7. Groundwater Quality

DP (2023b) identified potential sources of contamination that may impact on groundwater quality beneath the site, including contaminated filling, on-site and nearby commercial activities including motor garages, associate car service centres and dry cleaners; and underground features including grease traps.

In order to assess the current groundwater contamination status at the site and evaluate whether historical / current / off-site land uses have impacted on groundwater, groundwater sampling was conducted from three groundwater monitoring wells (BH103, BH104 and BH105) installed as part of DP (2023b).

Groundwater wells BH103 and BH105 were sampled on 20 June 2023, whilst groundwater well BH104 was sampled on 22 June 2023. Groundwater samples including a replicated sample were collected using a low flow peristatic pump via the micro-purge (minimal drawdown) method.

Groundwater samples were tested for a range of potential contaminants including: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc), total recoverable hydrocarbon (TRH), polycyclic aromatic hydrocarbons (PAH), benzene, toluene, ethyl benzene (BTEX), organochlorine pesticides (OCP), organophosphorus pesticides (OPP), polychlorinated biphenyls (PCB), phenols and per-and polyfluoroalkyl substances (PFAS). In addition, groundwater samples were

also tested for total dissolved solids (TDS), total suspended solids (TSS), oil and grease and iron to assist in establishing groundwater characterisation needed as part of this DMP.

The following key guidelines and reference documents were consulted for deriving the assessment criteria for groundwater quality at the site:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013) [NEPM] (NEPC, 2013);
- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018);
- CRC CARE *Health screening levels for petroleum hydrocarbons in soil and groundwater* (CRC CARE, 2011); and
- HEPA PFAS National Environmental Management Plan (NEMP) (HEPA, 2020).

The results of the laboratory testing on groundwater samples are summarised in Table J3 (extracted from DP, 2023b) in Appendix F. The relevant assessment criteria are slow shown on Table J3. The laboratory test results certificates are also included in Appendix F.

DP (2023b) concluded the following:

- All analytical results for groundwater samples were below the site adopted assessment criteria for freshwater and health screening level adopted for the site for TRH, BTEX, PAH, OCP/OPP, PCB, phenols and PFAS;
- Metals concentrations (dissolved and total) exceeded the assessment criteria in all samples for zinc;
- Metals concentrations (dissolved and total) exceeded the assessment criteria in sample BH104 for cadmium, chromium, copper and lead; and
- Metals concentration (dissolved and total) exceeded the assessment criteria in sample BH105 for copper.

However, these detected concentrations are likely to be representative of regional conditions and are often found in urban environments where there are impacts associated with water supply and waste water infrastructure.

The inorganics concentrations for TSS, TDS and iron were elevated. Given the metals concentrations discussed above, and the elevated inorganics concentrations, it was considered likely that any form of dewatering would require treatment of the groundwater prior to stormwater or sewer disposal to meet the relevant criteria.

DP (2023b) also provided comment that, according to 1:25,000 Acid Sulfate Soil Risk map, the site is not located at or near an area associated with a risk of acid sulphate soils.

8. Groundwater Disposal and Council Requirements

All collected groundwater requiring disposal will need to be tested against the requirements of the receiving authority. For example, disposal to stormwater will require Council approval and be subject to their water quality requirements for discharge to stormwater.

Ongoing monitoring of groundwater quality will be required to check that the groundwater quality complies with the nominated criteria for disposal. Suggested monitoring and reporting requirements are given in Section 10.

Where groundwater does not comply with the nominated requirements some form of groundwater treatment will be required prior to disposal. The treatment system should be determined and adjusted based on the groundwater test results prior to disposal and may include a combination of the following:

- Use of settlement tanks with addition of a flocculation agent to control heavy metals and suspended solids;
- Use of carbon filters to control hydrocarbons; and
- Use of specialist treatment systems to control heavy metals and hydrocarbons.

DP consider that, where there is an absence of Council-provided water quality criteria, water quality data should be compared to the following criteria (including the criteria reference in Table 10) for the purpose of discharging to stormwater:

- Physical parameters (pH, conductivity, turbidity, TSS) based on requirements of (NHRMC, 2008), ANZECC (2000) and (Landcom, 2004);
- Aesthetics: the water should be free from floating debris; oil, scum and other matter; and substances producing objectionable colour, odour or turbidity; and
- Chemical contaminants: default guideline values (DGV) for the protection of freshwater ecosystems from ANZG (2018) and HEPA (2020). DGV should be for a 95% level of protection or, for bioacculmulative contaminants or to protect against species with risk of chronic toxicity, a 99% level of protection.

Table 10: Nominated groundwater quality criteria

Analyte / Parameter	Screening value (µg/L unless otherwise stated)
Metals / Metalloids	
Arsenic (III) / (V)	24 / 13
Cadmium	0.2
Chromium (III) / (VI)	3.3 / 1
Copper	1.4
Lead	3.4
Mercury (inorganic)	0.06
Nickel	11
Zinc	8

Analyte / Parameter	Screening value (µg/L unless otherwise stated)
BTEX	
Benzene	950
Toluene	180
Ethylbenzene	80
m-Xylene	75
o-Xylene*	350
p-Xylene*	200
PAH	
Naphthalene	2.5
B(a)P	0.1
Anthracene	0.4
Phenanthrene	2.0
Fluoranthene	1
TRH and VOC	Laboratory practical quantification limit as initial screen.
Phenols	
Phenol	320
OCP	
Aldrin	1
DDT	0.006
Endrin	0.01
Heptachlor	0.01
Hexachlorobenzene	0.05
Lindane	0.07
Methoxychlor	0.005
OPP	
Azinphos methyl (Guthion)	0.02
Chlorpyrifos	0.01
Diazinon	0.01
Dimethoate	0.01
Fenitrothion	0.1
Malathion	0.05
Parathion	0.0007

Analyte / Parameter	Screening value (µg/L unless otherwise stated)
PCB	
Arochlor 1242	0.3
Aroclor 1254	0.01
PFAS	
PFOS	0.00023
PFOA	19
Physiochemical Parameters	
Conductivity	200 - 300 µs/cm
pH	6.5 – 8.5 pH units
Dissolved Oxygen	60 - 120 % saturation
Turbidity	50 NTU
Total Suspended Solids	< 50 mg/L

Any drained basement design may require periodic inspections to prevent build up / blockages in the drain systems, e.g. ferrous iron sludge.

In addition, a long-term treatment system is recommended to form part of a contingency plan in the design of drained basement should it be required to facilitate stormwater discharge.

9. Impact Assessment

9.1 Aquifer Interference Policy Considerations

The NSW Aquifer Interference Policy (AIP) indicates that the term “aquifer” is commonly understood to mean a groundwater system that is sufficiently permeable to allow water to move within it, and which can yield productive volumes of groundwater. A groundwater system is defined as any type of saturated geological formation that can yield low or high volumes of water. The site is underlain by shallow fill / soils, then shale and sandstone that is of relatively low permeability with potentially low yield. The groundwater system is therefore considered to be a ‘less productive groundwater source’ as outlined in the AIP.

Table 1 in Section 3.2.1 of the AIP outlines minimal impact considerations. The AIP indicates that “if predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable”. The following minimal impact considerations are outlined for less productive porous and fractured rock groundwater sources:

- Less than or equal to 10% cumulative variation in water table 40 m from any high priority GDE or high priority culturally significant site;
- A cumulative pressure head decline of no more than a 2 m at any water supply work; and

- Any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.

9.2 Risk Assessment

An assessment of the potential effects of dewatering on neighbouring properties and groundwater dependent ecosystems has been summarised in Table 11.

Table 11: Assessment of Potential Effects of Dewatering.

Item	Comment
Proximity of Groundwater Dependent Ecosystems (GDEs)	The closest water course is Berrys Creek, located 900 m west of the site. Drawdown impacts to GDEs are unlikely.
Water Supply Losses by neighbouring groundwater users	A review of registered bores within a 500 m radius of the surrounding site was undertaken. The search identified no extraction bores within the search area.
Potential Subsidence of neighbouring structures	The groundwater drawdown is expected to occur within bedrock. Settlements on adjacent structures due to the drawdown in rock would be expected to be negligible.
Mounding of water upgradient of structure	The basement is designed to be drained. Due to the drained basement induced mounding due to drained basement is expected to be unlikely.

10. Monitoring and Reporting Requirements

10.1 Monitoring and reporting requirements

The following monitoring programme and associated reporting outlined in Table 12 below is suggested during excavation and construction works on-site, assuming a continuous dewatering process.

Table 12: Monitoring and Reporting Requirements

Item	Monitoring Required	Monitoring Frequency, Reporting and Notes	Reporting
Assess effect of works on groundwater levels	Installation of 3 groundwater wells outside the excavation perimeter (including at least one upgradient) and subsequent measurement of groundwater levels would be required.	Base reading two weeks after installation. Once excavation reaches water table carry out weekly monitoring. Continue weekly monitoring two weeks after completion of bulk excavation level. Then monitor monthly or as advised by the geotechnical engineer until the water level differences reduce to acceptable levels. Preferably dataloggers should be installed.	Weekly then monthly

Item	Monitoring Required	Monitoring Frequency, Reporting and Notes	Reporting
Quantity of water disposed off-site	Calibrated Flowmeter connected to any pump-out system.	Continuous monitoring of pump-out volumes. Inclusion of results in a final water quality monitoring report (i.e., as outlined in a DMP)	Weekly
Visual Inspection	No visible oil and grease, 'sheen' and / or no significant discolouration or odours If any of the above signs are noted, then any discharge will be suspended until further analytical testing is completed.	Inspections daily where accessible (e.g. holding tanks, wells, discharge points).	
Routine Water Quality Sampling and Testing (Assuming Continuous treatment)	Sample collection will be based on the dewatering method to be used. In general, samples are to be collected from both water entering the system and water following treatment. Contaminant and physical properties tested to be nominated by the authority accepting water but to include: • Metals (total and dissolved); • TRH; • BTEX; • PAH; • Conductivity; • pH; • Dissolved Oxygen; • Turbidity; • Total dissolved solids; • Major cation / anions / sodium absorption ratio / hardness;	Samples collected initially daily (first week) and then weekly. Results to be compared against criteria in Section 8. Physical parameters (pH, dissolved oxygen, turbidity and conductivity) may be monitored using suitable on-site probes / testing kits once correlations are established with analytical results. Based on ongoing review of results the scope (and/or need) of inlet water testing, and the scope of outlet testing may be reduced, i.e., once the treatment system has been assessed as adequate for the range of contaminants detected. Inclusion of results in a final water quality monitoring report (i.e., the dewatering completion report).	Weekly

Item	Monitoring Required	Monitoring Frequency, Reporting and Notes	Reporting
	• Major nutrients (ammonia, nitrate, N and P); and • Faecal coliforms and e.coli		
Construction Dewatering Completion Report	To be prepared by a suitably qualified consultant upon completion of construction dewatering works and to be submitted to Council. The summary report will incorporate the above information and: • Any on-site records kept by the contractor (e.g., visual observations, any unexpected finds records etc.); • All analytical results (i.e., each batch of water disposed) compared against the adopted screening criteria; • Quality control testing; • Record of water disposed (i.e., for each disposal event); and • Comment on any unexpected finds or non-conformances, and / or otherwise if the dewatering works have complied with this DMP.		

Note: Testing frequency and analysis requirements may be reviewed in consultation with the environmental consultant dependent upon ongoing results.

10.2 Long-term monitoring

Monitoring for potential long-term impacts from the drained basement design is recommended to include the following:

- Monthly in-situ field water quality measurements using a calibrated portable water quality meter for both groundwater and discharge water (ie, from any pump out point / drains) for the following:
  - Electrical conductivity, temperature, pH and redox potential;
- If identified during the construction dewatering phase as a potential contaminant issue, additional analytical testing for specific contaminants of concern;
- Monthly meter readings of discharge volumes / flowrates. In this regard automated readings are recommended; and
- Preparation of an annual report to the approval authority.

Groundwater quality monitoring frequency during long-term monitoring may be considered to be reduced based on both the results of the construction dewatering monitoring and / or initial long-term monitoring results, eg, reduction to quarterly or bi-annual.
Requirements for long-term monitoring are recommended to be incorporated into a building management plan for the property.

10.3 Contingency plan

As per Section 10.1, at any hold point if any non-conformance is encountered then dewatering will be suspended. The following general contingency plan will be enacted:

- Notify the Site Manager / Contractor and the Geotechnical / Environmental Consultant (as relevant);
- Environmental Consultant to inspect the site / unexpected finds and collect additional water quality samples as advised;
    - If required, notification to the approval authority / NSW EPA in the event of a potential contaminant release to groundwater;
- Should water quality be deemed unsuitable for disposal, suspend dewatering and treat water prior to discharge. If on-site treatment cannot meet the required discharge criteria then a contingency strategy of off-site disposal as liquid waste may need to be adopted until the on-site treatment system can be modified / adjusted;
- Should dewatering volumes be higher than predicted or higher than discharge limits provided by relevant authorities, suspend construction and reduce pumping rates. Options may include lowering to 0.5 m below BEL, reduced pumping rates, or staged basement construction; and
- Written confirmation by the Consultant that disposal may resume (e.g., upon receipt of laboratory results).

11. Comments

Based on the results of the analysis, the groundwater inflow is sensitive to permeability of the shale and siltstone. Increased inflows may therefore occur if permeable shale and siltstone layers are intersected.

If required, further testing can be carried out to obtain additional information on the permeability of the shale and siltstone. This could include further testing in the existing wells over an extended period to establish if the bores will continue to yield over time, or if they are likely to dry up. Additional wells outside the excavation footprint may be required for longer term monitoring. This may be required as the existing wells could be damaged during demolition / excavation works. These wells may also be used for further testing.

The predicted lowered groundwater levels extend to the model boundaries. This indicates that the extent of the drawdown may be slightly underestimated in the far field. The predicted inflow, on the other hand, may be overestimated.

Based on the inflow estimate of over 3 ML/year, the proposed drained basement requires a Water Access License and a Water Supply Works Approval from WaterNSW, assuming that the groundwater take is approved.

The selection of an appropriate strategy for basement design should include consideration of the regulatory risks (i.e., whether or not the necessary approvals and licenses can be obtained, or conditions of consent become too onerous), construction stage risks (e.g. excessive costs or delays due to

grouting, groundwater management, dewatering or design changes), long-term risks (e.g. cost of ongoing groundwater management/licenses), as well as the known costs of design and construction.

12. References

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

CRC CARE. (2011). *Health screening levels for petroleum hydrocarbons in soil and groundwater.* Parts 1 to 3, Technical Report No. 10: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

HEPA. (2020). *PFAS National Environmental Management Plan (NEMP).* Version 2.0: Heads of EPAs Australia and New Zealand and Australian Government Department of the Environment.

Landcom. (2004). *Managing Urban Stormwater: Soils and Construction, Volume 1 ("Blue Book").* 4th Edition, March 2004: Landcom, New South Wales Government.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

NHMRC. (2008). *Guidelines for Managing Risks In Recreational Water.* Canberra: National Health and Medical Research Council.

NHMRC, NRMMC. (2022). *Australian Drinking Water Guidelines 6 2011, Version 3.8 updated Sept 2022.* Canberra: National Health and Medical Research Council, National Resource Management Ministerial Council.

NHRMC. (2019). *Guidance on Per and Polyfluoroalkyl substances (PFAS) in Recreational Water.* Canberra: National Health and Medical Research Council.

13. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at Falcon Street, Crows Nest in accordance with DP's proposal 86645.03.P.002.Rev0 dated 5 May 2023 and acceptance received from Greg Colbran dated 10 May 2023. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Deicorp Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Appendix B

Provided Drawings

BEFORE YOU DIG
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SHORT LINE TABLE		
Number	Bearing	Distance
1	189°25'40"	1.07
2	9°25'40"	4.175
3	189°33'40"	0.025
4	99°26'40"	3.685
5	279°25'40"	0.025
6	189°25'40"	6.655
7	189°25'40"	5.66
8	99°33'40"	0.115
9	189°33'40"	6.94
10	189°21'20"	5.38
11	9°31'20"	3.7
12	9°31'20"	0.825
13	99°33'40"	1.48
14	9°22'40"	1.56
15	189°31'20"	1.655
16	99°40'40"	0.11
17	9°40'40"	2.955
18	101°48'40"	1.055
19	99°31'20"	6.115
20	9°31'40"	1.265
21	99°23'40"	2.005
22	99°25'40"	0.115
23	9°25'40"	2.82
24	99°28'	0.975

NOTES:
1. THE LOCATION OF THE METRO LOT HAS BEEN DERIVED FROM DP1231642
2. THE LOCATION OF THE METRO TUNNELS HAVE BEEN DERIVED FROM 'FOR CONSTRUCTION' DRAWINGS PROVIDED BY TRANSPORT FOR NSW FOR THE SYDNEY METRO CITY & SOUTHWEST PROJECT INDICATING VARIOUS ALIGNMENT COORDINATES AND LEVELS ADJACENT TO THE DEVELOPMENT SITE
3. THE BOUNDARIES OF THE DEVELOPMENT SITE HAVE BEEN DERIVED FROM A PLAN PREPARED BY DAW AND WALTON CONSULTING SURVEYORS TITLED 'DETAIL SURVEY @ PACIFIC HIGHWAY CROWS NEST' DRAFTED 12-04-23, JOB NUMBER 4950-20
4. THE PROPOSED BOREHOLE POINT INDICATED ON THE PLAN AND SECTIONS IS THE CLOSEST PINK PAINT MARK LOCATED ON SITE TO THE METRO TUNNELS

NOTES:
- 'A' DENOTES RIGHT OF CARRIAGEWAY (AS SHOWN IN DP29672)
- 'B' DENOTES RIGHT OF FOOTWAY (AS SHOWN IN DP29672)
- 'C' DENOTES EASEMENT FOR SEWERAGE (AS SHOWN IN DP29672)
- 'D' DENOTES EASEMENT FOR DRAINAGE (AS SHOWN IN DP29672)
- 'E' DENOTES EASEMENT FOR ROOF WATER DRAINAGE (AS SHOWN IN DP29672)
- 'F' DENOTES RIGHT OF WAY (AS SHOWN IN DP29672)
- 'G' DENOTES EASEMENT FOR SULLAGE WATER (AS SHOWN IN DP29672)
- 'H' DENOTES RIGHT OF CARRIAGEWAY (VIDE K770818)
- 'P' DENOTES 0.23 BRICK PARTY WALL

LEGEND
- GULLY PIT & LINTEL

1st RESERVE LINE METRO
2nd RESERVE LINE METRO
CENTRELINE METRO TUNNEL
STREET
ALEXANDER
FALCON
PACIFIC
HIGHWAY
70 DP 1231642 (IN STRATUM)
1 DP 562966
1 DP 127595
11 DP 29672
10 DP 29672
3 DP 29672
2 DP 29672
4 DP 29672
5 DP 29672
6 DP 29672
7 DP 29672
8 DP 29672
9 DP 29672
1 DP 16402
2 DP 16402
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4 DP 16402
5 DP 16402
6 DP 16402
BH101
BH104
BH105

0 4 6 8 12 16 20
SCALE 1: 200 @ A1

0 8 12 16 24 32 40
SCALE 1: 400 @ A3

Registered Surveyor
Date 05 / 05 / 2023

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REVISION	DATE	DESCRIPTION	CCAD REF	APPROVED
02	05/05/2023	TITLE BLOCK AMENDED	-	A.K.
01	04/05/2023	ORIGINAL ISSUE	-	A.K.

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COORD. SYSTEM: MGA2020
MARK ADOPTED: PM 286
COORDINATES: E 333 681.947 N 6255 172.989
VERTICAL DATUM
DATUM: AHD
BM ADOPTED: PM 286
RL: 96.802

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w: www.stantec.com

SURVEYED	DRAWN	CHECKED	PASSED
L.Z.	A.G.	A.K.	A.K.

PROJECT: PROJECT

PLAN SHOWING RELATIONSHIP OF PROPOSED BOREHOLES TO SYDNEY METRO TUNNELS AT FIVE WAYS, CROWS NEST

CLIENT: DEICORP

SHEET 1 OF 1

DRAWING NUMBER	REV
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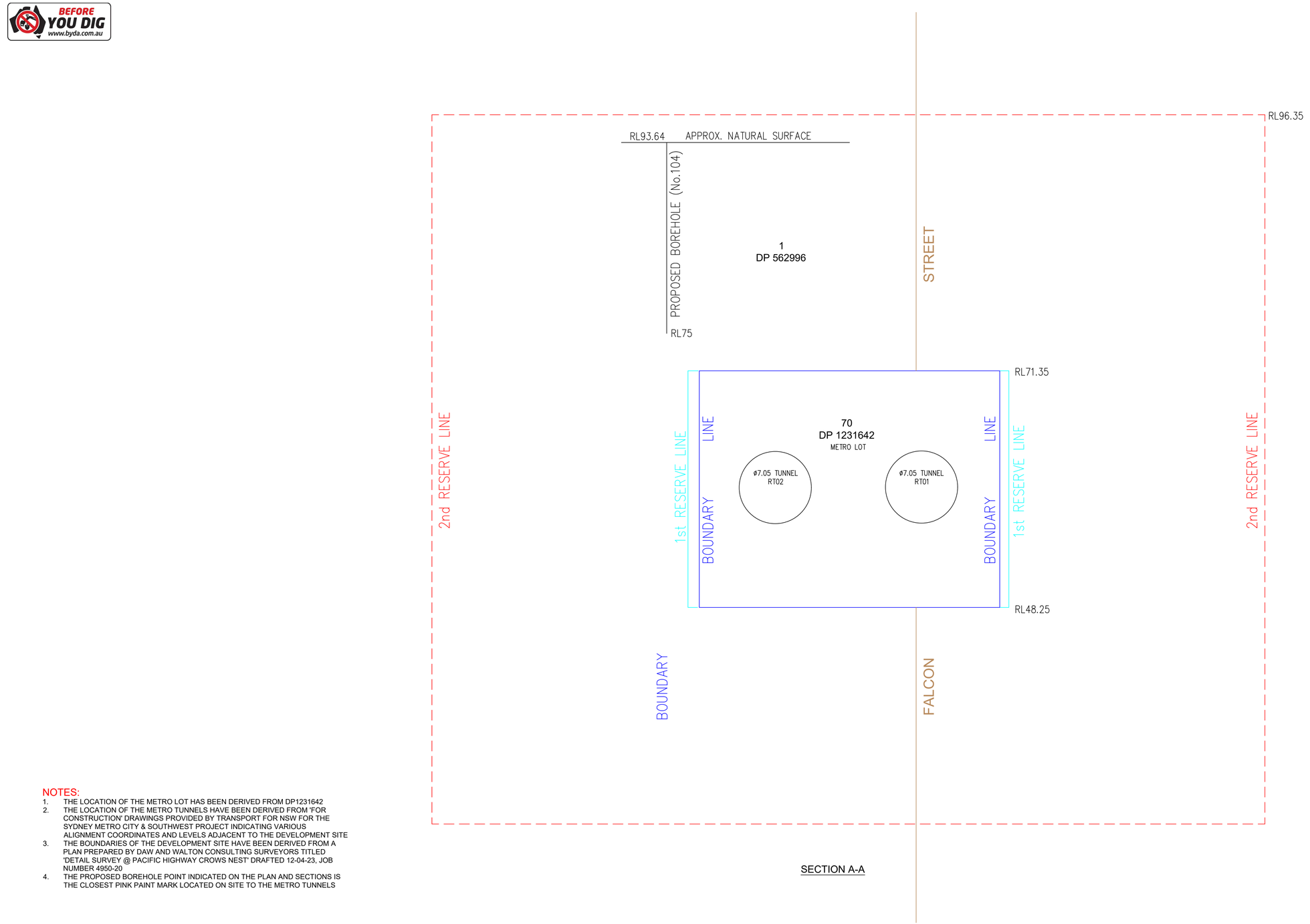

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0 4 6 8 12 16 20
SCALE 1: 200 @ A1

0 8 12 16 24 32 40
SCALE 1: 400 @ A3

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PLAN SHOWING RELATIONSHIP OF PROPOSED BOREHOLES TO SYDNEY METRO TUNNELS AT FIVE WAYS, CROWS NEST

CLIENT: DEICORP

SHEET 2 OF 1
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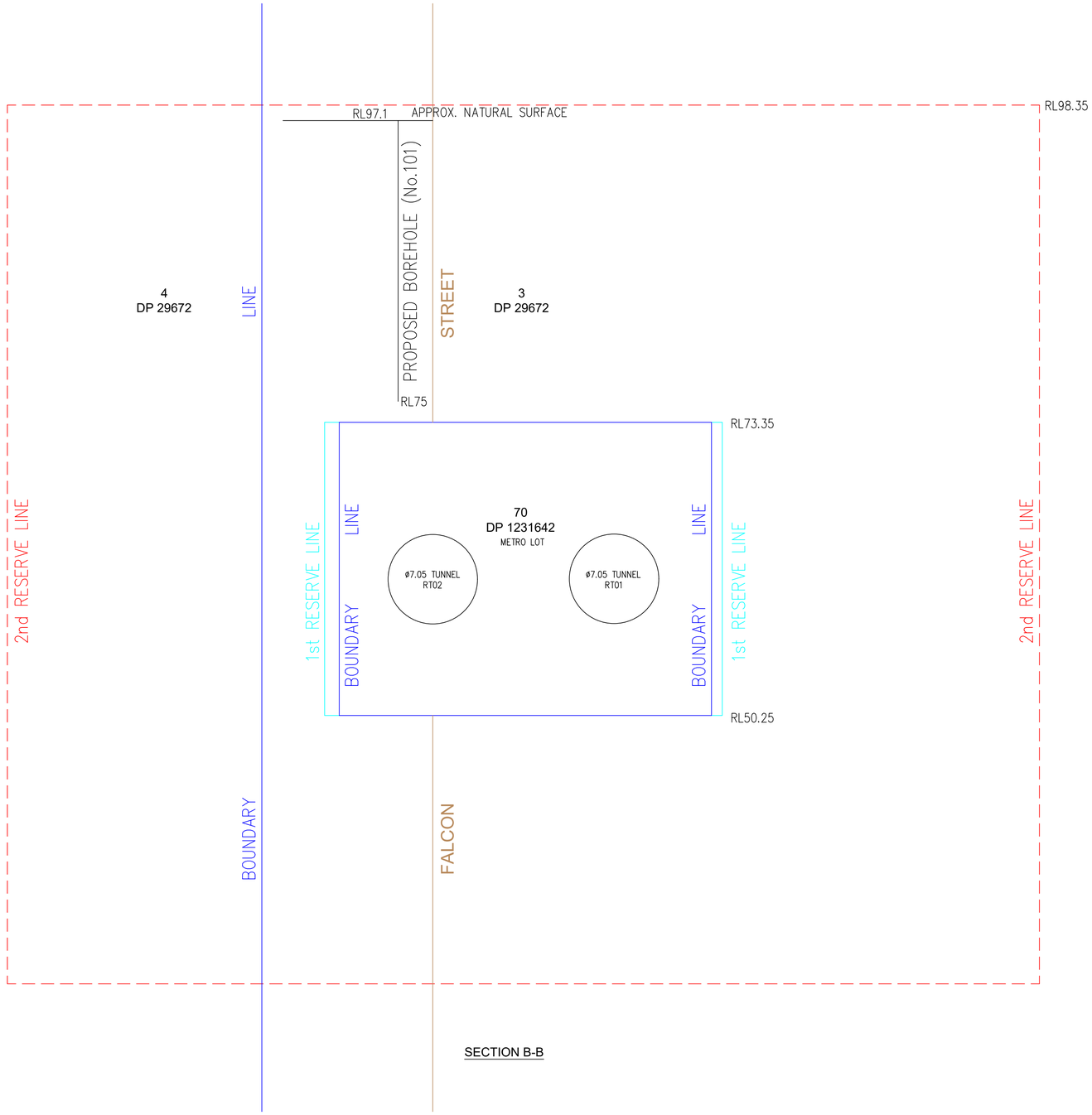
REV: 02



SECTION B-B

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SCALE 1: 400 @ A3

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PROJECT: PROJECT

PLAN SHOWING RELATIONSHIP OF PROPOSED BOREHOLES TO SYDNEY METRO TUNNELS AT FIVE WAYS, CROWS NEST

CLIENT: DEICORP

SHEET 3 OF 1

DRAWING NUMBER	REV
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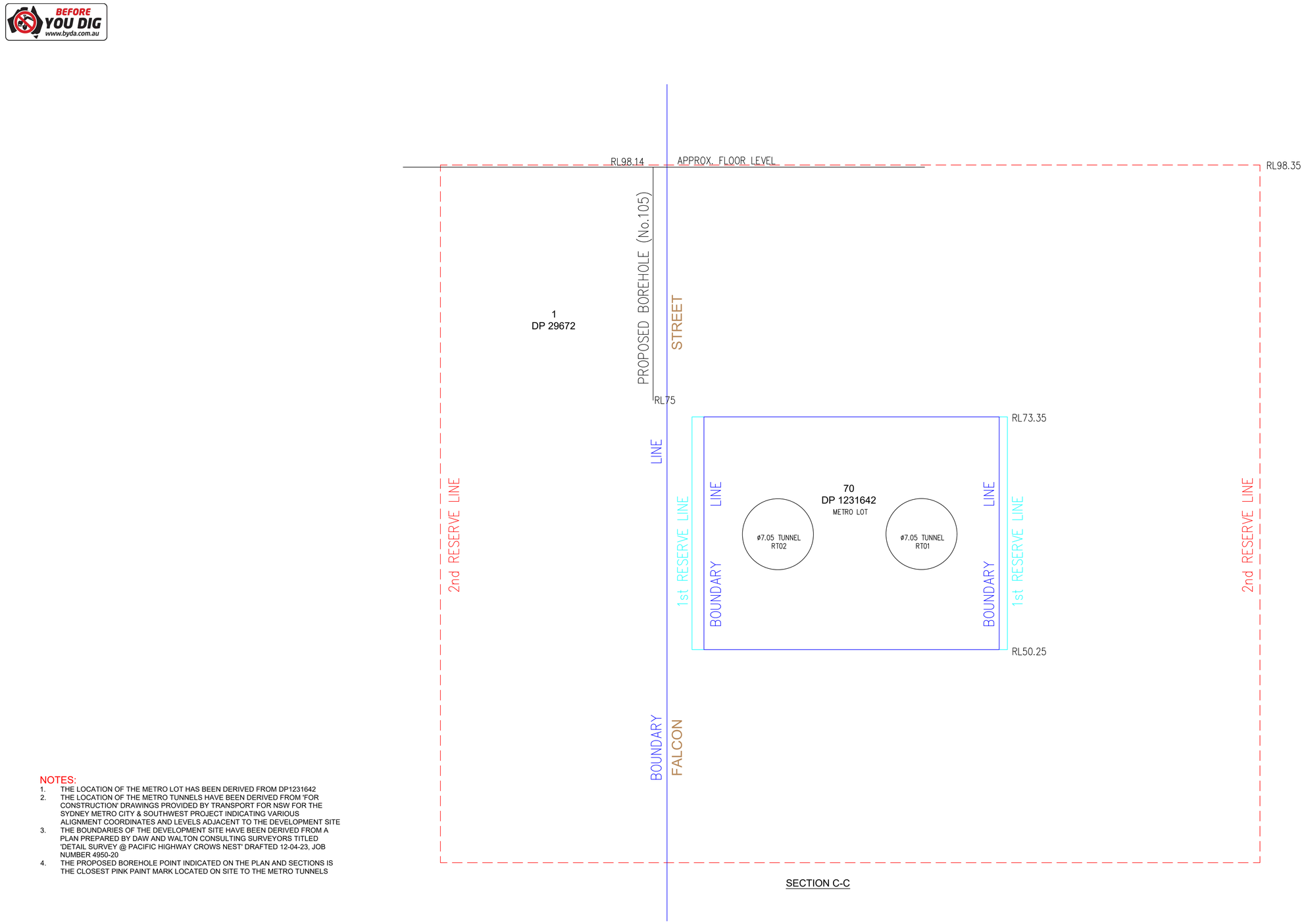

SECTION C-C

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SCALE 1: 400 @ A3

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SURVEYED	DRAWN	CHECKED	PASSED
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PROJECT: PROJECT

PLAN SHOWING RELATIONSHIP OF PROPOSED BOREHOLES TO SYDNEY METRO TUNNELS AT FIVE WAYS, CROWS NEST

CLIENT: DEICORP

SHEET 4 OF 1
DRAWING NUMBER: 3050-01019-001-002
REV: 02

TURNER SILVESTERFULLER

Ground Level

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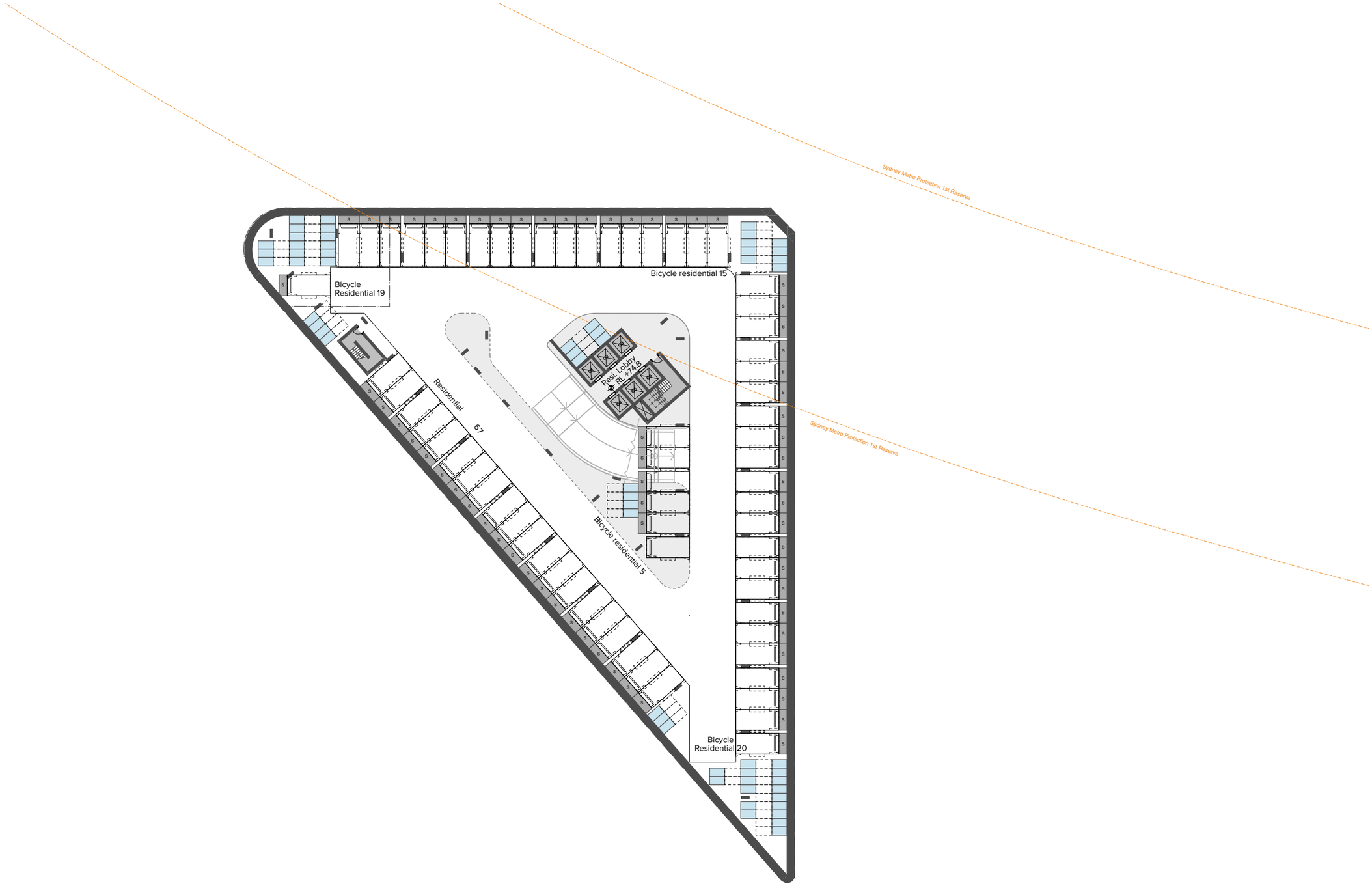
Rev. B _ 14.05.20



- Residential
- Residential Adaptable
- Car Share
- Residential Visitors
- Non Residential
- Bicycle Residents
- Bicycle Residents Visitors
- Bicycle Commercial
- Bicycle Commercial Visitors
- Bicycle Retail
- Bicycle Retail Visitors

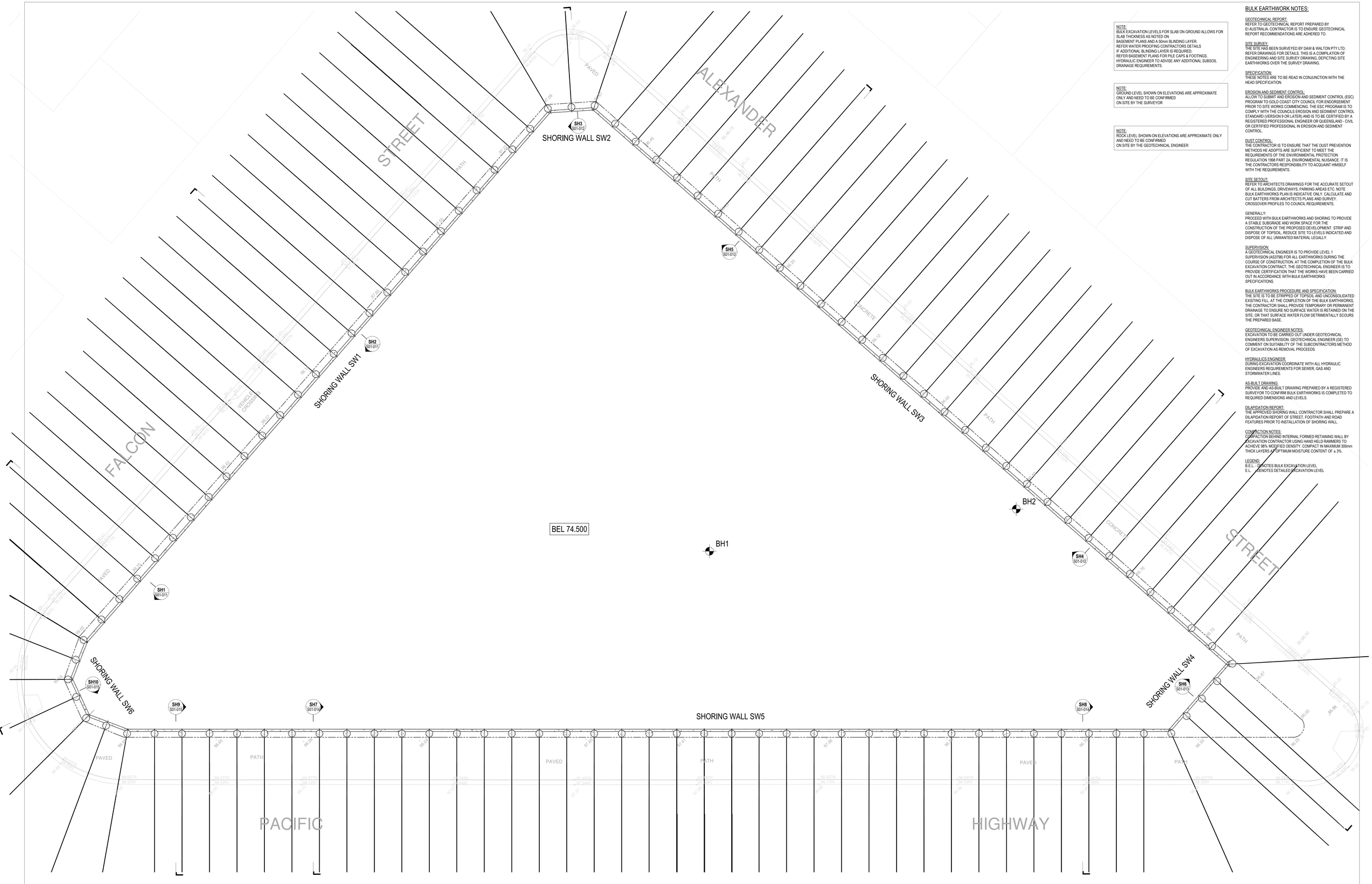
TURNER SILVESTERFULLER

Basement 07

PP-110-008 1:500, 1:200 @ A3

0 5 10 15m

Rev. B _ 14.05.20



NOTE:
BULK EXCAVATION LEVELS FOR SLAB ON GROUND ALLOWS FOR SLAB THICKNESS AS NOTED ON BASEMENT PLANS AND A 50mm BLINDING LAYER.
REFER WATER PROOFING CONTRACTORS DETAILS
IF ADDITIONAL BLINDING LAYER IS REQUIRED.
REFER BASEMENT PLANS FOR PILE CAPS & FOOTINGS.
HYDRAULIC ENGINEER TO ADVISE ANY ADDITIONAL SUBSOIL DRAINAGE REQUIREMENTS.

NOTE:
GROUND LEVEL SHOWN ON ELEVATIONS ARE APPROXIMATE ONLY AND NEED TO BE CONFIRMED ON SITE BY THE SURVEYOR

NOTE:
ROCK LEVEL SHOWN ON ELEVATIONS ARE APPROXIMATE ONLY AND NEED TO BE CONFIRMED ON SITE BY THE GEOTECHNICAL ENGINEER

BULK EARTHWORK NOTES:

GEOTECHNICAL REPORT:
REFER TO GEOTECHNICAL REPORT PREPARED BY EI AUSTRALIA. CONTRACTOR IS TO ENSURE GEOTECHNICAL REPORT RECOMMENDATIONS ARE ADHERED TO.

SITE SURVEY:
THE SITE HAS BEEN SURVEYED BY DAW & WALTON PTY LTD. REFER DRAWINGS FOR DETAILS. THIS IS A COMPILATION OF ENGINEERING AND SITE SURVEY DRAWING, DEPICTING SITE EARTHWORKS OVER THE SURVEY DRAWING.

SPECIFICATION:
THESE NOTES ARE TO BE READ IN CONJUNCTION WITH THE HEAD SPECIFICATION.

EROSION AND SEDIMENT CONTROL:
ALLOW TO SUBMIT AND EROSION AND SEDIMENT CONTROL (ESC) PROGRAM TO GOLD COAST CITY COUNCIL FOR ENDORSEMENT PRIOR TO SITE WORKS COMMENCING. THE ESC PROGRAM IS TO COMPLY WITH THE COUNCILS EROSION AND SEDIMENT CONTROL STANDARD (VERSION 9 OR LATER) AND IS TO BE CERTIFIED BY A REGISTERED PROFESSIONAL ENGINEER OR QUEENSLAND - CIVIL OR CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL.

DUST CONTROL:
THE CONTRACTOR IS TO ENSURE THAT THE DUST PREVENTION METHODS HE ADOPTS ARE SUFFICIENT TO MEET THE REQUIREMENTS OF THE ENVIRONMENTAL PROTECTION REGULATION 1998 PART 2A, ENVIRONMENTAL NUISANCE. IT IS THE CONTRACTORS RESPONSIBILITY TO ACQUAINT HIMSELF WITH THE REQUIREMENTS.

SITE SETOUT:
REFER TO ARCHITECTS DRAWINGS FOR THE ACCURATE SETOUT OF ALL BUILDINGS, DRIVEWAYS, PARKING AREAS ETC. NOTE BULK EARTHWORKS PLAN IS INDICATIVE ONLY. CALCULATE AND CUT BATTERS FROM ARCHITECTS PLANS AND SURVEY. CROSSOVER PROFILES TO COUNCIL REQUIREMENTS.

GENERALLY:
PROCEED WITH BULK EARTHWORKS AND SHORING TO PROVIDE A STABLE SUBGRADE AND WORK SPACE FOR THE CONSTRUCTION OF THE PROPOSED DEVELOPMENT. STRIP AND DISPOSE OF TOPSOIL, REDUCE SITE TO LEVELS INDICATED AND DISPOSE OF ALL UNWANTED MATERIAL LEGALLY.

SUPERVISION:
A GEOTECHNICAL ENGINEER IS TO PROVIDE LEVEL 1 SUPERVISION (AS3798) FOR ALL EARTHWORKS DURING THE COURSE OF CONSTRUCTION. AT THE COMPLETION OF THE BULK EXCAVATION CONTRACT, THE GEOTECHNICAL ENGINEER IS TO PROVIDE CERTIFICATION THAT THE WORKS HAVE BEEN CARRIED OUT IN ACCORDANCE WITH BULK EARTHWORKS SPECIFICATIONS.

BULK EARTHWORKS PROCEDURE AND SPECIFICATION:
THE SITE IS TO BE STRIPPED OF TOPSOIL AND UNCONSOLIDATED EXISTING FILL. AT THE COMPLETION OF THE BULK EARTHWORKS, THE CONTRACTOR SHALL PROVIDE TEMPORARY OR PERMANENT DRAINAGE TO ENSURE NO SURFACE WATER IS RETAINED ON THE SITE, OR THAT SURFACE WATER FLOW DETRIMENTALLY SCOURS THE PREPARED BASE.

GEOTECHNICAL ENGINEER NOTES:
EXCAVATION TO BE CARRIED OUT UNDER GEOTECHNICAL ENGINEERS SUPERVISION. GEOTECHNICAL ENGINEER (GE) TO COMMENT ON SUITABILITY OF THE SUBCONTRACTORS METHOD OF EXCAVATION AS REMOVAL PROCEEDS.

HYDRAULICS ENGINEER:
DURING EXCAVATION COORDINATE WITH ALL HYDRAULIC ENGINEERS REQUIREMENTS FOR SEWER, GAS AND STORMWATER LINES.

AS-BUILT DRAWING:
PROVIDE AND AS-BUILT DRAWING PREPARED BY A REGISTERED SURVEYOR TO CONFIRM BULK EARTHWORKS IS COMPLETED TO REQUIRED DIMENSIONS AND LEVELS.

DILAPIDATION REPORT:
THE APPROVED SHORING WALL CONTRACTOR SHALL PREPARE A DILAPIDATION REPORT OF STREET, FOOTPATH AND ROAD FEATURES PRIOR TO INSTALLATION OF SHORING WALL.

COMPACTION NOTES:
COMPACTION BEHIND INTERNAL FORMED RETAINING WALL BY EXCAVATION CONTRACTOR USING HAND HELD RAMMERS TO ACHIEVE 98% MODIFIED DENSITY. COMPACT IN MAXIMUM 300mm THICK LAYERS AT OPTIMUM MOISTURE CONTENT OF ± 3%.

LEGEND:
B.E.L. - DENOTES BULK EXCAVATION LEVEL
E.L. - DENOTES DETAILED EXCAVATION LEVEL

PRELIMINARY ISSUE

NOTE: DO NOT SCALE OFF DRAWINGS. REFER TO ARCHITECTURAL PLANS. VERIFY DIMENSIONS ON SITE.

REV	DATE	REVISION DESCRIPTION	BY
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P1	22.05.23	ISSUED FOR PRELIMINARY INFORMATION	RCL

CLIENT: DEICORP

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3 Thomas Holt Drive
MACQUARIE PARK NSW 2113
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PO Box 77
NORTH RYDE BC NSW 1670

PROJECT: **FIVEWAYS CROWS NEST**
391423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE: **SITE RETENTION PLAN**

JOB NUMBER:	DRG NUMBER:	
23012	S01-001	
DESIGNED BY: RC	DATE:	
DRAWN BY: RCL	SCALE: 1:100 @ A0	SIZE: A0 REV: P2

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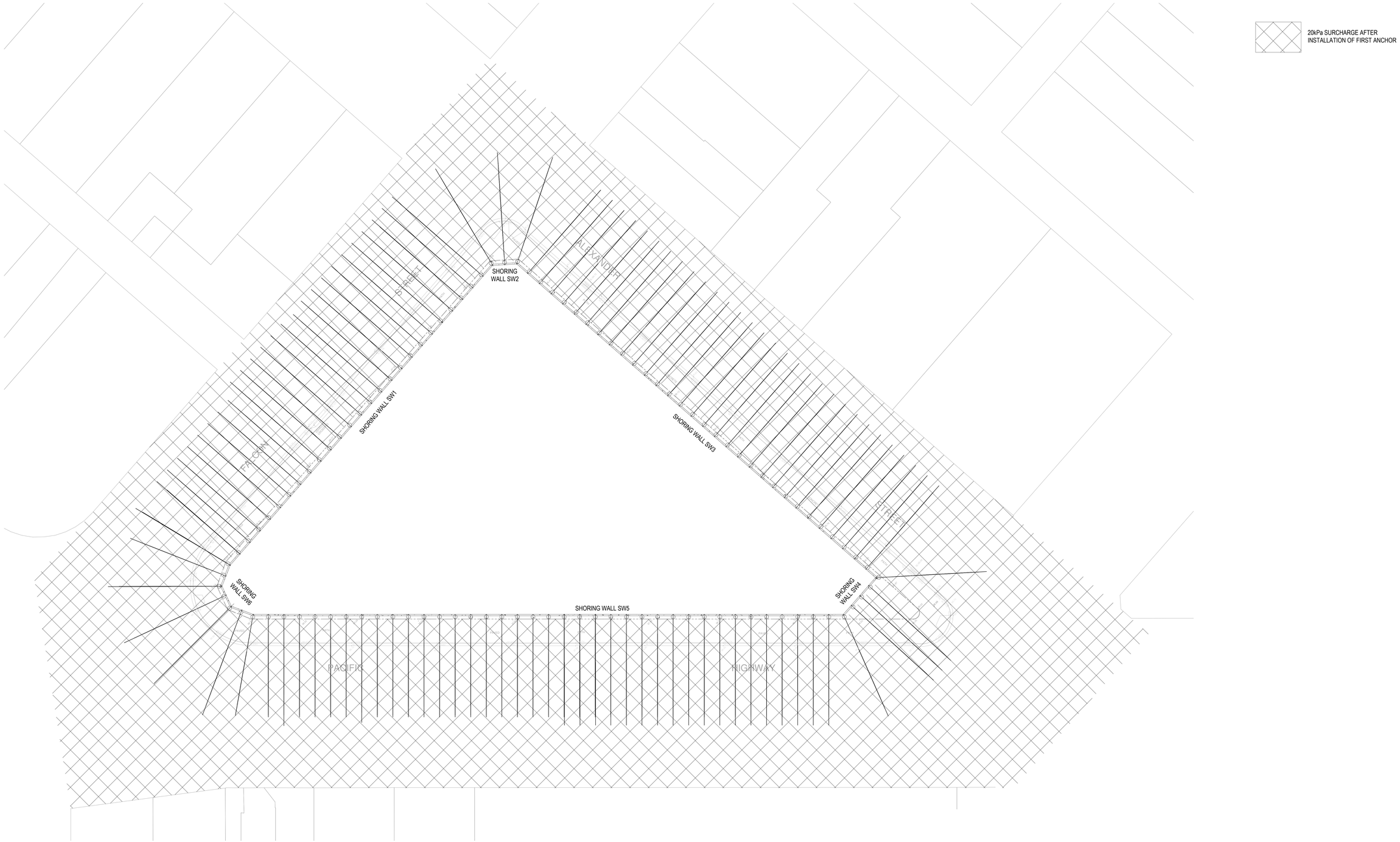

SHORING SURCHARGE LOADING PLAN

SCALE 1 : 200

PRELIMINARY ISSUE

NOTE: DO NOT SCALE OFF DRAWINGS. REFER TO ARCHITECTURAL PLANS. VERIFY DIMENSIONS ON SITE.

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NORTH RYDE BC NSW 1670

PROJECT: **FIVEWAYS CROWS NEST**
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE: **SHORING SURCHARGE LOADING PLAN**

JOB NUMBER:	DRG NUMBER:	
23012	S01-002	
DESIGNED BY: RC	DATE:	
DRAWN BY: RCL	SCALE: 1:200 @ A0	SIZE: A0 / REV: P2

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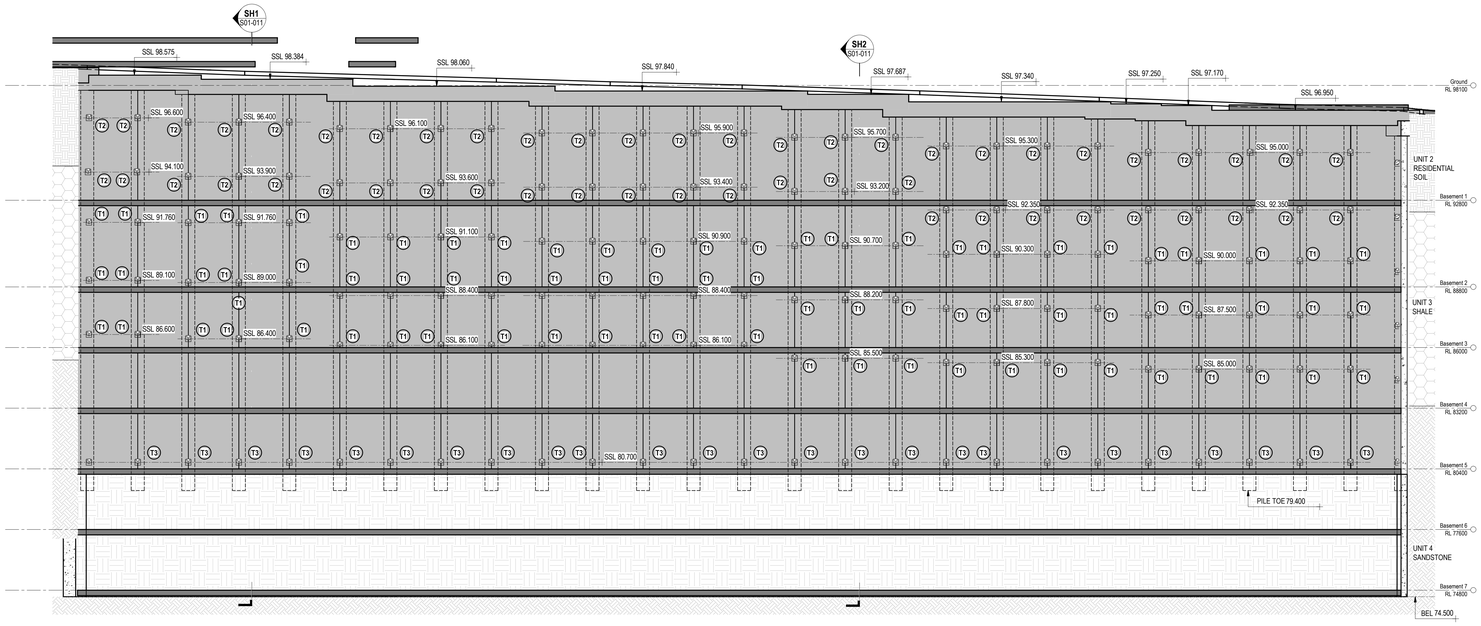
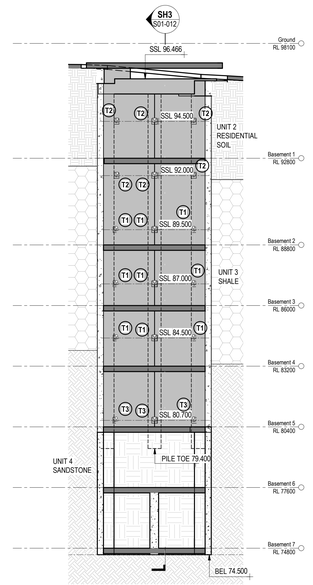


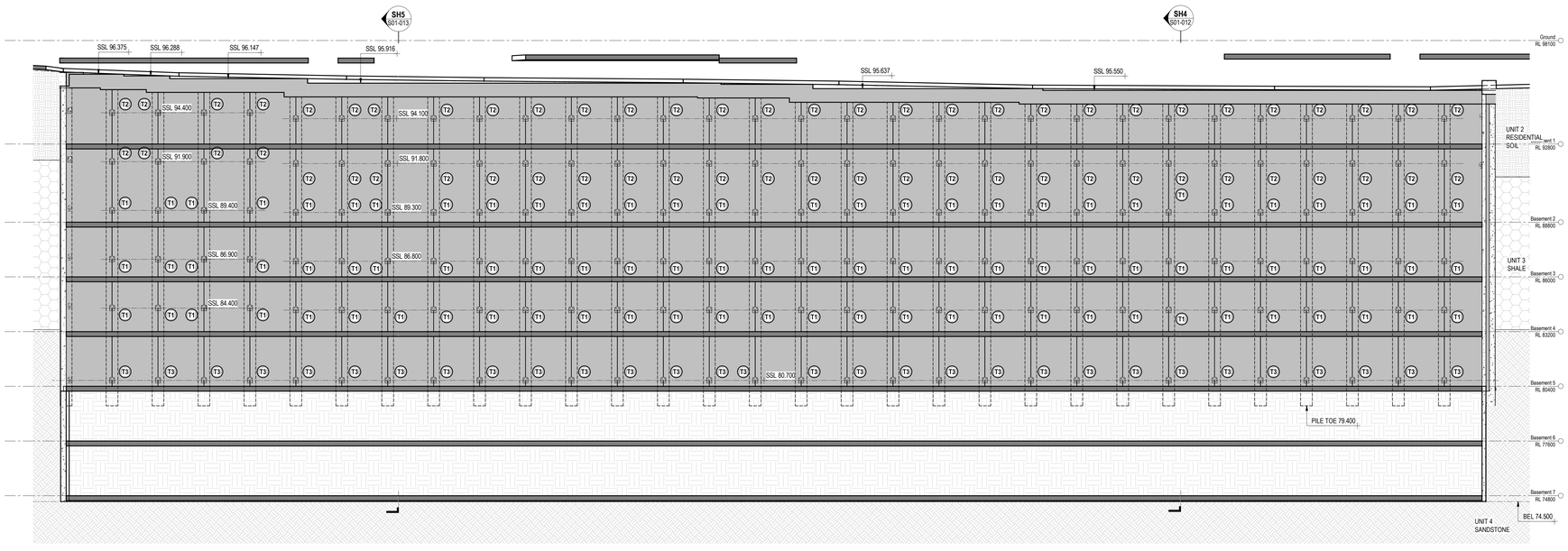
SHORING WALL SW1

SCALE 1 : 100



SHORING WALL SW2

SCALE 1 : 100



SHORING WALL SW3

SCALE 1 : 100

SHORING WALL SW4

SCALE 1 : 100

ANCHOR SCHEDULE				
MARK	SWL	LO	INCLINATION	MIN. BOND LENGTH
T1	1030kN	690kN	30°	11m
T2	990kN	675kN	30°	11m
T3	600kN	400kN	30°	5m

'SWL' DENOTES SAFE WORKING LOAD
'LO' DENOTES LOCK OFF LOAD

SHORING ANCHOR NOTES:
BOND LENGTH NOMINATED IN SHORING ANCHOR SCHEDULE FOR COORDINATION PURPOSES ONLY. SHORING CONTRACTOR IS RESPONSIBLE FOR FINAL ANCHOR DESIGN. BOND LENGTHS MAY NEED TO BE VARIED DEPENDING ON SITE CONDITIONS ENCOUNTERED.
BOND LENGTH BASED ON A 130mm HOLE WITH ALLOWABLE BOND STRESS OF 300 kPa.

HATCH DENOTES EXTENT OF 200 THICK SHOTCRETE BETWEEN SHORING PILES

HATCH DENOTES EXPOSED ROCK FACE TO BE RETAINED WITH SHOTCRETE AND ROCKBOLTS TO GEOTECHNICAL ENGINEER'S DETAILS

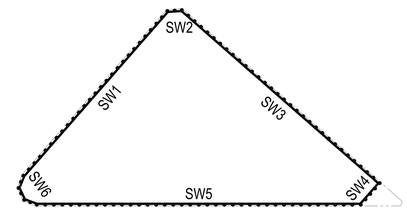
NOTE:
GROUND LEVEL SHOWN ON ELEVATIONS ARE APPROXIMATE ONLY AND NEED TO BE CONFIRMED ON SITE BY THE SURVEYOR

NOTE:
ROCK LEVEL SHOWN ON ELEVATIONS ARE APPROXIMATE ONLY AND NEED TO BE CONFIRMED ON SITE BY THE GEOTECHNICAL ENGINEER

NOTE:
MAXIMUM 500mm EXCAVATION BELOW ANCHOR HEIGHT PERMITTED PRIOR TO INSTALLING ANCHOR

GEOTECHNICAL ENGINEER TO INSPECT EXPOSED SHALE FACE REGULARLY DURING EXCAVATION AND NOMINATE APPROPRIATE ROCK BOLTS AND SHOTCRETE AS REQUIRED TO ENSURE STABILITY AT ALL TIMES.

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWING S01-001 - SITE RETENTION PLAN FOR SHORING PILE SETOUT DIMENSIONS.



SHORING KEY PLAN

SCALE 1 : 600

PRELIMINARY ISSUE

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NORTH RYDE BC NSW 1670

PROJECT:
FIVEWAYS CROWS NEST
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE:
SHORING WALL ELEVATIONS - SHEET 1

JOB NUMBER:	DRG NUMBER:	REV:
23012	S01-005	P2
DESIGNED BY: RC	DATE:	
DRAWN BY: RCL	SCALE: 1:100, 1:600 @ A0	SIZE: A0

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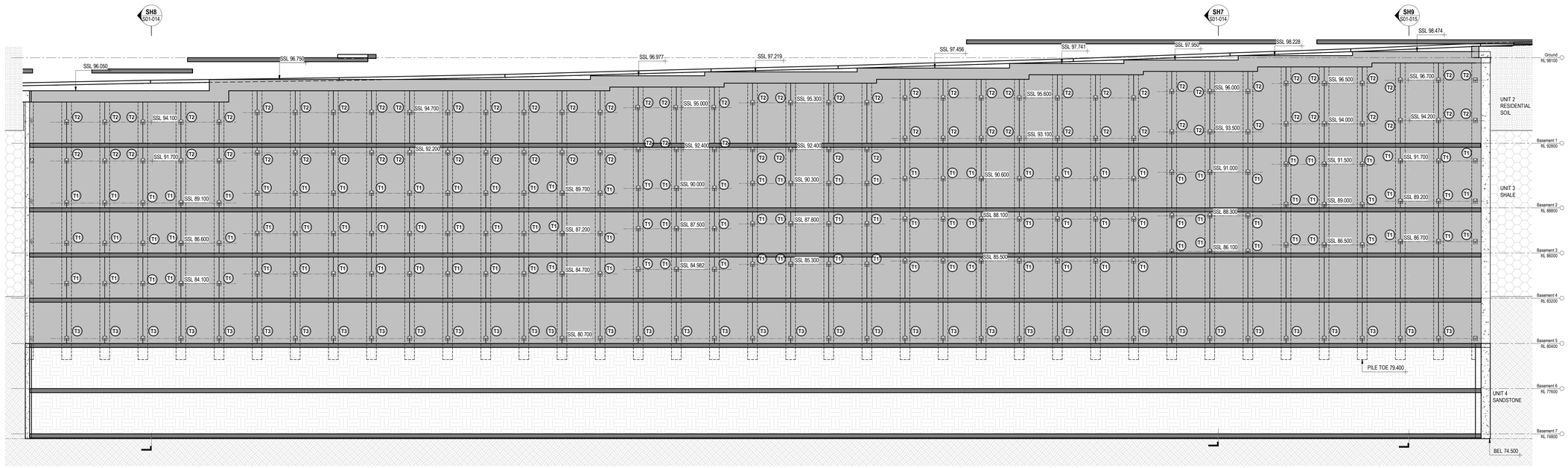
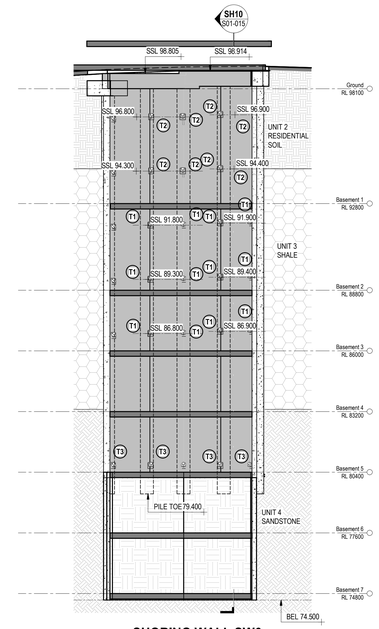


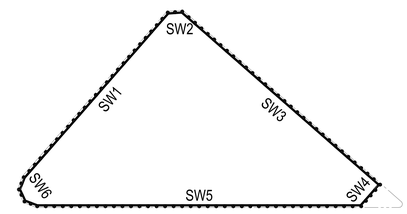
SHORING WALL SW5

SCALE 1 : 100



SHORING WALL SW6

SCALE 1 : 100



SHORING KEY PLAN

SCALE 1 : 600

ANCHOR SCHEDULE				
MARK	SWL	LO	INCLINATION	MIN. BOND LENGTH
T1	1030kN	690kN	30°	11m
T2	990kN	675kN	30°	11m
T3	600kN	400kN	30°	5m

'SWL' DENOTES SAFE WORKING LOAD
'LO' DENOTES LOCK OFF LOAD

SHORING ANCHOR NOTES:
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HATCH DENOTES EXTENT OF 200 THICK SHOTCRETE BETWEEN SHORING PILES

HATCH DENOTES EXPOSED ROCK FACE TO BE RETAINED WITH SHOTCRETE AND ROCKBOLTS TO GEOTECHNICAL ENGINEER'S DETAILS

NOTE:
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GEOTECHNICAL ENGINEER TO INSPECT EXPOSED SHALE FACE REGULARLY DURING EXCAVATION AND NOMINATE APPROPRIATE ROCK BOLTS AND SHOTCRETE AS REQUIRED TO ENSURE STABILITY AT ALL TIMES.

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWING S01-001 - SITE RETENTION PLAN FOR SHORING PILE SETOUT DIMENSIONS.

PRELIMINARY ISSUE

NOTE: DO NOT SCALE OFF DRAWINGS. REFER TO ARCHITECTURAL PLANS. VERIFY DIMENSIONS ON SITE.

REV	DATE	REVISION DESCRIPTION	BY
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NORTH RYDE BC NSW 1670

PROJECT:
FIVEWAYS CROWS NEST
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE:
SHORING WALL ELEVATIONS - SHEET 2

JOB NUMBER:	DRG NUMBER:	
23012	S01-006	
DESIGNED BY: RC	DATE:	
DRAWN BY: RCL	SCALE: 1:100, 1:600 @ A0	SIZE: A0 / REV: P2

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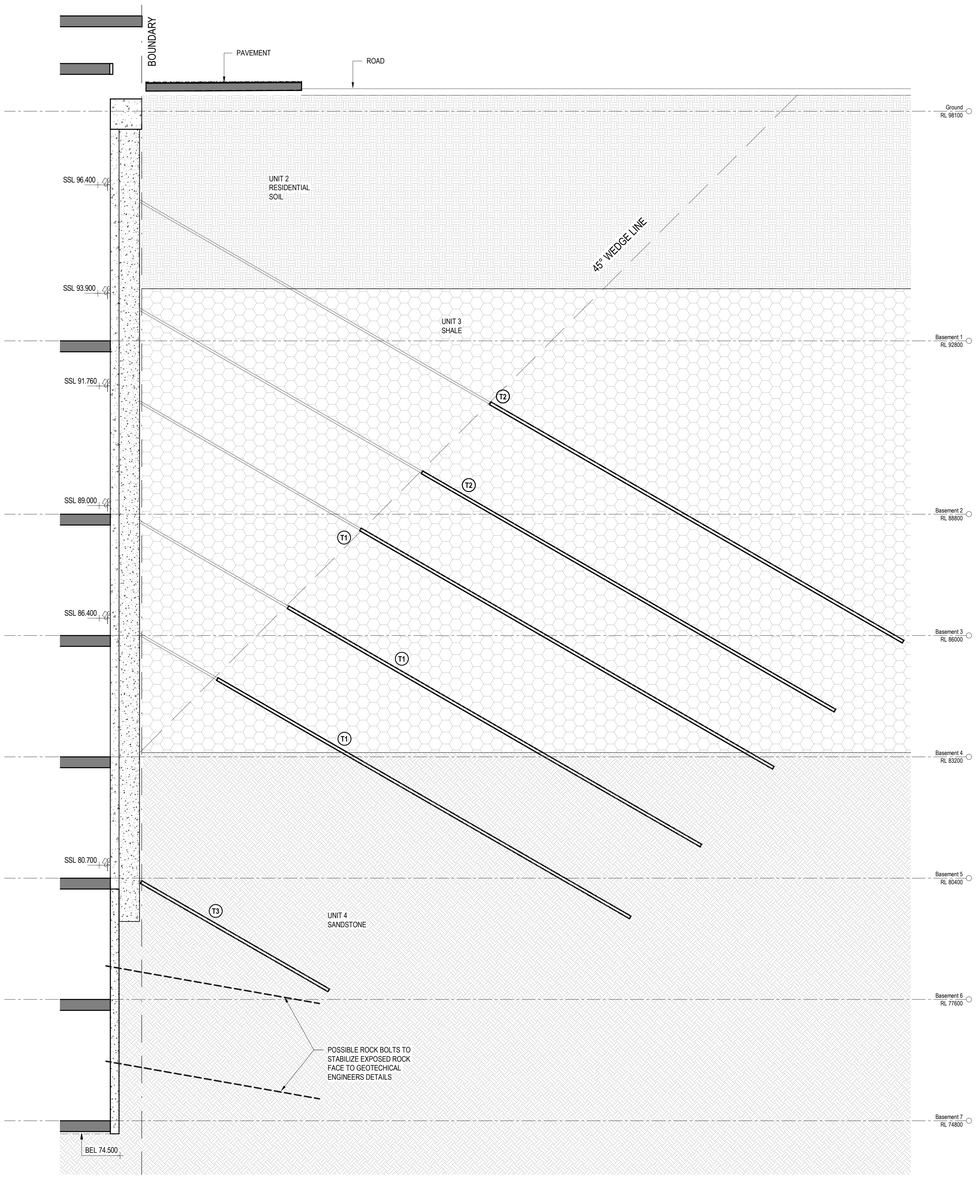

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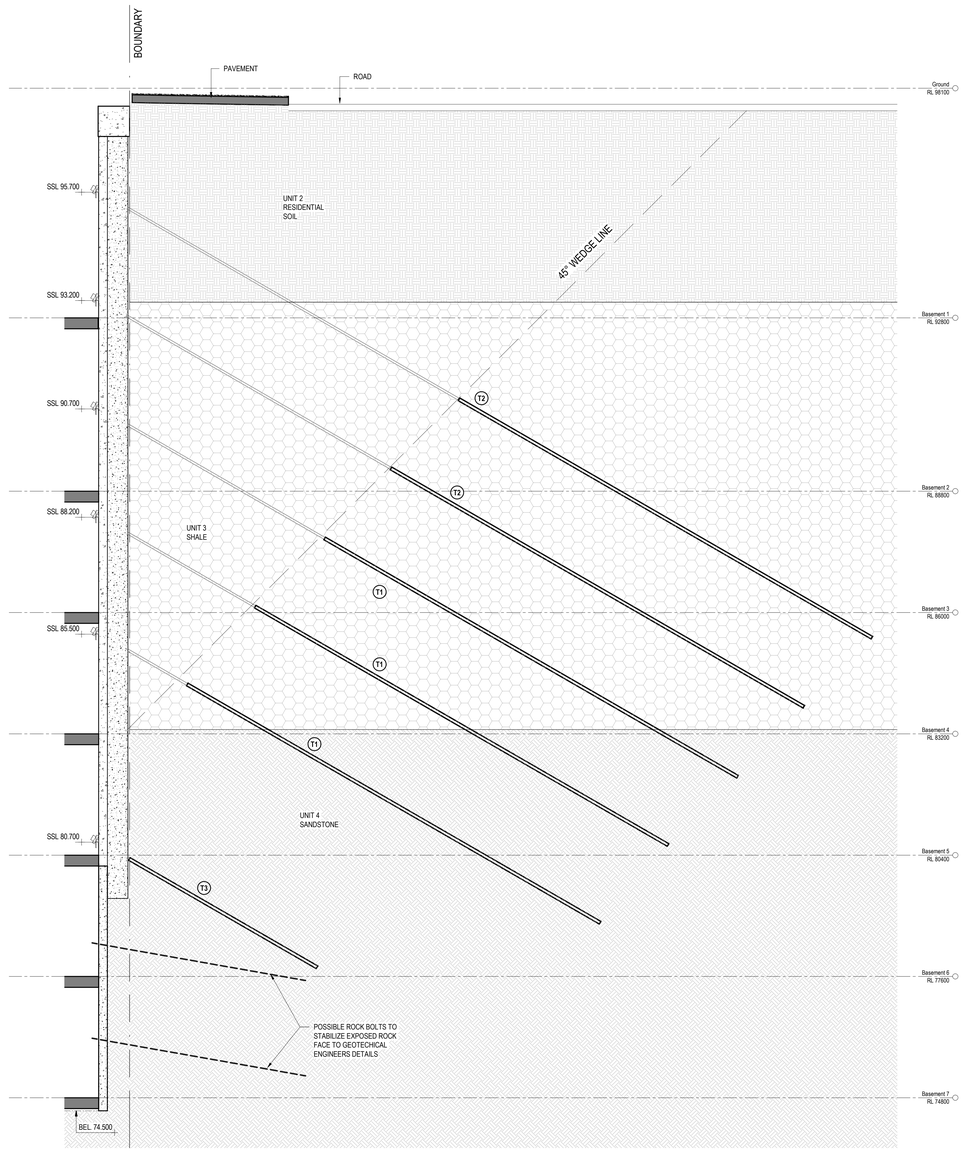

SECTION SH2 (S01-001)
Scale 1 : 50

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NOTE:
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NOTE:
BUILDER TO PROVIDE TEMPORARY SHORING WHERE CAPPING BEAM IS MORE THAN 500mm BELOW N.G.L.

NOTES:
REFER TO DRAWING S01-001 FOR SHORING AND BULK EX PLAN

PRELIMINARY ISSUE

NOTE: DO NOT SCALE OFF DRAWINGS. REFER TO ARCHITECTURAL PLANS. VERIFY DIMENSIONS ON SITE.

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PROJECT: **FIVEWAYS CROWS NEST**
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE: **SHORING WALL SECTIONS - SHEET 1**

JOB NUMBER:	DRG NUMBER:	
23012	S01-011	
DESIGNED BY: RC	DATE:	
DRAWN BY: RCL	SCALE: 1:50 @ A0	SIZE: A0 / REV: P2

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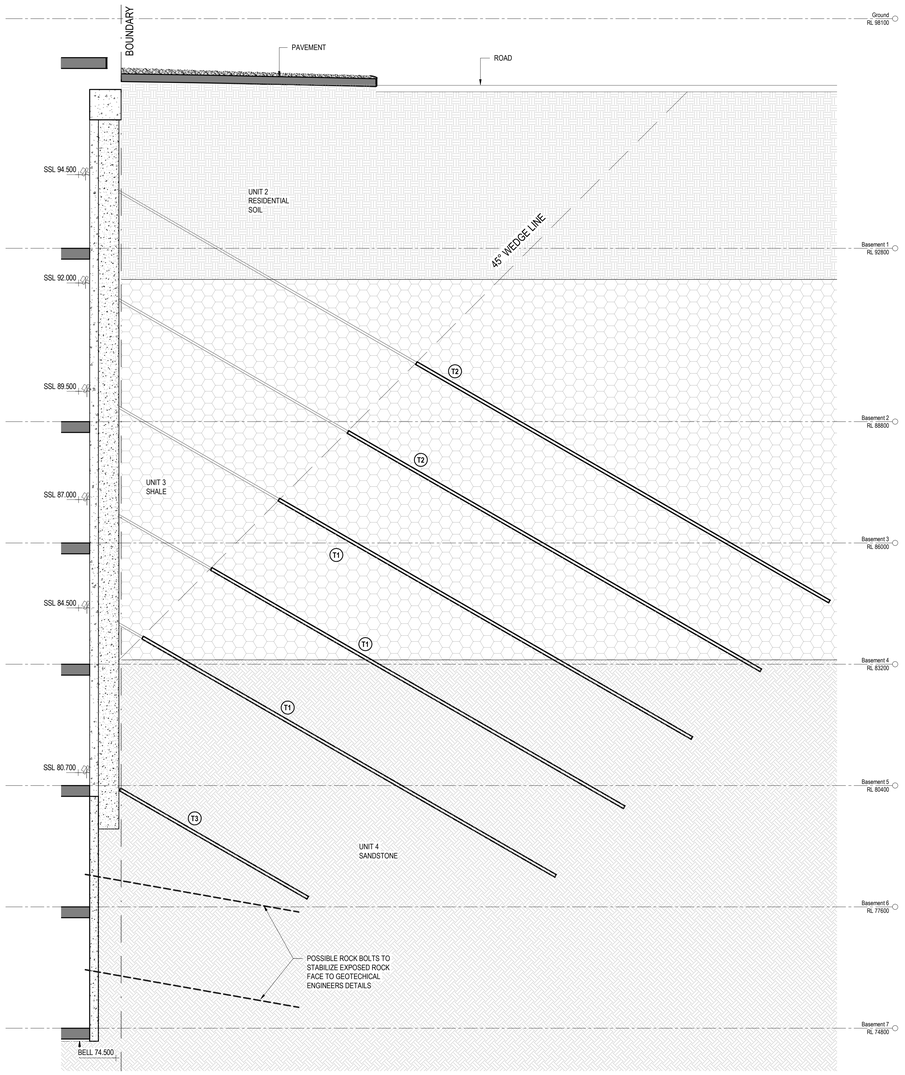

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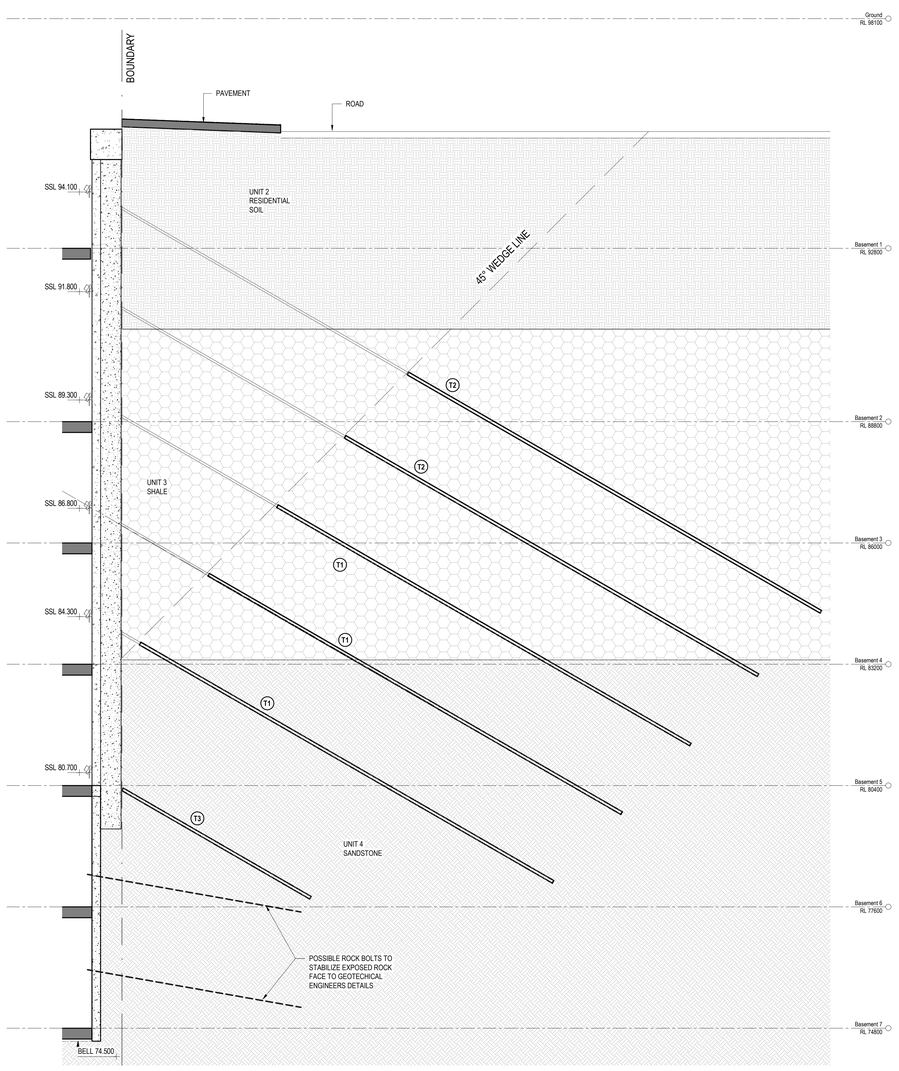
Scale 1 : 50



SECTION SH4 (S01-001)
Scale 1 : 50

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NOTE:
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NOTES:
REFER TO DRAWING S01-001 FOR SHORING AND BULK EX PLAN

PRELIMINARY ISSUE

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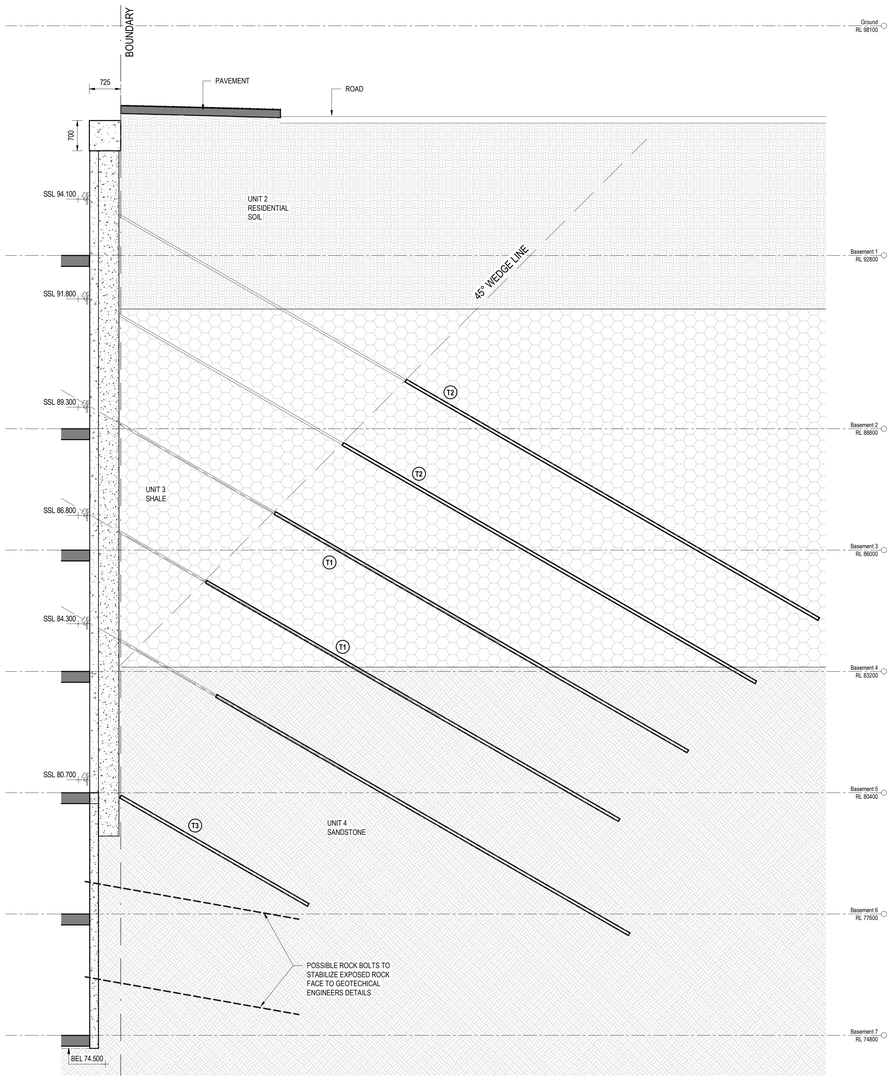
PROJECT:
FIVEWAYS CROWS NEST
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE:
SHORING WALL SECTIONS - SHEET 2

JOB NUMBER:	DRG NUMBER:	
23012	S01-012	
DESIGNED BY: RC	DATE:	
DRAWN BY: RCL	SCALE: 1:50 @ A0	SIZE: A0 / REV: P2

9/06/2023 1:13:20 PM



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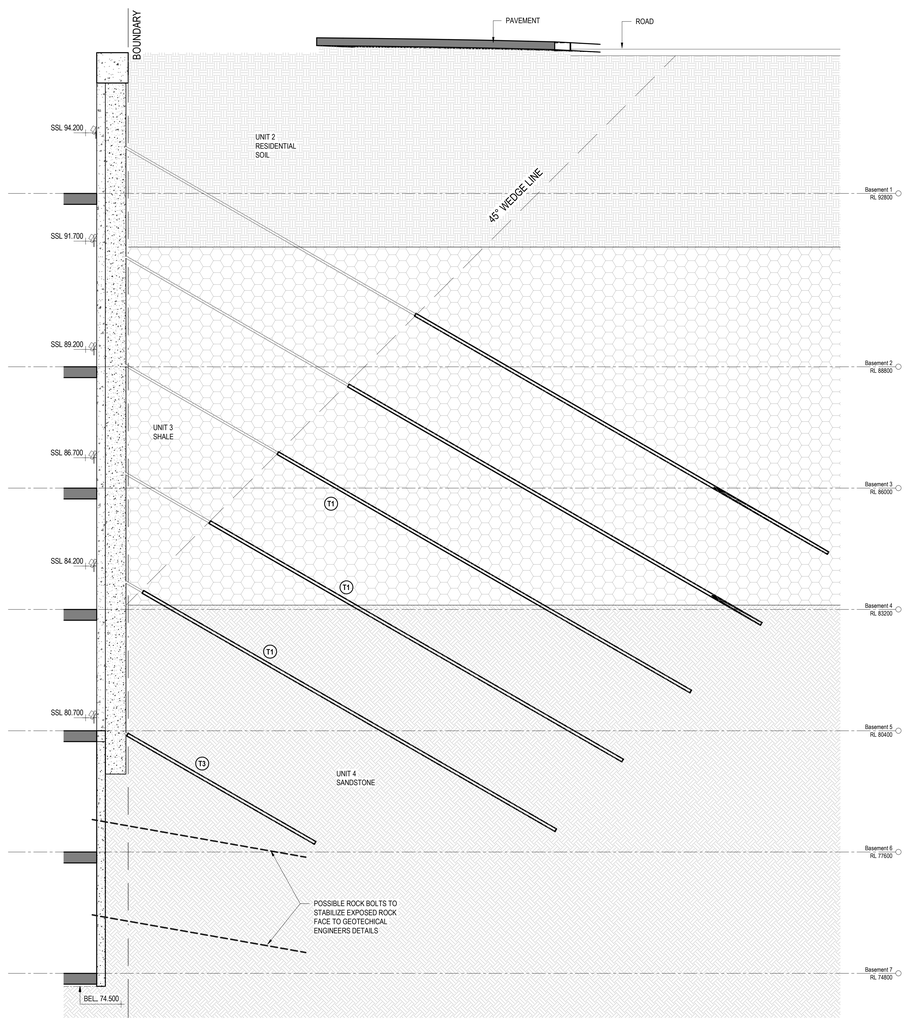

SECTION SH6 (S01-001)
Scale 1 : 50

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NOTES:
REFER TO DRAWING S01-001 FOR SHORING AND BULK EX PLAN

PRELIMINARY ISSUE

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PROJECT:
FIVEWAYS CROWS NEST
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE:
SHORING WALL SECTIONS - SHEET 3

JOB NUMBER:	DRG NUMBER:	
23012	S01-013	
DESIGNED BY:	DATE:	
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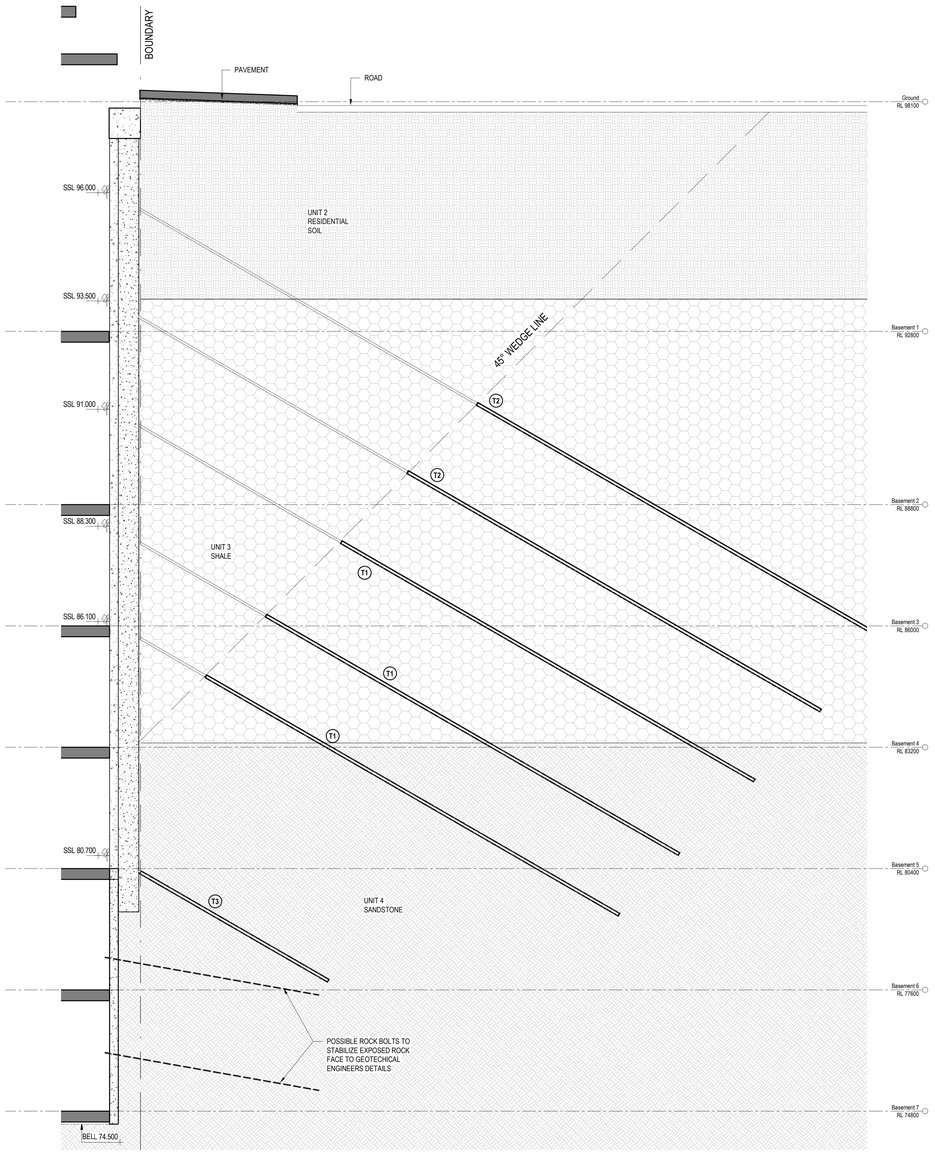
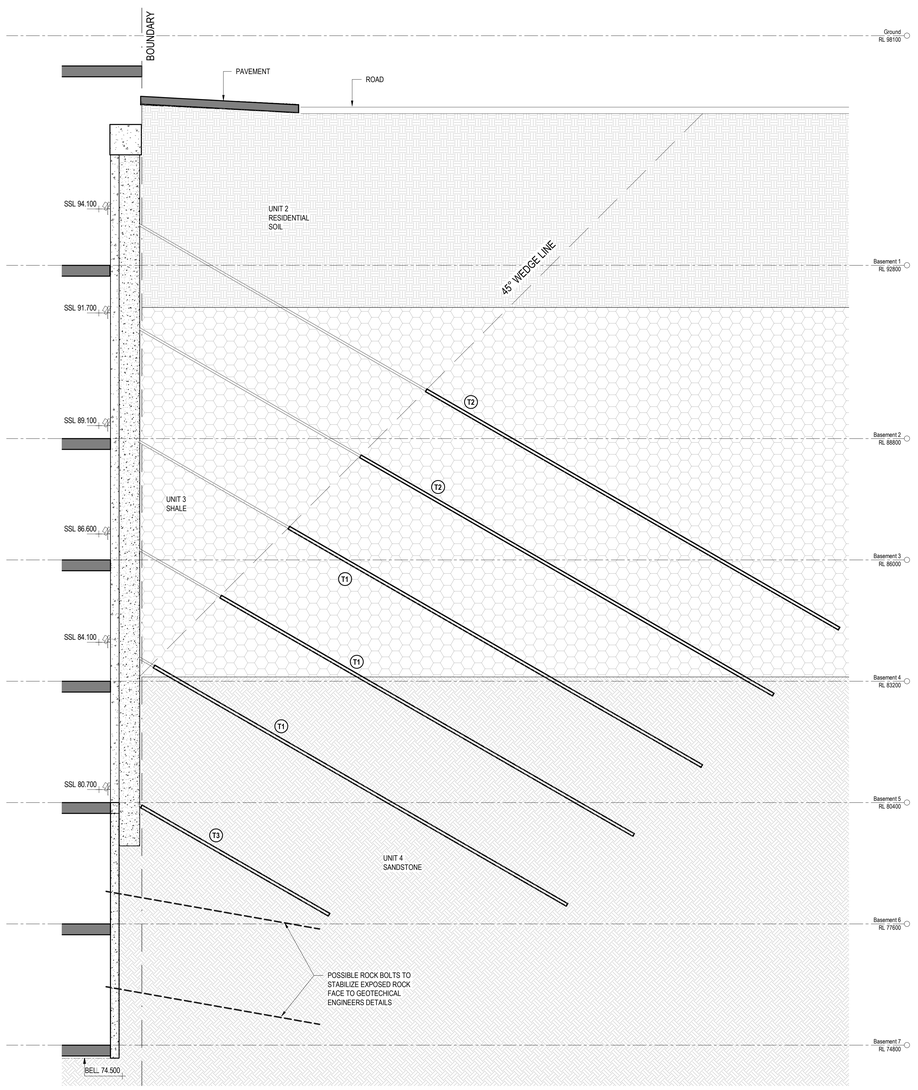


SECTION SH7 (S01-001)
Scale 1 : 50



SECTION SH8 (S01-001)
Scale 1 : 50

PRELIMINARY ISSUE

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PROJECT: **FIVEWAYS CROWS NEST**
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE: **SHORING WALL SECTIONS - SHEET 4**

JOB NUMBER:	DRG NUMBER:	
23012	S01-014	
DESIGNED BY:	DATE:	
RC		
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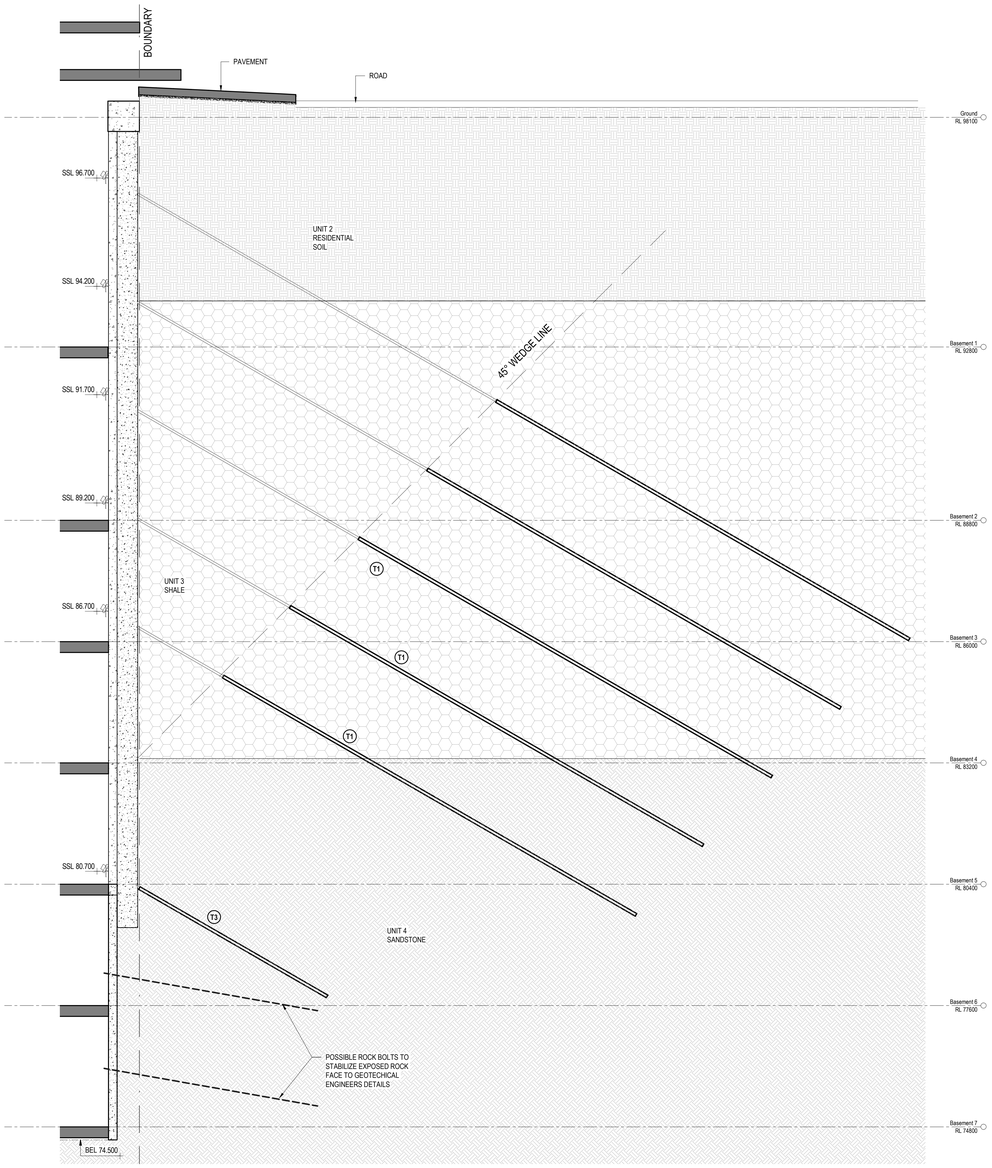

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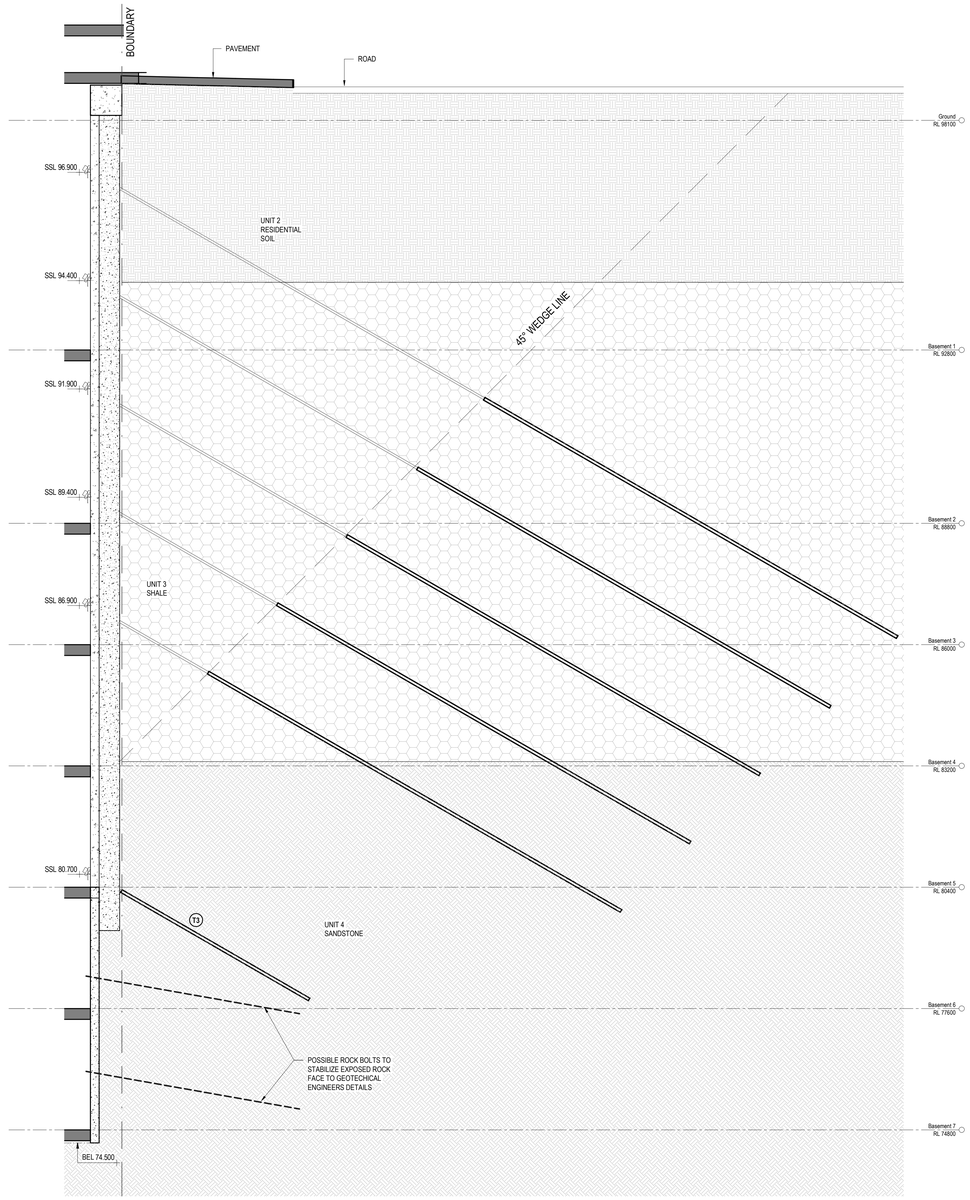

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PRELIMINARY ISSUE

NOTE: DO NOT SCALE OFF DRAWINGS. REFER TO ARCHITECTURAL PLANS. VERIFY DIMENSIONS ON SITE.

REV	DATE	REVISION DESCRIPTION	BY
P2	09.06.23	ISSUED FOR PRELIMINARY INFORMATION	RCL
P1	22.05.23	ISSUED FOR PRELIMINARY INFORMATION	RCL

CLIENT: DEICORP

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PROJECT:
FIVEWAYS CROWS NEST
3914/23 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE:
SHORING WALL SECTIONS - SHEET 5

JOB NUMBER:	DRG NUMBER:	
23012	S01-015	
DESIGNED BY: RC	DATE:	
DRAWN BY: RCL	SCALE: 1:50 @ A0	SIZE: A0 / REV: P2

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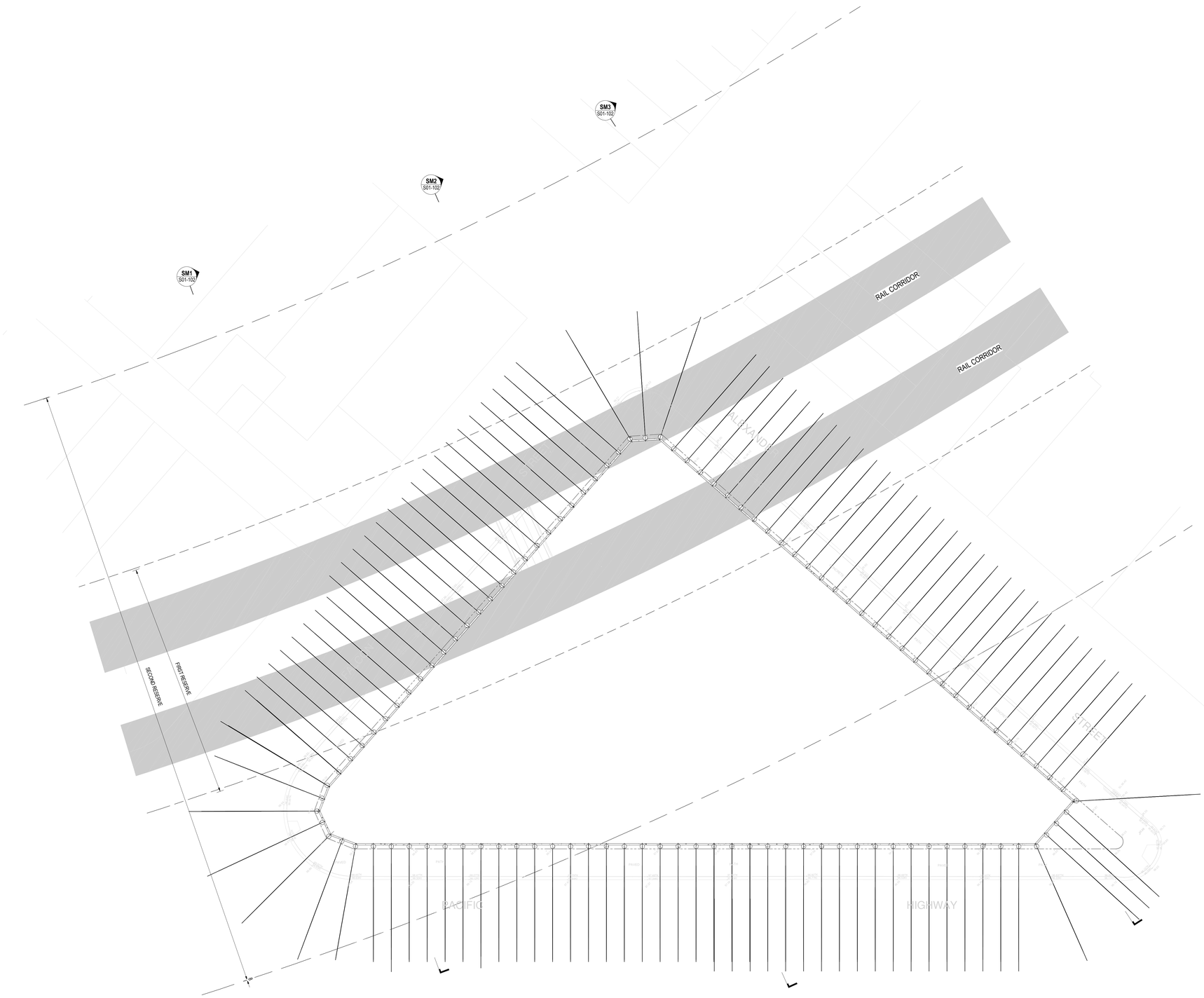
REFERENCED DRAWINGS

SURVEY - JOB NUMBER 4950-20 REVISION 02 DATE 23-04-20 BY DAW & WALTON CONSULTING SURVEYORS

DESIGN APPROACH BASEMENT DRAWINGS BY TURNER
DESIGN APPROACH METRO SECTION DRAWING BY TURNER

SWCSWTSE-JAB-TPW-AL-DRG-505123 REVISION 02 DATE 17-05-19, CLIENT TRANSPORT FOR NSW

SYDNEY METRO UNDERGROUND CORRIDOR PROTECTION TECHNICAL GUIDELINES, REFERENCE iCentral SM-20-00081444 VERSION 2 DATE APRIL 2021 BY WSP



SITE RETENTION PLAN WITH METRO RAIL TUNNEL

SCALE 1 : 200

PRELIMINARY ISSUE

NOTE: DO NOT SCALE OFF DRAWINGS. REFER TO ARCHITECTURAL PLANS. VERIFY DIMENSIONS ON SITE.

REV	DATE	REVISION DESCRIPTION	BY
P2	09.06.23	ISSUED FOR PRELIMINARY INFORMATION	RCL
P1	22.05.23	ISSUED FOR PRELIMINARY INFORMATION	RCL

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PROJECT: **FIVEWAYS CROWS NEST**
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE: **SITE RETENTION PLAN WITH METRO RAIL TUNNEL**

JOB NUMBER:	DRG NUMBER:	
23012	S01-101	
DESIGNED BY:	DATE:	
RC		
DRAWN BY:	SCALE:	SIZE: / REV:
RCL	1:200 @ A0	A0 / P2

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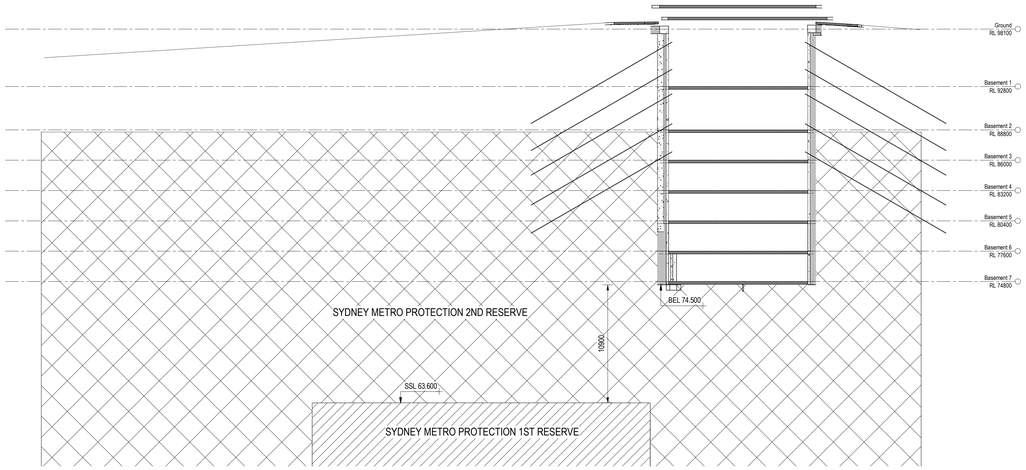

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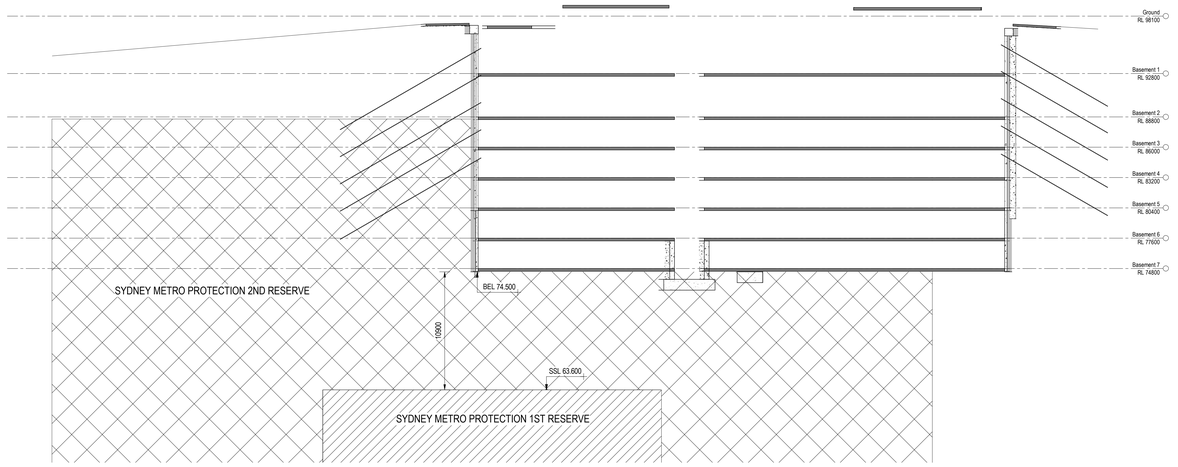

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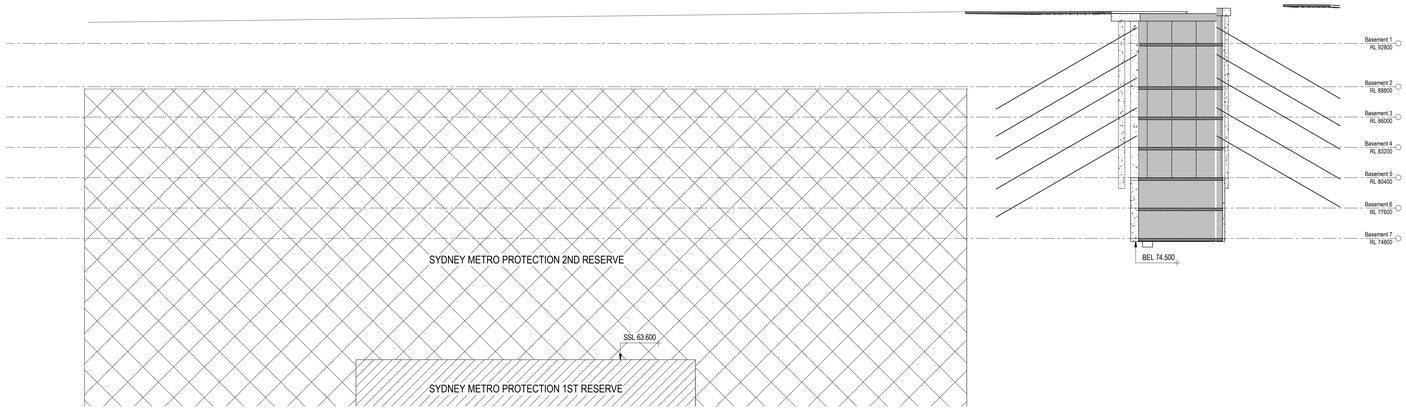

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PRELIMINARY ISSUE

NOTE: DO NOT SCALE OFF DRAWINGS. REFER TO ARCHITECTURAL PLANS. VERIFY DIMENSIONS ON SITE.

REV	DATE	REVISION DESCRIPTION	BY
P2	09.06.23	ISSUED FOR PRELIMINARY INFORMATION	RCL
P1	22.05.23	ISSUED FOR PRELIMINARY INFORMATION	RCL

CLIENT: DEICORP

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PROJECT:
FIVEWAYS CROWS NEST
391/423 PACIFIC HIGHWAY
CROWS NEST NSW 2065

TITLE:
SITE SECTIONS WITH METRO RAIL TUNNEL

JOB NUMBER:	DRG NUMBER:	
23012	S01-102	
DESIGNED BY:	DATE:	
RC		
DRAWN BY:	SCALE:	SIZE: / REV:
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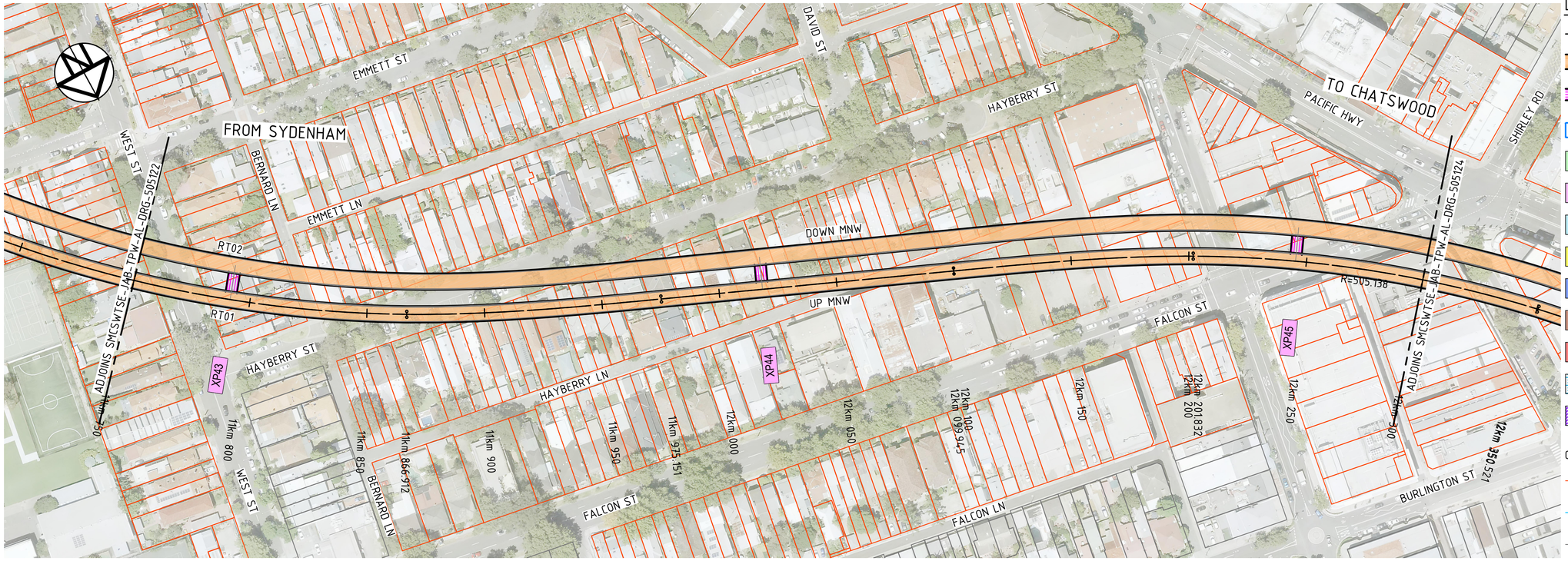
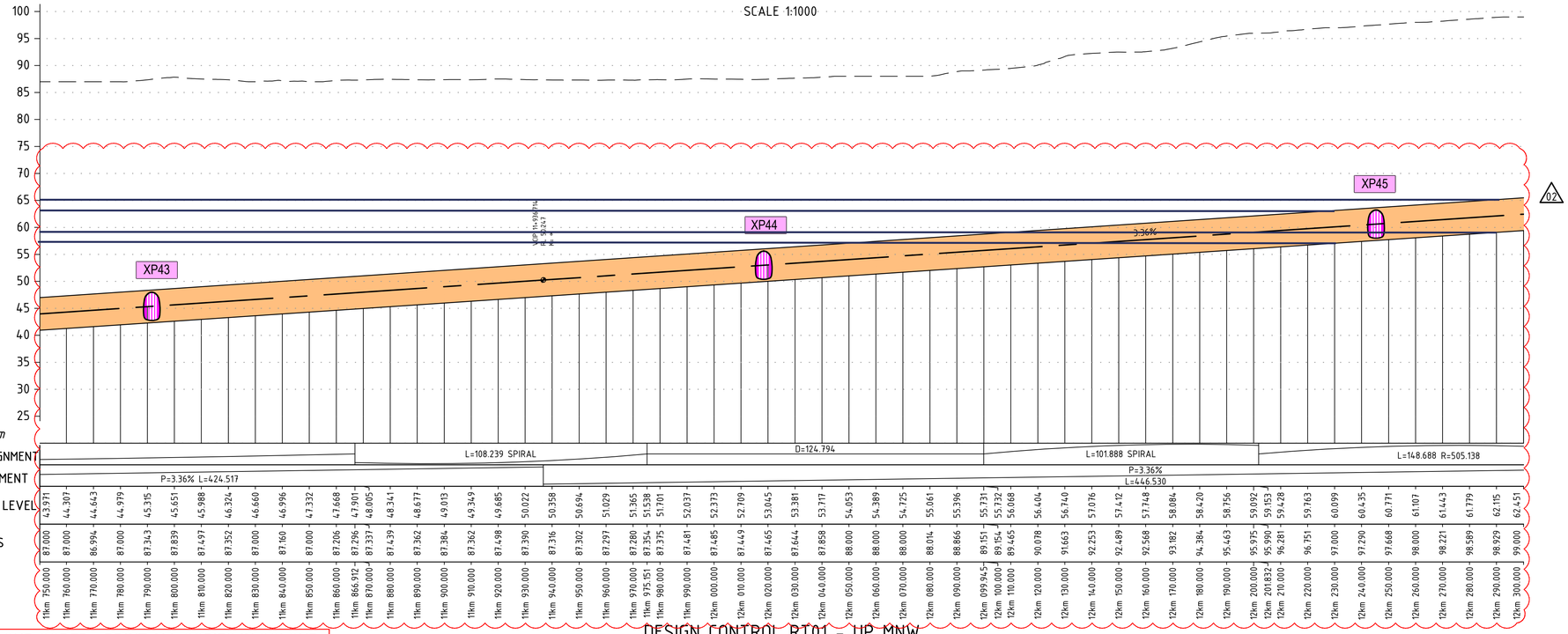


PLAN
SCALE 1:1000



DATUM R.L 20.0m

HORIZONTAL ALIGNMENT

VERTICAL ALIGNMENT

TUNNEL CENTRE LEVEL

EXISTING LEVELS

KILOMETRAGE

11km 750.000	11km 760.000	11km 770.000	11km 780.000	11km 790.000	11km 800.000	11km 810.000	11km 820.000	11km 830.000	11km 840.000	11km 850.000	11km 860.000	11km 866.912	11km 870.000	11km 880.000	11km 890.000	11km 900.000	11km 910.000	11km 920.000	11km 930.000	11km 940.000	11km 950.000	11km 960.000	11km 970.000	11km 975.151	11km 980.000	11km 990.000	12km 000.000	12km 010.000	12km 020.000	12km 030.000	12km 040.000	12km 050.000	12km 060.000	12km 070.000	12km 080.000	12km 090.000	12km 099.945	12km 100.000	12km 110.000	12km 120.000	12km 130.000	12km 140.000	12km 150.000	12km 160.000	12km 170.000	12km 180.000	12km 190.000	12km 200.000	12km 201.832	12km 210.000	12km 220.000	12km 230.000	12km 240.000	12km 250.000	12km 260.000	12km 270.000	12km 280.000	12km 290.000	12km 300.000
43.971	44.307	44.643	44.979	45.315	45.651	45.988	46.324	46.660	46.996	47.332	47.668	47.901	48.005	48.341	48.677	49.013	49.349	49.685	50.022	50.358	50.694	51.029	51.365	51.538	51.701	52.037	52.373	52.709	53.045	53.381	53.717	54.053	54.389	54.725	55.061	55.396	55.731	55.732	56.068	56.404	56.740	57.076	57.412	57.748	58.084	58.420	58.756	59.092	59.153	59.428	59.763	60.099	60.435	60.771	61.107	61.443	61.779	62.115	62.451
87.000	87.000	86.994	87.000	87.343	87.839	87.497	87.352	87.000	87.160	87.000	87.206	87.296	87.337	87.439	87.362	87.384	87.362	87.498	87.390	87.316	87.302	87.297	87.280	87.354	87.375	87.481	87.485	87.449	87.465	87.644	87.858	88.000	88.000	88.000	88.014	88.866	89.151	89.154	89.465	90.078	91.663	92.253	92.489	92.568	93.182	94.384	95.463	95.975	95.990	96.281	96.751	97.000	97.290	97.668	98.000	98.221	98.589	98.929	99.000

DESIGN CONTROL RT01 - UP MNW
SCALE - HORIZ. 1:1000, VERT. 1:500

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

LEGEND

- TUNNEL ALIGNMENT CONTROL LINE
- RUNNING TUNNELS
- CROSS PASSAGES AND CROSS PASSAGES WITH SUMP
- STUB TUNNEL
- DIVE STRUCTURES
- STATION EXCAVATIONS
- NOZZLE ENLARGEMENTS
- CROSSOVER CAVERN
- STATION SHAFTS
- STATION CAVERNS
- STATION ADITS
- SHAFT
- LIFT SHAFTS

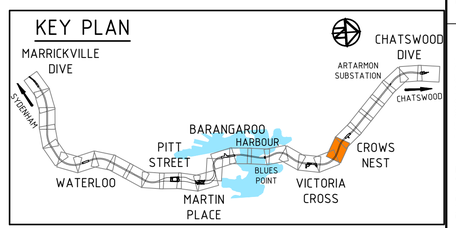
CADASTRAL MODEL (BASED ON PR124656-SACM-001-E)

- SURVEY ACCURATE CADASTRAL MODEL
- NEAR SURVEY ACCURATE CADASTRE
- DIGITAL CADASTRAL DATABASE

NOTE

1. FOR ALL ALIGNMENT NOTES REFER DRAWING NO. SMCSWTSE-JAB-TPW-AL-DRG-505005.

KEY PLAN



FOR CONSTRUCTION

AMD	DESCRIPTION	DESIGNER SIGN./DATE	VERIFIED SIGN./DATE	APPROVED SIGN./DATE
02	AMENDMENTS TO VERTICAL ALIGNMENT DESIGN FOR RT01 AND RT02	17.05.19	17.05.19	17.05.19
01	ASSURED FOR CONSTRUCTION	17.04.19	17.04.19	17.04.19
00	ASSURED FOR CONSTRUCTION	09.01.18	09.01.18	09.01.18

CO-ORDINATE SYSTEM: MGA | HEIGHT DATUM: AHD | SCALE: AS SHOWN

SCALES
0 10 20 30 40 50 60m
SCALE 1:1000 AT A1 SIZE
0 5 10 15 20 25 30m
SCALE 1:500 AT A1 SIZE

IC CERTIFIED - IC CERTIFICATE SMCSWTSE-IC-CER-B2-008

CLIENT
NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: Metro city & southwest | John Holland | CPB | Ghella | Arcadis | BG&E | NOMA Consulting | Hochtief | PSM | McMullen Jacobs Associates

DRAWN	E. ESTORES JR.	17.05.19
DESIGNED	TfNSW	-
DRG CHECK	F. BATHAN	17.05.19
DESIGN CHECK	N/A	-
APPROVED	D.ROBERTSON	17.05.19

SYDNEY METRO CITY & SOUTHWEST

TSE PROJECT WIDE

ALIGNMENT

GA PLAN AND LONGITUDINAL SECTION

TUNNEL ALIGNMENT CONTROL LINE RT01 - SHEET 23

FILE No. | SHEET: 39 OF 76 | A1

STATUS: FOR CONSTRUCTION ©

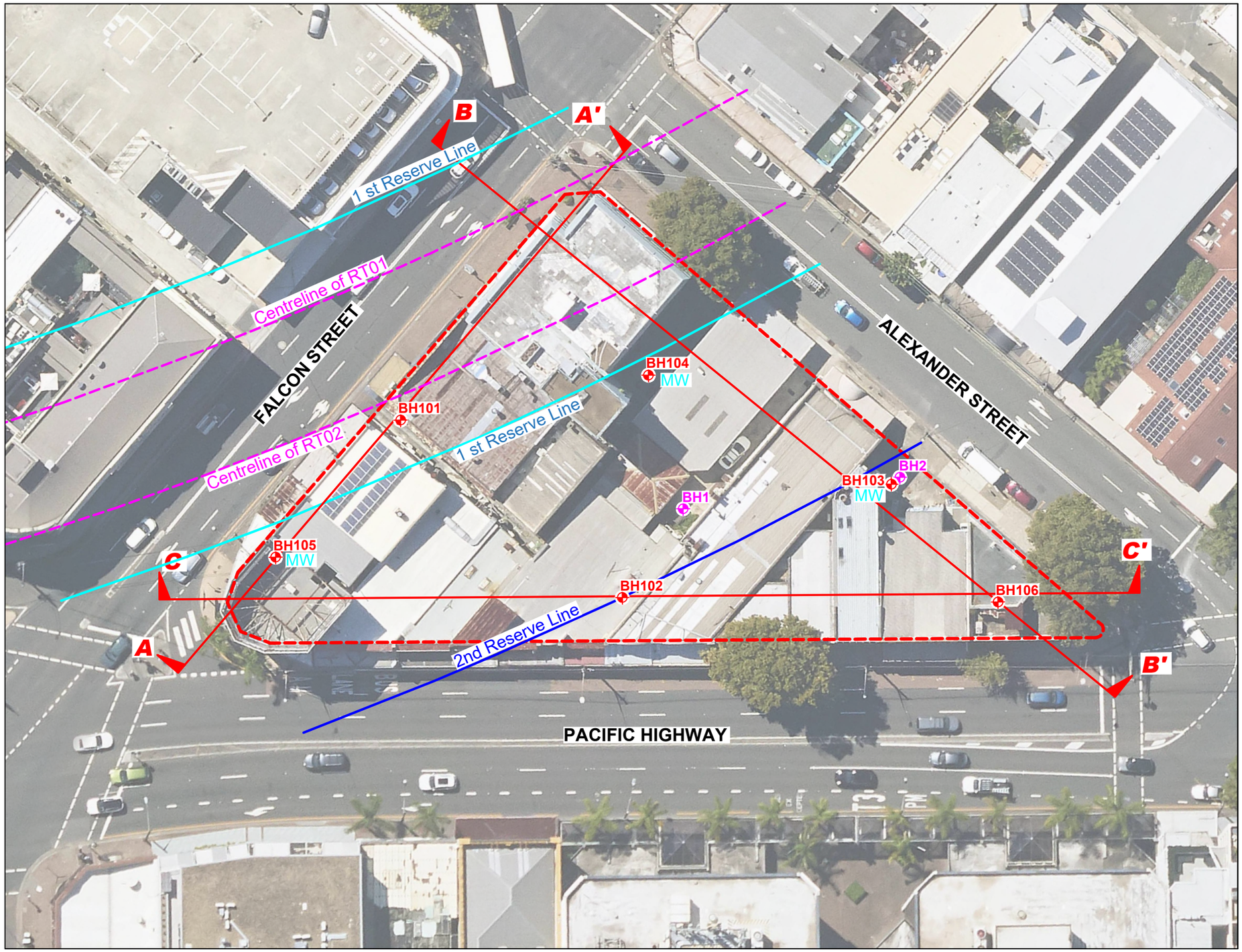
DRG No. SMCSWTSE-JAB-TPW-AL-DRG-505123 | 02 | EDMS No.

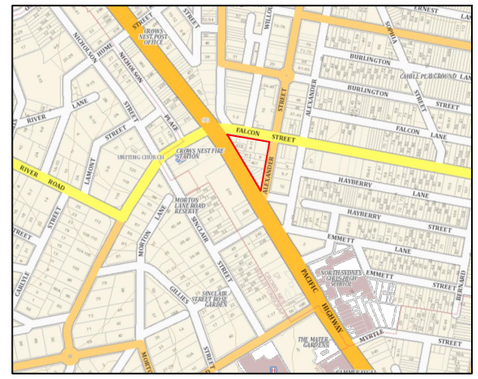
DF 801*554

File Plotted C:\SMCSW-TSE-Export\ | Plot Date & Time 5/17/2019 12:27 PM | Plotted by EEAZ4049

Appendix C

DP Groundwater Well Location Plan and Borehole/Well Logs





Locality Plan

NOTE:
1: Base image from Metromap (Dated (01.03.2023)
2: Base Plan from Stantec, Drawing No.3050-01019-001-002, Revision 02 (Dated 05.05.2023)

0 5 10 15 20 30 40 50m

1:500 @ A3

LEGEND

- DP Borehole Location
- EI Australia Borehole Location
- MW Temporary Observation Well
- Site Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Deicorp Pty Ltd		TITLE: **Test Location Plan**
OFFICE: Sydney	DRAWN BY: MN	**Fiveways, Crows Nest**
SCALE: 1:500 @ A3	DATE: 29.06.2023	**391-423 Pacific Hwy, 3-15 Falcon St and 8 Alexander St, Crows Nest**

PROJECT No: 86645.03
DRAWING No: 1
REVISION: 0

Description and Classification Methods

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

Soil Types

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

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

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

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

Definitions of grading terms used are:

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

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

In fine grained soils (>35% fines)

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

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

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

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

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

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

Soil Descriptions

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Origin

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

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

Moisture Condition – Coarse Grained Soils

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

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

Moisture Condition – Fine Grained Soils

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

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

Rock Strength

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

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Rock Descriptions

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

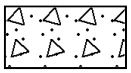
Symbols & Abbreviations

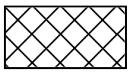
Graphic Symbols for Soil and Rock

General


Asphalt


Road base

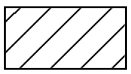

Concrete

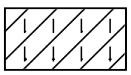

Filling

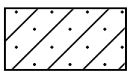
Soils


Topsoil

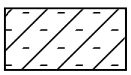

Peat

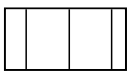

Clay

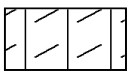

Silty clay

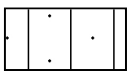

Sandy clay

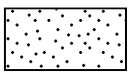

Gravelly clay

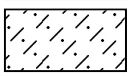

Shaly clay

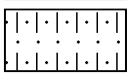

Silt


Clayey silt


Sandy silt

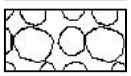

Sand

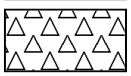

Clayey sand


Silty sand


Gravel

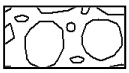

Sandy gravel


Cobbles, boulders

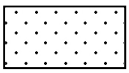

Talus

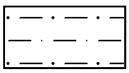
Sedimentary Rocks

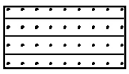

Boulder conglomerate

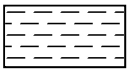

Conglomerate


Conglomeratic sandstone

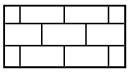

Sandstone


Siltstone

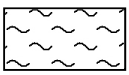

Laminite

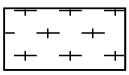

Mudstone, claystone, shale


Coal


Limestone

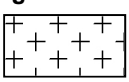
Metamorphic Rocks

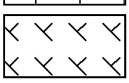

Slate, phyllite, schist

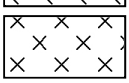

Gneiss

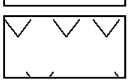

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 97.1 m AHD
EASTING: 333557
NORTHING: 6255475
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 86645.03
DATE: 1/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
97	0.05	BASALT PAVERS - 50mm thick										
	0.1	BEDDING SAND - 50mm thick										
		FILL/Gravelly CLAY: low to medium plasticity, grey and mottled orange-brown, sub-angular brick, concrete and bluemetal gravel, trace fine to medium sand, w = PL, apparently firm										
96	1											
	1.8											
	1.9	Gravelly CLAY Cl: medium plasticity, grey and pale orange, sub-angular shale gravel, w = PL, extremeley weathered shale										
95	2	Bore discontinued at 1.9m - discontinued due to sewer position unconfirmed.										
94	3											
93	4											
92	5											
91	6											
90	7											
89	8											
88	9											

RIG: Vac-Truck **DRILLER:** AUM **LOGGED:** JCP **CASING:** None

TYPE OF BORING: Non Destructive Digging

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Borehole discontinued to due to unknown location of sewer pipe.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.5 m AHD
EASTING: 333552
NORTHING: 6255441.3
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 86645.03
DATE: 15 - 17/5/2023
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
96	0.9	FILL/Sandy SILT: low plasticity, pale brown and brown, fine sand, with gravel, brick and gyprock cobbles, trace fabric, wood, plastic fines, w < PL, apparently loose							E			
									E			
95	1	Silty CLAY CI: low plasticity, pale orange-brown and grey mottled orange, w < PL, ironstone gravel, apparently dense, residual							E			
		Below 1.48m: ironstone gravel lenses										
94	2 2.0	SHALE: pale grey, grey and orange-brown, thinly laminated, very low strength, extremely weathered, fractured, Ashfield Shale						Unless otherwise stated, discontinuities are bedding, 0-5°, pl, sm, cly vn or fe stn	C	100	0	
93	3	Below 3.0m: highly weathered						3.02m: J40°, pl, sm, cln 3.06m: Fg 40mm 3.1m: J60°, pl, he, cly vn 3.19m: J30°, pl, sm, cln, roots 3.21m: J60°, pl-ir, sm, cln 3.26-3.35m: J60-80°, pl-ir, sm, cln	C	93	9	PL(A) = 0.4
92	4 4.34	Below 4.34m: very low to low strength						3.36m: J85-90°, pl-un, sm, cln, 50mm 3.45m: J30°, un, sm, cln 3.48m: J60°, pl, he, fe stn 3.53m: B0°, pl-un, sm, cly vn and roots 3.54m: J40°, pl, he, cly vn 3.66-3.81m: J70-90°, ir, sm, cln 3.82-3.92m: 2x J50°, pl, he	C	100	0	PL(A) = <0.1 PL(A) = <0.1 PL(A) = 0.2
91	5							4.06-4.14m: J60°, pl, sm, cly vn 4.19m: Ds 50mm 4.24m: CORE LOSS: 100mm	C	100	52	PL(A) = 0.1
90	6 6.8	SHALE: dark grey, thinly laminated, very low to low strength, slightly weathered to fresh, slightly fractured, Ashfield Shale						4.35m: J75°, pl, sm, cly vn 4.59m: J30°, pl, sm, cln 4.7m: J75°, pl, sm, cly vn 4.78m: J40°, pl, sm, cln				
89	7							4.82m: J40°, pl, sm, cln 4.84m: J60°, pl-un, sm, cln, 60mm 4.94m: J40° pl, sm, cln 5.02m: B10°, pl, he, cly vn 5.1m: J10°, pl, he, cly vn 5.17m: Ds 60mm 5.33m: Ds 30mm 5.37m: B10°, pl, cly ctg 2mm	C	92	21	PL(A) = 0.1 PL(A) = 0.2
88	8	Below 8.0m: low strength										
87	9							5.48m: J55°, pl, sm, cln 5.76-5.96m: 3x B10°, pl, sm, cly vn and fe stn 6.02m: J20°, pl, sm, cln 6.06m: J80°, pl, sm, cln, 30mm 6.28m: J15°, pl, he, fe	C	91	12	PL(A) = 0.1
	10.0											

RIG: Proline **DRILLER:** Tightsite **LOGGED:** ECB **CASING:** HQ to 1.5m

TYPE OF BORING: Hand auger to 1.5m, NMLC Coring to 23.25m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.5 m AHD
EASTING: 333552
NORTHING: 6255441.3
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 86645.03
DATE: 15 - 17/5/2023
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
86	10.76	SHALE: dark grey, thinly laminated, low strength, fresh, slightly fractured, Ashfield Shale Below 10.15m: fractured, steeply dipping joints						stn 6.44m: J10°, pl, he, fe stn 6.72m: J20°, pl, sm, cln 6.82-6.91m: J90°, pl-ir, sm, cln 6.91m: J30°, pl, sm, cln, 70mm 6.97m: J20°, pl, sm, cln 7.06m: J70°, pl-un, sm, cln, 70mm 7.14-7.41m: 5x J40°, pl, sm, cln 7.5-8.0m: 2x J85°, pl, sm, cln 8.19-8.67m: 8x J20-30°, pl, sm, cln 8.60-9.04m: J85°, pl, sm, cln 9.18m: J85°, pl, sm, cln 9.20-10.09m: 12x J15-30°, pl, sm, cln 10.1-10.2m: J70° pl, sm, cln, 100mm 10.46m: Fg 40mm 10.51-10.73m: J60°, pl, sm, cln 10.73m: CORE LOSS: 30mm 11.07-11.65m: J85°, pl, sm, cln 11.88m: Fg 300mm 11.66-12.23m: J85-90°, pl, sm, cln 12.29-12.83m: 2x J85-90°, pl, sm, cl 12.9m: J70°, pl, sm, cln 12.96m: J30°, pl, sm, cln 13.09m: J50°, pl, sm, cln 13.14m: J20°, pl, sm, cln 13.14-13.38m: 3x J20-30°, pl, sm, cln 13.49-13.66m: 2x J50-60°, pl, cm, cln 13.86m: J30°, pl, sm, cln 13.86-14.01m: 2x J25-30°, pl sm, cln 14.22-14.54m: J15-40°, pl, sm, cln 14.66-14.88m: 11x J40°, pl, sm, cln 14.94-15.04m: J60° pl, sm, cln, 100mm 15.35m: J25°, pl, sm, cln 15.49m: J40°, pl, sm, cln 15.59-16.09m: 4x J15-30°, pl, sm, cln 16.21m: J70°, pl, sm, cln 16.27-16.59m: 4x J25-40°, pl, ro, cln 17.28-17.71m: 5x J15-30°, pl, ro, cln 19.17m: B20°, pl, ro, cln 19.37m: B0-5°, un, ro, cln	C	91	12	PL(A) = 0.3
85	11	At 11.76m: tuff layer, 10mm thick							C	97	90	PL(A) = 0.2
84	12											
83	13								C	100	90	PL(A) = 0.2
82	14								C	100	94	PL(A) = 0.3
81	15											
	15.34	SILTSTONE: dark grey and pale grey, thickly laminated, low strength, fresh, slightly fractured, Mittagong Formation										PL(A) = 0.2
	16								C			PL(A) = 0.7 PL(A) = 0.2
80	16.1	SANDSTONE: fine grained, pale grey and grey, distinct and indistinctly cross-bedded medium strength, fresh, slightly fractured, Mittagong Formation										
79	17 17.0	SANDSTONE: fine to medium grained, pale grey and grey, thinly cross-bedded, with siltstone laminations, high strength, fresh, unbroken, Hawkesbury Sandstone							C	100	68	PL(A) = 0.9
78	18											PL(A) = 1.2
77	19								C	100	93	PL(A) = 1
	20.0											

RIG: Proline **DRILLER:** Tightsite **LOGGED:** ECB **CASING:** HQ to 1.5m

TYPE OF BORING: Hand auger to 1.5m, NMLC Coring to 23.25m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.5 m AHD
EASTING: 333552
NORTHING: 6255441.3
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 86645.03
DATE: 15 - 17/5/2023
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
76	21	SANDSTONE: fine to medium grained, pale grey and grey, thinly cross-bedded, with siltstone laminations, high strength, fresh, unbroken, Hawkesbury Sandstone						20.57m: B20°, pl, ro, cln	C	100	100	PL(A) = 1.3
75	22								C	100	100	PL(A) = 0.9
74	23											PL(A) = 1.1
	23.25											PL(A) = 0.7
73	24	Bore discontinued at 23.25m - target depth reached										
72	25											
71	26											
70	27											
69	28											
68	29											
67												

RIG: Proline **DRILLER:** Tightsite **LOGGED:** ECB **CASING:** HQ to 1.5m

TYPE OF BORING: Hand auger to 1.5m, NMLC Coring to 23.25m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH102 PROJECT: 86645.03 MAY 2023

1.48 – 6.0m

BORE: BH102 PROJECT: 86645.03 MAY 2023

6.0 – 11.0m

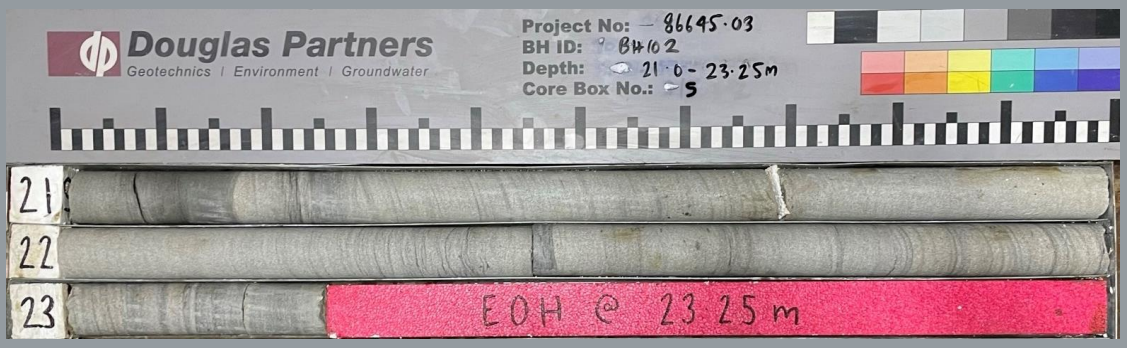
BORE: BH102 PROJECT: 86645.03 MAY 2023

11.0 – 16.0m

BORE: BH102 PROJECT: 86645.03 MAY 2023

16.0 – 21.0m

BORE: BH102 **PROJECT: 86645.03** **MAY 2023**



21.0 – 23.25m

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
EASTING: 333581
NORTHING: 6255420.4
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
96	0.1	CONCRETE: 100mm thick							E			
		FILL/Sandy GRAVEL: sub-angular to sub-rounded gravel, grey, fine to medium sand, plastic fines, trace cobbles, moist, apparently loose							E			
95	1								E			
									S			1,1,2 N = 3
	1.8	FILL/CLAY: low to medium plasticity, grey, trace fine to medium sand, w = PL, firm							E			
94	2											
	2.3	Below 2.0m: w > PL CLAY CI: medium plasticity, grey and pale grey, w = PL, firm, residual						Unless otherwise stated, all discontinuities are bedding, 0-5°, pl, sm, cln, cly vn or fe stn	S			2,4,25/140mm refusal
	2.9	LAMINITE: pale grey, thinly laminated, grey and brown, medium strength then very low strength, highly weathered, highly fractured, Ashfield Shale										
93	3							3.07-3.19m: J55°, pl, sm, cln, 120mm 3.26m: J20°, he, pl, cly vn 3.56m: J20°, pl, sm, cln	C	100	0	PL(A) = 0.8
92	4							3.91m: B0°, pl, sm, cly ctg 20mm 3.95m: Ds 50mm 4.26m: J0-5°, ir, sm, fe stn 4.31m: Fg 40mm 4.35-4.77m: 4x Ds 20-60mm 4.85m: J20°, pl, sm, fe stn				PL(A) = <0.1
91	5								C	100	25	
								5.56m: J70°, pl, sm, cln 5.15-6.12m: 4x B0°, pl, sm, cly ctg 2-30mm				PL(A) = <0.1
90	6							6.16m: J30°, pl, he 6.27-6.32m: 3x J70-80°, pl, sm, fe stn 6.47m: Fg 80mm 6.49m: J20°, pl, sm, cln 6.65m: J10°, pl, sm, cln				PL(A) = <0.1
89	7							6.75-6.9m: J85-90°, pl, sm, fe stn 6.89m: Ds 40mm 6.96m: J15°, pl, sm, cln 7.16m: B0, pl, sm, cly ctg 20mm 7.05-7.36m: 3x J30°, pl, sm, cln or fe stn 7.39m: Ds 40mm 7.43-7.53m: 2x J70°, pl, sm, cly vn 8.37-8.44m: 2x J60°, pl, he, fe stn 8.62m: J60°, pl, sm, fe stn 8.64-8.79m: Fg 150mm 9m: CORE LOSS: 910mm				PL(A) = 0.1
88	8					16-05-23			C	69	5	PL(A) = <0.1 PL(A) = 0.1
87	9											
	9.0											
	9.91											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
EASTING: 333581
NORTHING: 6255420.4
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
86	10.0	SHALE: dark grey, thinly laminated, very low to low strength, slightly weathered, highly fractured, Ashfield Shale						9.92m: J90°, pl, sm, cln 9.93m: J40°, pl, sm, cln 9.96m: J65°, pl, sm, cln	C	91	22	PL(A) = <0.1
85	11							10.12-10.3m: 4x J20-45°, pl, sm, cln 10.45m: J35°, pl, sm, cln 10.38-10.58m: J85°, pl, sm, cly vn	C	91	22	
	11.05											PL(A) = 0.1
84	12							10.7m: J60°, pl, he 10.86m: Fg 20mm 11m: CORE LOSS: 50mm 11.15m: J60°, pl, sm, cln 11.25m: J30°, pl, sm, cln	C	98	36	
	12.44							11.37-11.48m: J60°, pl, sm, cln				
83	13							11.64m: J35°, pl, sm, cln 11.8-11.95m: 2x J60°, pl, sm, cln				PL(A) = <0.1 PL(A) = <0.1
	13.28	SILTSTONE: pale grey and grey, very low strength, sandstone laminations, slightly weathered, unbroken, Mittagong Formation						12.05-12.13m: 3x J50°, pl, sm, cln 12.25-12.35m: J75°, pl, sm, cln 12.41m: CORE LOSS: 30mm	C	100	0	
82	14							12.73m: J20°, pl, sm, cln 12.74-12.84m: 2x J40°, he, pl 13.25m: J20°, pl, sm, cln				PL(A) = <0.1 PL(A) = <0.1
81	15								C	100	0	
	15.0	SANDSTONE: fine grained, pale grey and grey, low strength, thinly cross-bedded, siltstone laminations, slightly weathered then fresh, slightly fractured, Mittagong Formation Below 15.75m: low to medium strength										PL(A) = <0.1
80	16							16.05m: Fg 60mm				PL(A) = 0.4
								16.27-16.55m: 2x Ds 20mm				PL(A) = 0.2
79	17							17.13m: J45°, st, ro, cln				PL(A) = 0.2 PL(A) = 0.4
								17.34m: Fg 40mm	C	100	85	
	17.8							17.62m: J30°, pl-ir, ro, cln				
78	18	SANDSTONE: medium grained, pale grey, high strength, thinly cross-bedded, siltstone laminations, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.7
77	19											PL(A) = 1.3
									C	100	100	PL(A) = 1.2
	20.0											PL(A) = 1.2

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
EASTING: 333581
NORTHING: 6255420.4
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
76		SANDSTONE: medium grained, pale grey, high strength, thinly cross-bedded, siltstone laminations, fresh, unbroken, Hawkesbury Sandstone						20.52m: B5°, pl-ir, ro, cly ctg 2mm 20.71m: J20°, pl, ro, cly vn	C	100	100	PL(A) = 1
75	21											
74	22											PL(A) = 1.2
73	23	Between 23.1 and 27.0m: medium to coarse grained						23.21m: B0°, pl-un, ro, cly ctg 2mm	C	100	97	PL(A) = 1.1
72	24							24.21m: J40°, pl, ro, cln				PL(A) = 1.5
71	25											PL(A) = 1.6
70	26								C	100	100	PL(A) = 1.2
69	27							27.23m: B5°, pl, ro, cly vn				PL(A) = 0.7
68	28											PL(A) = 0.8
67	29							28.63-29.57m: 3x B15-20°, pl, ro, cbs vn and cly vn 29.64m: J30°, pl, ro, cln 29.67m: B5°, pl, ro, cly	C	100	96	PL(A) = 1.1
	30.0											PL(A) = 1.1

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
EASTING: 333581
NORTHING: 6255420.4
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
66		SANDSTONE: As above						vn	C	100	96	PL(A) = 1.2
	30.57	Bore discontinued at 30.57m - target depth reached										
65	31											
64	32											
63	33											
62	34											
61	35											
60	36											
59	37											
58	38											
57	39											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
EASTING: 333581
NORTHING: 6255420.4
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
96	0.1	CONCRETE: 100mm thick		E	0.1				Gatic cover
		FILL/Sandy GRAVEL: sub-angular to sub-rounded gravel, grey, fine to medium sand, plastic fines, trace cobbles, moist, apparently loose		E	0.2 0.5				
95	1			E	0.6 0.9				Blank pipe 0.1-12.1m
				S	1.0 1.45		1,1,2 N = 3		
	1.8	FILL/CLAY: low to medium plasticity, grey, trace fine to medium sand, w = PL, firm		E	1.9 2.0				Backfill 0.0-3.8m
94	2	Below 2.0m: w > PL							
	2.3	CLAY CI: medium plasticity, grey and pale grey, w = PL, firm, residual		S	2.5		2,4,25/140mm refusal		
93	2.9	LAMINITE: pale grey, thinly laminated, grey and brown, medium strength then very low strength, highly weathered, highly fractured, Ashfield Shale			2.94 3.0		PL(A) = 0.8		
				C	3.1 3.89				
92	4				4.66		PL(A) = <0.1		
91	5			C	5.65		PL(A) = <0.1		
90	6				6.49		PL(A) = <0.1		
89	7				6.96 7.05		PL(A) = 0.1		
								16-05-23	Bentonite 3.8-11.6m
88	8				7.95		PL(A) = <0.1		
				C	8.16		PL(A) = 0.1		
87	9								
	9.0								
	9.91				9.91				

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
EASTING: 333581
NORTHING: 6255420.4
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
96	10.0	SHALE: dark grey, thinly laminated, very low to low strength, slightly weathered, highly fractured, Ashfield Shale		C	10.07		PL(A) = <0.1		
				C					
85	11 11.05				11.05		PL(A) = 0.1		11
					11.1				
				C					
84	12								12
	12.44				12.45				
					12.62		PL(A) = <0.1		
83	13				13.0		PL(A) = <0.1		13
	13.28			C					
		SILTSTONE: pale grey and grey, very low strength, sandstone laminations, slightly weathered, unbroken, Mittagong Formation			13.9		PL(A) = <0.1		
82	14				13.97				14
					14.56		PL(A) = <0.1		
				C					
81	15 15.0	SANDSTONE: fine grained, pale grey and grey, low strength, thinly cross-bedded, siltstone laminations, slightly weathered then fresh, slightly fractured, Mittagong Formation			15.45		PL(A) = <0.1		15
		Below 15.75m: low to medium strength							
80	16				15.95		PL(A) = 0.4		16
					16.0				
					16.5		PL(A) = 0.2		
79	17				16.96		PL(A) = 0.2		17
					17.0		PL(A) = 0.4		
				C					
	17.8								
78	18	SANDSTONE: medium grained, pale grey, high strength, thinly cross-bedded, siltstone laminations, fresh, slightly fractured, Hawkesbury Sandstone			17.97		PL(A) = 0.7		18
					18.89		PL(A) = 1.3		
77	19				18.96				19
					19.34		PL(A) = 1.2		
				C					
	20.0				19.92		PL(A) = 1.2		

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
EASTING: 333581
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BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
76		SANDSTONE: medium grained, pale grey, high strength, thinly cross-bedded, siltstone laminations, fresh, unbroken, Hawkesbury Sandstone							
75	21			C	20.96		PL(A) = 1		Gravel 11.6-30.57m; Machine slotted PVC screen 12.1-30.1m
					21.87				
74	22				21.96		PL(A) = 1.2		
73	23	Between 23.1 and 27.0m: medium to coarse grained			22.96		PL(A) = 1.1		
				C					
72	24				23.95		PL(A) = 1.5		
					24.91				
71	25				24.96		PL(A) = 1.6		
70	26				25.96		PL(A) = 1.2		
				C					
69	27				26.96		PL(A) = 0.7		
					27.83				
68	28				27.95		PL(A) = 0.8		
67	29			C	28.95		PL(A) = 1.1		
	30.0				29.95		PL(A) = 1.1		

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.0 m AHD
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NORTHING: 6255420.4
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86645.03
DATE: 11 - 15/5/2023
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
66		SANDSTONE: As above		C	30.31		PL(A) = 1.2		End cap
	30.57	Bore discontinued at 30.57m - target depth reached			30.57				
65	31								31
64	32								32
63	33								33
62	34								34
61	35								35
60	36								36
59	37								37
58	38								38
57	39								39

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 2.5m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 2.5m, NMLC Coring to 30.57m

WATER OBSERVATIONS: Free groundwater observed at 2.0m.

REMARKS: Groundwater well installed to 30.1m. Screen 18.1m - 30.1m. Solid PVC 0.1m-18.1m. Sand to 17.3m. Bentonite to 3.3m. Backfill to 0.1m.

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH103 PROJECT: 86645.03 MAY 2023

3.0 – 7.0m

BORE: BH103 PROJECT: 86645.03 MAY 2023

7.0 – 12.0m

BORE: BH103 PROJECT: 86645.03 MAY 2023

13.0 – 17.0m

BORE: BH103 PROJECT: 86645.03 MAY 2023

17.0 – 22.0m

BORE: BH103 PROJECT: 86645.03 MAY 2023

22.0 – 27.0m

BORE: BH103 PROJECT: 86645.03 MAY 2023

27.0 – 30.57m

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 93.6 m AHD
EASTING: 333577
NORTHING: 6255452.5
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86645.03
DATE: 17 - 19/5/2023
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
93	0.1	CONCRETE: 100mm thick										
	0.25	FILL/GRAVEL: sub-angular bluemetal gravel, grey, with plastic fines, moist							E			
		Silty CLAY CI: medium plasticity, pale grey, grey and red, trace non-plastic fines, w~PL, apparently hard, extremely weathered shale						Unless otherwise stated, all disconformities are bedding, 0-5°, pl, sm or ro, cln or cly vn or fe stn	E			
1	1.3	SHALE: brown, thinly laminated, very low strength, highly weathered then slightly weathered, fractured, Ashfield Shale						1.45m: B0°, pl, sm, cly ctg 10mm				PL(A) = <0.1
92								1.72m: B0°, pl, sm, cly ctg 10mm				
2								1.92m: Cs 80mm				
								2.05-2.16m: 5x B0°, pl, he, fe stn				
91								2.19m: Cs 20mm				PL(A) = <0.1
								2.33m: B0°, pl, sm, cly ctg 3mm	C	100		
3								2.43m: J50°, pl, sm, cln				
								2.51m: J45°, pl, sm, fg				
90								2.61m: Fg 50mm				
								2.81m: J30°, pl, sm, fg 20mm				
								3.22m: Cs 50mm				PL(A) = <0.1
4								3.29m: B0°, pl, sm, cly ctg 10mm				
								3.32m: J50°, pl, sm, cln				
								3.41m: Cs 70mm				
89								3.38-3.48m: J70-80°, pl, sm, cly ctg 10mm				PL(A) = <0.1
						17-05-23		3.5-3.56m: 2x J30°, pl, sm, ctg 10mm				
5								3.58m: B0°, pl, sm, cly ctg 10mm	C	76		
								3.70-4.16m: 3x J70-80°, pl, sm, cln				PL(A) = <0.1
								4.23m: Cs 40mm				
	5.12	SHALE: brown, thinly laminated, very low strength, highly weathered then slightly weathered, fractured, Ashfield Shale						4.88-5.06m: J70-80°, pl, sm, cln				
88	5.61							5.08m: J70°, pl, sm, cln				
								5.12m: CORE LOSS: 490mm				
6								5.61-5.83m: Cz 220mm				
								5.93-6.83m: 5x J30-55°, pl, sm, cln				
87		Below 6.42m: very low to low										PL(A) = <0.1
								6.89m: J80-90°, ir, sm, cln	C			
7								6.96m: B0°, pl, sm, cly ctg 10mm				PL(A) = 0.1
86								7.17m: J90°, pl, sm, cln				
								7.37-7.41m: 2x Ds 20-30mm				
								7.19-7.82m: 3x J30-50°, pl, sm, cln				
8								7.89m: Cs 20mm				
	8.27							8m: B0°, pl, sm, cly ctg 10mm				PL(A) = <0.1
	8.41	Below 8.41m: fresh						8.04m: Ds 20mm				
85								8.27m: CORE LOSS: 140mm				
								8.44-8.57m: 3x 45-60°, pl, sm, cln				
9								8.71m: J60°, pl ,sm, cln	C			
								8.78-9.11m: J70-80°, pl, sm, cln				
84								9.09-9.15m: 2xJ25-40°, pl, sm, cln				
	10.0							9.33m: B0°, pl, sm, cly				

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 1.3m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 1.3m, NMLC Coring to 18.85m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 18.8m. Screen 6.8m - 18.8m. Solid PVC 0.1m - 6.8m. Sand to 5.8m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
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BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 93.6 m AHD
EASTING: 333577
NORTHING: 6255452.5
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86645.03
DATE: 17 - 19/5/2023
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
83	10.48	SHALE: dark grey, thinly laminated, very low to low strength, fresh, fragmented to fractured, Ashfield Shale						ctg 5mm 9.40-9.49m: 4x J20-30°, pl, sm, cln 9.47-9.74m: Clay band 270mm 9.77m: J40°, pl, sm, cln 9.8-10.47m: Clay band 670mm 10.48m: CORE LOSS: 110mm 10.58m: J30°, pl, sm, cly ctg 20mm 10.69-11.18m: 7x 20-40°, pl, sm, cln 11m: CORE LOSS: 50mm 11.2-11.64m: 6x J60-70°, pl, sm, cln, 2x he 11.36-11.59m: J30-40°, pl, sm, cln 11.72m: Cs 60mm 11.89-12.16m: 3x J25-35°, pl, sm, cln 12.25m: Fg 40mm 12.35m: Fg 40mm 12.4m: J30°, pl ,sm, cln 12.45-12.56m: Ds 110mm 12.58-12.7m: 2x J70-80°, pl, sm, cln 13.25-13.35m: Clay band 100mm 13.74m: Fg 20mm 14.52-14.79m: Cz 270mm 14.74m: B15°, pl, sm, cbs vn 15.59-15.64m: Cz 150mm 15.77m: CORE LOSS: 450mm 17.16-17.19m: 3x B15°, pl, he	C			PL(A) = <0.1
82	11 11.05	Below 11.6m: medium strength										PL(A) = 0.3
81	12								C			PL(A) = 0.4
80	13 13.0	SILTSTONE: pale grey, thickly laminated, medium strength, fresh, fractured, Mittagong Formation										PL(A) = 0.4
79	13.75	SANDSTONE: fine grained, grey and pale grey, very thinly cross-bedded, medium to high strength, fresh, fractured, Hawkesbury Sandstone							C			PL(A) = 2.4
78	14 15								C			PL(A) = 0.7 PL(A) = 1.2
77	15.77 16 16.22	SANDSTONE: fine to medium grained, grey and pale grey, cross-bedded, high strength, fresh, unbroken, Hawkesbury Sandstone							C	100		PL(A) = 1.1
76	17											PL(A) = 1.3
75	18	Below 18.2m: coarse grained										
74	18.85 19	Bore discontinued at 18.85m - target depth reached										PL(A) = 1.1

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 1.3m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 1.3m, NMLC Coring to 18.85m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 18.8m. Screen 6.8m - 18.8m. Solid PVC 0.1m - 6.8m. Sand to 5.8m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 93.6 m AHD
EASTING: 333577
NORTHING: 6255452.5
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86645.03
DATE: 17 - 19/5/2023
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
93	0.1	CONCRETE: 100mm thick							Gatic cover
	0.25	FILL/GRAVEL: sub-angular bluemetal gravel, grey, with plastic fines, moist		E	0.2–0.3				
				E	0.4–0.5				
		Silty CLAY CI: medium plasticity, pale grey, grey and red, trace non-plastic fines, w~PL, apparently hard, extremely weathered shale							Blank pipe 0.0-6.8m
92	1.3	SHALE: brown, thinly laminated, very low strength, highly weathered then slightly weathered, fractured, Ashfield Shale			1.3				
					1.67		PL(A) = <0.1		
91				C	2.48		PL(A) = <0.1		Bentonite 3.7-5.8m
90					3.58		PL(A) = <0.1		
					3.87				
89				C	4.47		PL(A) = <0.1	17-05-23	
	5.12	SHALE: brown, thinly laminated, very low strength, highly weathered then slightly weathered, fractured, Ashfield Shale			5.04		PL(A) = <0.1		
88	5.61								
					5.87				
87		Below 6.42m: very low to low		C	6.42		PL(A) = <0.1		
86				C	7.39		PL(A) = 0.1		
	8.27				8.26		PL(A) = <0.1		
85	8.41	Below 8.41m: fresh			8.41				
84				C					
	10.0								

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 1.3m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 1.3m, NMLC Coring to 18.85m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 18.8m. Screen 6.8m - 18.8m. Solid PVC 0.1m - 6.8m. Sand to 5.8m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
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BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 93.6 m AHD
EASTING: 333577
NORTHING: 6255452.5
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86645.03
DATE: 17 - 19/5/2023
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
83	10.48	SHALE: dark grey, thinly laminated, very low to low strength, fresh, fragmented to fractured, Ashfield Shale		C	10.6				
	10.59	At 10.03m: tuff layer, 10mm							
	11.05				11.52		PL(A) = <0.1		
82		Below 11.6m: medium strength			12.1		PL(A) = 0.3		Gravel 5.8-18.8m
81					12.67				
				C	12.96		PL(A) = 0.4		Machine slotted PVC screen 6.8-18.8,
	13.0	SILTSTONE: pale grey, thickly laminated, medium strength, fresh, fractured, Mittagong Formation			13.0		PL(A) = 0.4		
80	13.75	SANDSTONE: fine grained, grey and pale grey, very thinly cross-bedded, medium to high strength, fresh, fractured, Hawkesbury Sandstone		C	13.97		PL(A) = 2.4		
79					14.58				
					14.96		PL(A) = 0.7		
78				C	15.48		PL(A) = 1.2		
	15.77	SANDSTONE: fine to medium grained, grey and pale grey, cross-bedded, high strength, fresh, unbroken, Hawkesbury Sandstone			16.22				
77	16.22				16.95		PL(A) = 1.1		
76				C					
					17.96		PL(A) = 1.3		
75		Below 18.2m: coarse grained							
	18.85				18.81		PL(A) = 1.1		End cap
74		Bore discontinued at 18.85m - target depth reached			18.85				

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** HWT to 1.3m

TYPE OF BORING: Diatube to 0.1m, Solid flight augering to 1.3m, NMLC Coring to 18.85m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 18.8m. Screen 6.8m - 18.8m. Solid PVC 0.1m - 6.8m. Sand to 5.8m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH104 PROJECT: 86645.03 MAY 2023

1.3 – 6.0m

BORE: BH104 PROJECT: 86645.03 MAY 2023

6.0 – 11.0m

BORE: BH104 PROJECT: 86645.03 MAY 2023

11.0 – 16.0m

BORE: BH104 PROJECT: 86645.03 MAY 2023

16.0 – 18.85m

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 98.1 m AHD
EASTING: 333534.6
NORTHING: 6255480
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86645.03
DATE: 31/5 - 6/6/2023
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
98	0.02	FLOORBOARDS: wooden flooring, 20mm										
		VOID: 480mm										
	0.5	FILL/Gravelly Silty SAND: fine, pale grey, angular concrete and brick gravel, non-plastic fines, with concrete cobbles, wood fragments, metal sheeting, plastic, fluorescent lights, brick and wire, dry, apparently loose							E			
97	0.9								A			
	1	Silty CLAY (CL): low plasticity, orange-brown, non-plastic fines, trace gravel, w < PL, apparently stiff, residual							A			
96	2	Below 1.2m: red and pale grey, with ironstone gravel										
		Below 2.5m: extremely weathered shale										
95	3											
	3.6	SHALE: dark grey and mottled orange, thinly laminated, very low to low strength, highly weathered then moderately weathered, highy fractured, Ashfield Shale						3.68m: B0°, pl, sm, fe stn 3.75m: B0°, pl, sm, fe stn, cly ctg 10mm 4.1m: CORE LOSS: 270mm	C	100	62	PL(A) = 0.1
94	4											
	4.37											PL(A) = 0.1
93	5	Below 5.0m: pale to dark grey, slightly weathered				06-06-23		4.86m: J60°, pl, sm, cln 4.89m: J40°, pl, sm, cln 4.91m: B0, pl, sm, cly vn 5.03m: Fg 60mm 5.13m: J85°, pl, sm, cln 5.29m: Fg 20mm	C	82	80	PL(A) = <0.1
92	6	Below 6.0m: fresh						5.46m: B, pl, sm, cly ctg 5mm 5.49m: Ds 30mm 5.53m: J55°, pl, sm, cln 6.11m: J40°, pl, sm, cln 6.20-6.30m: J60°, pl, sm, cln 6.29m: J40°, pl, sm, cln 6.35m: Fg 30mm 6.42m: Fg 40mm	C	100	61	PL(A) = 0.1 PL(A) = <0.1
91	7							6.52-6.77m: 2x J40°, pl, sm, cln 6.83m: Cs 30mm 6.89m: J40°, pl, sm, cln 7.1m: J30°, pl, sm, cln 7.12m: Cs 30mm 7.22m: J40°, pl, sm, cln 7.33-7.52m: Fg 190mm 7.90-7.97m: 2x J45°, pl, sm, cln 8m: J30°, pl, sm, cly vn 8.09m: Cs 20mm	C	100	63	PL(A) = 0.1 PL(A) = 0.1
90	8							8.21m: B0°, pl, sm, cly vn 8.66m: Fg 30mm 8.86m: B0°, pl, sm, cly ctg 20mm 8.89m: J60°, pl, sm, cln 8.95-9.14m: J60-70°, pl, sm, cln 9.23m: J75°, pl, sm, cln 9.3m: B0°, pl, sm, cly	C	100	52	PL(A) = <0.1
89	9											
	10.0											

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** PVC to 3.4m

TYPE OF BORING: Diatube to 0.02m, Solid flight augering to 1.5m, Wash boring to 3.6m, NMLC coring to 23.31m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 23.3m. Screen 11.3m - 22.3m. Solid PVC 0.5m - 11.3m. Sand to 10.3m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 98.1 m AHD
EASTING: 333534.6
NORTHING: 6255480
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86645.03
DATE: 31/5 - 6/6/2023
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
88	10.24	SHALE: pale to dark grey, thinly laminated, very low to low strength,fresh, highy fractured, Ashfield Shale						ctg 10mm 9.38m: J55°, pl, sm, cln 9.41m: B0°, pl, sm, cly cn 9.57m: J50°, pl, sm, cln 9.82m: J90°, pl, sm, cln 10.06m: J60°, pl, sm, cln 10.11m: Ds 50mm 10.19m: CORE LOSS: 50mm 10.28m: Cs 30mm 10.86m: Fg 20mm 10.98m: B0°, pl, sm, cly ctg 5mm 11.06-11.12m: 2x J30°, pl, sm, cln 11.25m: J50°, pl, sm, cln 11.41m: J30°, pl, sm, fg 11.48m: B0°, pl, sm, cly ctg 5mm 11.50-11.60m: 4x J30°, ir, sm, cln 11.76m: J50°, pl, sm, cln 11.84-11.94m: J70°, pl, sm, cln 12.52m: J30°, pl, he 13.35-13.74m: 3x J35-55°, pl, sm, cln 14.04m: J45°, pl, sm, cln 14.23m: J30°, pl, he 14.23-14.28m: 2x J30°, pl, he 14.31m: J85°, pl, p he 14.33m: J50°, pl, sm, cln 14.45-14.49m: 2x J20-30°, pl, sm, cln, fg 14.68m: J40°, pl, sm, cln 14.74m: F40°, pl, sm, slickenside, 14.84m: J25°, pl, sm, cln 14.94-15.08m: J75°, pl, sm, cln 15.08m: B0°, pl, sm, cly ctg 2mm 15.11m: J10°, pl, sm, cln 15.36m: J25°, pl, sm, cln 15.55m: J20°, pl, sm, cln 15.98m: J30°, pl, sm, cln 17.06m: B0°, pl, sm, cly vn 17.27m: J60°, pl, sm, cly vn 17.36m: J30°, pl, sm, cln 17.45-17.52m: slickensides 17.57m: Fg 40mm 17.64m: B0°, pl, sm, cly vn 17.7m: Fg 50mm 17.76-17.88m: J85°, pl, sm, cln, p he 18.18m: J20°, pl, sm,	C	100	52	
87	11								C	97	55	PL(A) = <0.1 PL(A) = 0.2
86	12	Below 11.5m: low strength, slightly fractured							C	100	91	PL(A) = 0.1 PL(A) = 0.7 PL(A) = 1
85	13	Below 12.5m: medium and high strength										
84	14								C	100	57	PL(A) = 1.7 PL(A) = 1.5
83	15	Between 14.67 and 14.77m: pyrite inclusions							C	100	0	
									C	100	27	
82	16								C	100	86	PL(A) = 0.6 PL(A) = 0.5
81	17								C	100	65	
	17.41	SILTSTONE: grey, thickly laminated, medium strength, fresh, fractured, Mittagong Formation										PL(A) = 0.4
80	17.9 18	SANDSTONE: fine to medium grained, pale grey and grey, thinly cross-bedded, with siltstone laminations (40%), medium to high and high strength, fresh, slightly fractured then unbroken, Hawkesbury Sandstone							C	100	75	PL(A) = 1
79	19											PL(A) = 0.4
	20.0								C	100	76	PL(A) = 1.3

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** PVC to 3.4m

TYPE OF BORING: Diatube to 0.02m, Solid flight augering to 1.5m, Wash boring to 3.6m, NMLC coring to 23.31m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 23.3m. Screen 11.3m - 22.3m. Solid PVC 0.5m - 11.3m. Sand to 10.3m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 98.1 m AHD
EASTING: 333534.6
NORTHING: 6255480
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86645.03
DATE: 31/5 - 6/6/2023
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
78		SANDSTONE: refer above						cln 18.19m: J55°, pl, sm, cln 18.39m: Fg 50mm 18.62m: J40°, pl, ro, cln 18.76m: B0°, pl, ro, cly vn 18.77m: B0°, pl, ro, cly ctg 10mm 18.81m: J30°, pl, ro, cln 19.03m: B0°, pl, ro, cly vn 19.52m: J20°, pl, sm, cln 19.92m: J60°, pl-ir, ro, cly and fg 20.13m: J60°, pl-ir, ro, cln 20.54m: Fg and Cly 80mm	C	100	76	PL(A) = 0.7
	20.6	SANDSTONE: medium grained, pale grey, cross-bedded, trace siltstone laminations, high strength, fresh, unbroken, Hawkesbury Sandstone Below 20.61m: minor siltstone laminations							C	100	100	PL(A) = 1.5
77	21											
76	22											PL(A) = 1.3
75	23								C	100	100	PL(A) = 1.1
	23.31	Bore discontinued at 23.31m - target depth reached										PL(A) = 1.4
74	24											
73	25											
72	26											
71	27											
70	28											
69	29											

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** PVC to 3.4m

TYPE OF BORING: Diatube to 0.02m, Solid flight augering to 1.5m, Wash boring to 3.6m, NMLC coring to 23.31m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 23.3m. Screen 11.3m - 22.3m. Solid PVC 0.5m - 11.3m. Sand to 10.3m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 98.1 m AHD
EASTING: 333534.6
NORTHING: 6255480
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86645.03
DATE: 31/5 - 6/6/2023
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
98	0.02	FLOORBOARDS: wooden flooring, 20mm							
		VOID: 480mm							
	0.5	FILL/Gravelly Silty SAND: fine, pale grey, angular concrete and brick gravel, non-plastic fines, with concrete cobbles, wood fragments, metal sheeting, plastic, fluorescent lights, brick and wire, dry, apparently loose		E	0.5 0.6				Stopcock
97	0.9	Silty CLAY (CL): low plasticity, orange-brown, non-plastic fines, trace gravel, w < PL, apparently stiff, residual		A	0.9 1.0				Blank pipe 0.0-11.31m
	1	Below 1.2m: red and pale grey, with ironstone gravel		A	1.3 1.5				
96	2	Below 2.5m: extremely weathered shale							
95	3								
	3.6	SHALE: dark grey and mottled orange, thinly laminated, very low to low strength, highly weathered then moderately weathered, highy fractured, Ashfield Shale			3.6				
94	4			C	3.88		PL(A) = 0.1		
	4.37				4.1 4.43		PL(A) = 0.1		
93	5	Below 5.0m: pale to dark grey, slightly weathered		C	4.94		PL(A) = <0.1	06-06-23	Bentonite 0.5-10.6m
					5.6 5.77		PL(A) = 0.1		
92	6	Below 6.0m: fresh		C					
91	7				6.94 7.15		PL(A) = <0.1		
				C	7.77		PL(A) = 0.1		
90	8				8.42 8.62		PL(A) = 0.1		
89	9			C	9.49		PL(A) = <0.1		
	10.0								

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** PVC to 3.4m

TYPE OF BORING: Diatube to 0.02m, Solid flight augering to 1.5m, Wash boring to 3.6m, NMLC coring to 23.31m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 23.3m. Screen 11.3m - 22.3m. Solid PVC 0.5m - 11.3m. Sand to 10.3m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 98.1 m AHD
EASTING: 333534.6
NORTHING: 6255480
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86645.03
DATE: 31/5 - 6/6/2023
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
88	10.24	SHALE: pale to dark grey, thinly laminated, very low to low strength,fresh, highy fractured, Ashfield Shale		C	10.19				
					10.51		PL(A) = <0.1		
87	11			C					11
					11.42		PL(A) = 0.2		
		Below 11.5m: low strength, slightly fractured			11.67				
					11.81		PL(A) = 0.1		
86	12			C					12
		Below 12.5m: medium and high strength			12.78		PL(A) = 0.7		
85	13				13.0		PL(A) = 1		13
					13.22				
84	14			C	13.92		PL(A) = 1.7		14
					14.53		PL(A) = 1.5		
		Between 14.67 and 14.77m: pyrite inclusions		C	14.79				
83	15				14.84				15
				C					
					15.44				
82	16			C	15.88		PL(A) = 0.6		16
					16.13		PL(A) = 0.5		
					16.31				
81	17			C					17 Gravel 10.3-23.31m
	17.41	SILTSTONE: grey, thickly laminated, medium strength, fresh, fractured, Mittagong Formation			17.42		PL(A) = 0.4		Machine slotted PVC screen 11.31-23.31m
	17.9				17.91				
80	18	SANDSTONE: fine to medium grained, pale grey and grey, thinly cross-bedded, with siltstone laminations (40%), medium to high and high strength, fresh, slightly fractured then unbroken, Hawkesbury Sandstone		C	18.53		PL(A) = 1		18
79	19				19.0		PL(A) = 0.4		19
					19.43				
				C	19.6		PL(A) = 1.3		
	20.0								

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** PVC to 3.4m

TYPE OF BORING: Diatube to 0.02m, Solid flight augering to 1.5m, Wash boring to 3.6m, NMLC coring to 23.31m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 23.3m. Screen 11.3m - 22.3m. Solid PVC 0.5m - 11.3m. Sand to 10.3m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 98.1 m AHD
EASTING: 333534.6
NORTHING: 6255480
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86645.03
DATE: 31/5 - 6/6/2023
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
78		SANDSTONE: refer above							
				C	20.43		PL(A) = 0.7		
	20.6	SANDSTONE: medium grained, pale grey, cross-bedded, trace siltstone laminations, high strength, fresh, unbroken, Hawkesbury Sandstone			20.87				
77	21	Below 20.61m: minor siltstone laminations			20.95		PL(A) = 1.5		21
				C					
76	22				21.95		PL(A) = 1.3		22
					22.3				
				C					
75	23				22.95		PL(A) = 1.1		23
	23.31				23.26		PL(A) = 1.4		End cap
		Bore discontinued at 23.31m - target depth reached			23.31				
74	24								24
73	25								25
72	26								26
71	27								27
70	28								28
69	29								29

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB **CASING:** PVC to 3.4m

TYPE OF BORING: Diatube to 0.02m, Solid flight augering to 1.5m, Wash boring to 3.6m, NMLC coring to 23.31m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Groundwater well installed to 23.3m. Screen 11.3m - 22.3m. Solid PVC 0.5m - 11.3m. Sand to 10.3m. Bentonite to 0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

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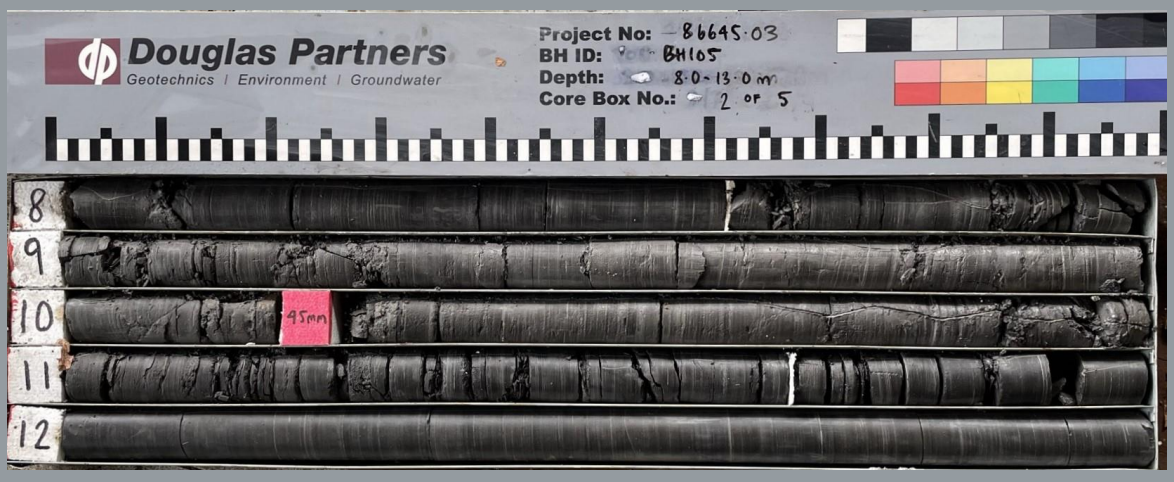
BORE: BH105 PROJECT: 86645.03 JUNE 2023

3.6 – 8.0m

BORE: BH105 PROJECT: 86645.03 JUNE 2023



8.0 – 13.0m

BORE: BH105 PROJECT: 86645.03 JUNE 2023

13.0 – 18.0m

BORE: BH105 PROJECT: 86645.03 JUNE 2023

18.0 – 23.0m

BORE: BH105 PROJECT: 86645.03 JUNE 2023

23.0 –23.31m

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.8 m AHD
EASTING: 333580
NORTHING: 62255395
DIP/AZIMUTH: 90°/--

BORE No: BH106
PROJECT No: 86645.03
DATE: 7 - 15/6/2023
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
96	0.02	TILE: 20mm thick										
	0.25	FILL/CONCRETE: 230mm thick with steel reinforcement										
		VOID: 750mm										
95	1.0	FILL/Silty SAND: fine to medium, brown-grey, with sub-angular to sub-rounded brick, ceramic and igneous gravel, dry, apparently loose							E			
		At 1.5m: asbestos fragment observed							E			
	1.9	FILL/GRAVEL: dark grey, sub-angular igneous gravel, dry, apparently medium dense							C			
94	2.5	Silty CLAY CL: medium plasticity, brown, with rootlet, w > PL, apparently firm, residual							C			
		Below 3.2m: brown and red mottled grey, with ironstone gravel, apparently very stiff										
93	3.7	Silty CLAY CL: medium to high plasticity, pale grey and red, with ironstone gravel, w~PL, apparently hard, residual						Unless otherwise stated, discontinuities comprise (B0-10°, pl/un, sm/ro/he, cln or fe stn, cly vn) and (J20-60°, pl, sm/he, cln or fe stn or cly vn)				
92	4.9	SHALE: pale grey, grey and pale brown, thinly laminated, very low to low strength, highly weathered with extremely weathered bands, highly fractured, Ashfield Shale						4.98m: J75°, pl, sm, cln 5.11-5.34m: J65°, pl, sm, fe stn and fg 5.38m: J70°, pl, sm, cln 5.51-5.69m: J70-75°, pl, sm, fe stn, cly vn 5.73m: J90°, ir, sm, fe stn 5.83m: Cs 70mm 5.92m: J70°, pl, sm, fe stn 6.02-6.13m: J80-85°, pl, sm, fe stn 6.33m: Cs 30mm 6.77-6.87m: J80°, pl, sm, cln	C	100	43	PL(A) = <0.1 PL(A) = 0.4
91	6	Below 6.5m: pale grey and dark grey, moderately weathered							C	100	85	PL(A) = 0.1
90	7											PL(A) = 0.1
89	7.8	SHALE: dark grey and pale grey, thinly laminated, very low strength, slightly weathered with an extremely weathered band, highly fractured, Ashfield Shale						7.63-7.80m: Fg 170mm 7.8m: CORE LOSS: 130mm 8.02m: Cs 20mm 8.28-8.38m: J60-80°, pl, sm, cln 8.57m: Cs 20mm 8.71m: J80°, pl, sm, cln 8.75m: Cs 20mm 8.8m: J60°, pl, sm, cln 8.96m: B5°, pl, he, cly ctg 5mm	C	89	49	PL(A) = 0.1
88	9											
87	9.8	SHALE: *refer next page*						9.04-10.00m: J80°(x2), pl, sm, cly 9.67m: Cs 10mm	C	100	57	PL(A) = 0.1
	10.0											

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB/YB **CASING:** PVC to 1.9m

TYPE OF BORING: Diatube to 0.25m, Hand auger to 1.9m, NMLC to 3.6m, Wash boring to 4.5m, NMLC to 22.30m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 100% water loss after 13.45m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.8 m AHD
EASTING: 333580
NORTHING: 62255395
DIP/AZIMUTH: 90°/--

BORE No: BH106
PROJECT No: 86645.03
DATE: 7 - 15/6/2023
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
86		SHALE: dark grey and pale grey, thinly laminated, very low to low strength, fresh with extremely weathered bands, fractured, Ashfield Shale At 10.03m: tuff layer, 5mm						10.21-10.34m: J70-80°, pl, sm, cly vn 10.34m: Cs 20mm 10.53m: B0°, pl, sm, cly ctg 5mm 10.49-10.63m: J70-80°, cu, sm, cly vn 10.56m: Ds 70mm 11.08m: Cs 20mm 11.10-11-30: J45-80°(x4), pl, sm, cln 11.46m: Cs 20mm	C	100	57	
	11								C	100	74	PL(A) = 0.1 PL(A) = 0.1
85	12							11.8m: J70-80°, pl, sm, cln 11.77-12.00m: J70-80°, pl, sm, cln 12.18m: J50°, pl, he, cln 12.25m: Cs 50mm 12.25-12.66m: J70-80°(x2), pl, sm, cln 12.76m: B0°, pl, he, cly ctg 5mm 12.78m: Cs 80mm	C	100	76	PL(A) = 0.2
84	13											
83	14							13.66m: Cs 20mm 13.73m: J70-80°, pl, sm, cln 13.70-14.22m: J70-80°(x2), pl, sm, cln 14.22-14.34m: Ds 120mm 14.57m: B0°, pl, he, cly inf 5mm	C	100	78	PL(A) = 0.2 PL(A) = 0.1
82	14.3	SILTSTONE: dark grey and pale grey, thickly laminated, low strength, fresh, slightly fractured, Mittagong Formation										
	15											
81	15.62	SANDSTONE: fine to medium grained, pale grey, distinctly and indistinctly bedded, with siltstone laminations, very low and low strength, fresh with extremely weathered bands, slightly fractured, Mittagong Formation						15.62-15.88m: Ds 260mm 16.16m: J45°, pl, ro, cly inf 5mm	C	100	84	PL(A) = <0.1
	16											
80	17							17.25m: B10°, pl, ro, cbs vn 17.36m: Ds 80mm 17.38-17.40m: B5°(x2), pl, he, cbs vn 17.55m: B5°, pl, he, cly inf 5mm 17.62m: Ds 40mm 17.66-17.92m: J70-80°, pl, ro, cln 17.84m: Ds 40mm 18.22m: Ds 50mm 18.46m: J45°, pl, ro, cly inf 5mm 18.91m: B5°, pl, ro, cbs vn 19.18m: B5°, pl, he, cbs vn 19.5m: Cs 20mm	C	100	81	PL(A) = 0.1
79	18											PL(A) = 0.2
78	19	19.0 SANDSTONE: fine to medium grained, pale grey, distinctly and indistinctly bedded, with siltstone laminations, high then medium to high strength, fresh, unbroken, Hawkesbury Sandstone							C	100	91	PL(A) = 0.2
77									C	100	99	PL(A) = 1

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB/YB **CASING:** PVC to 1.9m

TYPE OF BORING: Diatube to 0.25m, Hand auger to 1.9m, NMLC to 3.6m, Wash boring to 4.5m, NMLC to 22.30m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 100% water loss after 13.45m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Deicorp Pty Ltd
PROJECT: Fiveways Crows Nest
LOCATION: Pacific Highway, Alexander St, Falcon St, Crows Nest

SURFACE LEVEL: 96.8 m AHD
EASTING: 333580
NORTHING: 62255395
DIP/AZIMUTH: 90°/--

BORE No: BH106
PROJECT No: 86645.03
DATE: 7 - 15/6/2023
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
76	21	SANDSTONE: fine to medium grained, pale grey, distinctly and indistinctly bedded, with siltstone laminations, high then medium to high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	99	PL(A) = 0.9
								21.13m: Ds 40mm				
75	22								C	100	97	PL(A) = 0.9
	22.3	Bore discontinued at 22.3m - target depth reached										PL(A) = 0.4
74	23											
73	24											
72	25											
71	26											
70	27											
69	28											
68	29											
67												

RIG: Geo 205 **DRILLER:** Ground Test **LOGGED:** ECB/YB **CASING:** PVC to 1.9m

TYPE OF BORING: Diatube to 0.25m, Hand auger to 1.9m, NMLC to 3.6m, Wash boring to 4.5m, NMLC to 22.30m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: 100% water loss after 13.45m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: BH106 PROJECT: 86645.03 JUNE 2023

4.5 – 9.0m

BORE: BH106 PROJECT: 86645.03 JUNE 2023

9.0 – 14.0m

BORE: BH106 PROJECT: 86645.03 JUNE 2023

13.0 – 18.0m

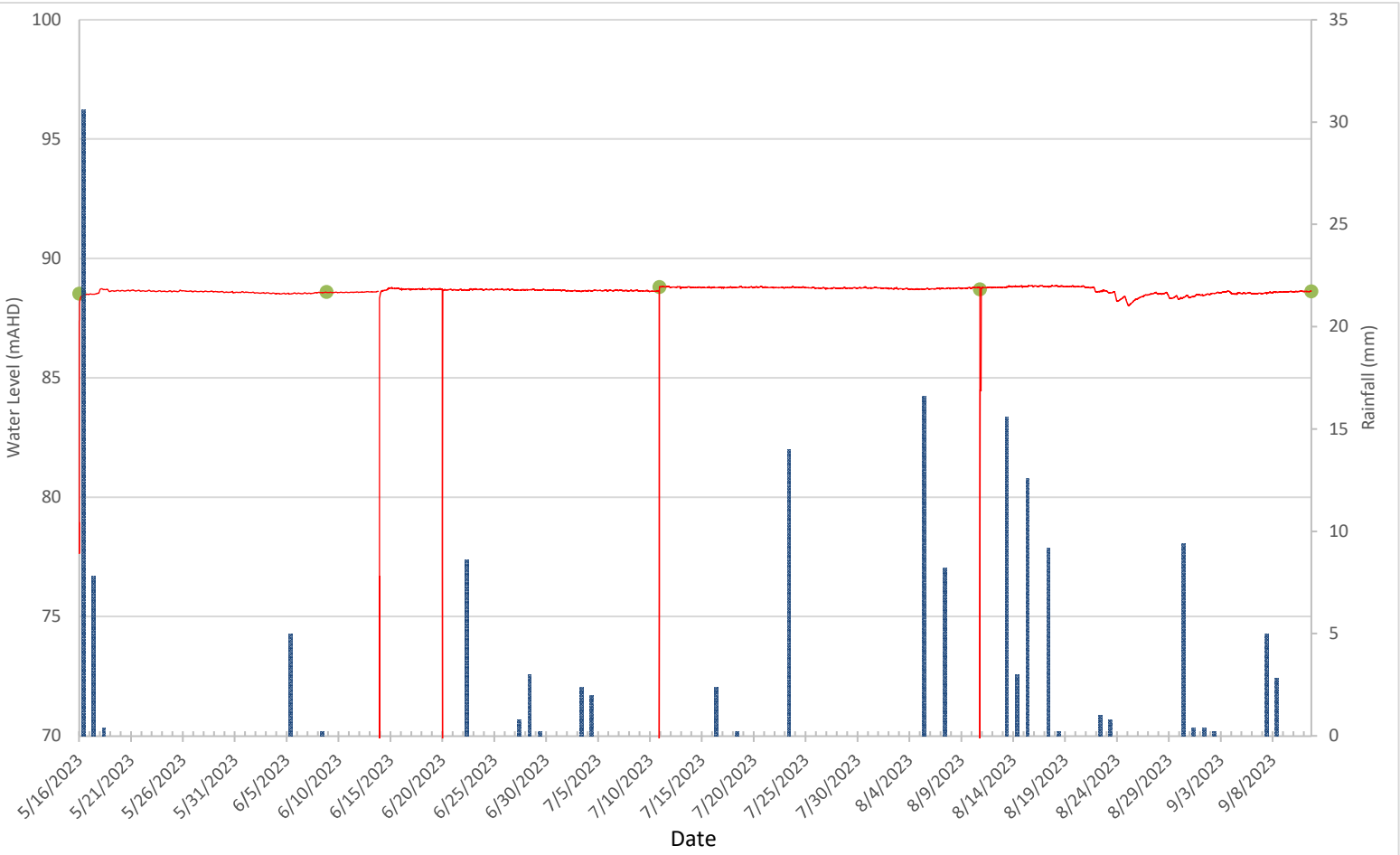
BORE: BH106 PROJECT: 86645.03 JUNE 2023

19.0 – 22.3m

Appendix D

Groundwater Level Readings

BH103

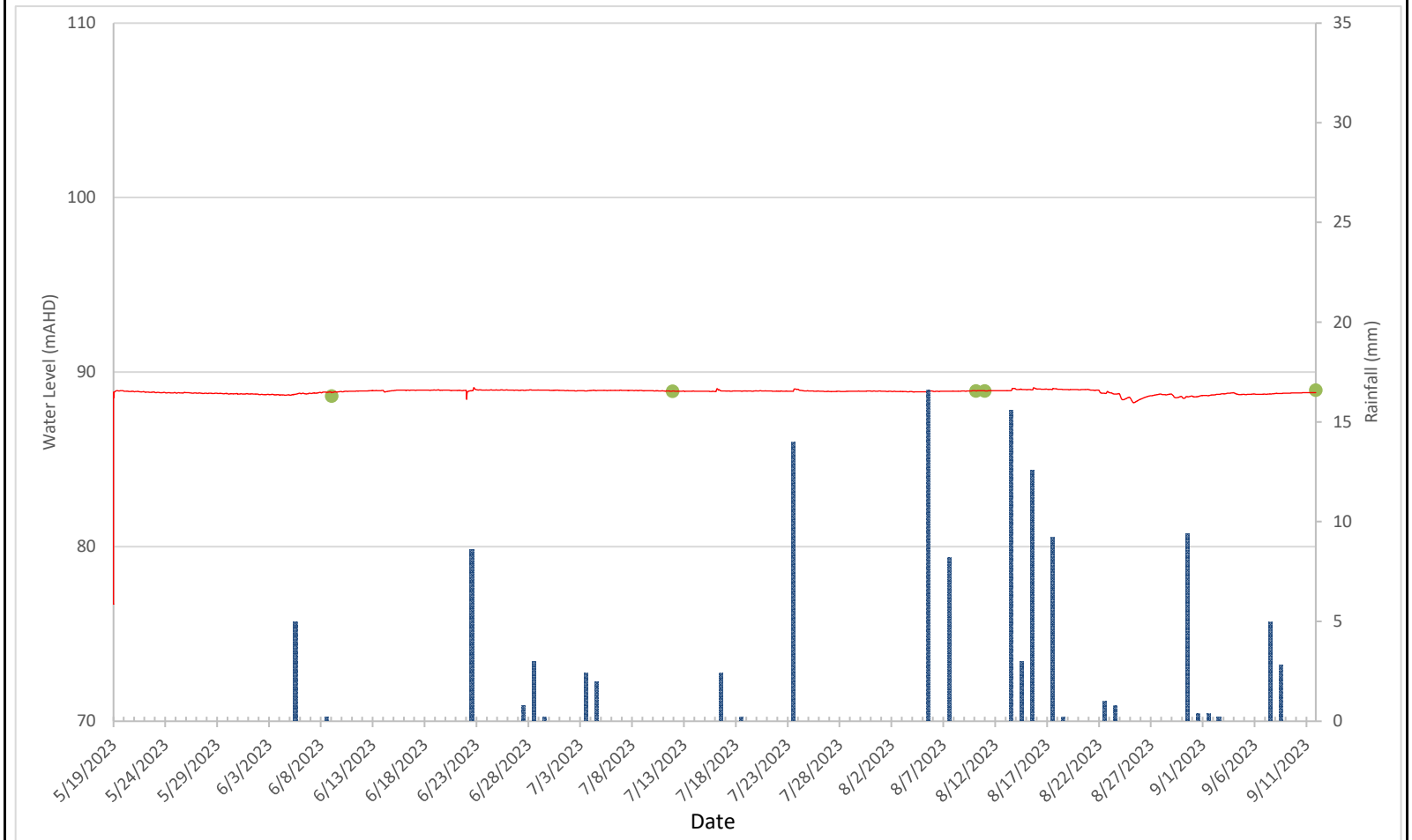


Douglas Partners
Geotechnics / Environment / Groundwater

Manual Levels
Water Level
Rainfall data (ST: 66214)

Date:	From	Drawn:
12/09/2023	16/05/2023	ECB
Project:	**To**	**PLOT NR**
86645.03	12/09/2023	1

BH104

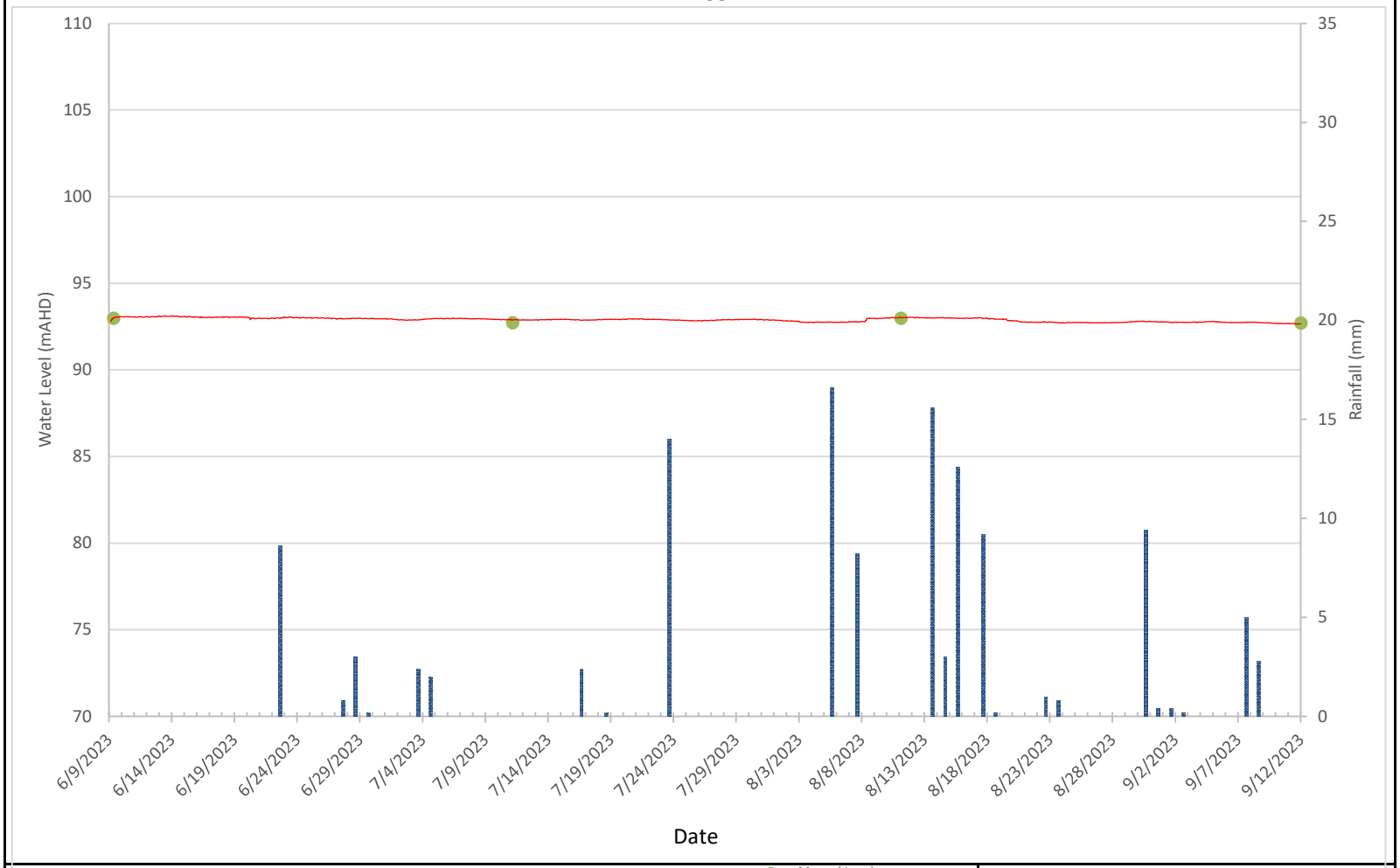


Douglas Partners
Geotechnics / Environment / Groundwater

Manual Levels
Water Level
Rainfall data (ST: 66214)

Date:	From	Drawn:
12/09/2023	16/05/2023	ECB
Project:	**To**	**PLOT NR**
86645.03	12/09/2023	**2**

BH05



Douglas Partners
Geotechnics / Environment / Groundwater

Date:	From	Drawn:
12/09/2023	16/05/2023	ECB
Project:	**To**	**PLOT NR**
86645.03	12/09/2023	3

Appendix E

Permeability Test Results

Douglas Partners
Geotechnics / Environment / Groundwater

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

Permeability Testing - Rising or Falling Head Test Report

Client:	Deicorp Properties	Project No:	86645.03
Project:	Proposed Residential Development	Test date:	09.06.2023
Location:	391-423 Pacific Hwy, 3-15 Falson Street	Tested by:	YB

Test Location

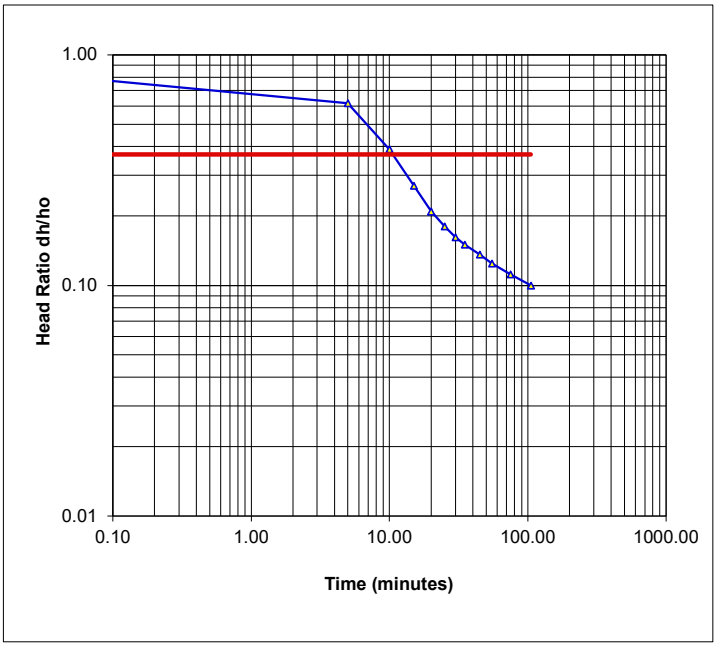
Description:	Standpipe in borehole	**Test No.**	BH103	
Material type:	Clay over Siltstone over Sandstone	Easting:	333582	m
		Northing	6255420	m
		Surface Level:	96	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	7.8	m
Well screen diameter (2R)	96	mm	Depth to water at start of test	16.4	m
Length of well screen (Le)	18	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.00	16.40	8.60	1.000
5.00	13.1	5.30	0.616
10.00	11.15	3.35	0.390
15.00	10.13	2.33	0.271
20.00	9.6	1.80	0.209
25.00	9.35	1.55	0.180
30.00	9.19	1.39	0.162
35.00	9.09	1.29	0.150
45.00	8.97	1.17	0.136
55.00	8.87	1.07	0.124
75.00	8.76	0.96	0.112
105.00	8.66	0.86	0.100



To = 10 mins
600 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 =**	**1.7E-07**	m/sec
	=	**0.062**	cm/hour

Douglas Partners
Geotechnics / Environment / Groundwater

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

Permeability Testing - Rising or Falling Head Test Report

Client:	Deicorp Properties	Project No:	86645.03
Project:	Proposed Residential Development	Test date:	09.06.2023
Location:	391-423 Pacific Hwy, 3-15 Falson Street	Tested by:	YB

Test Location

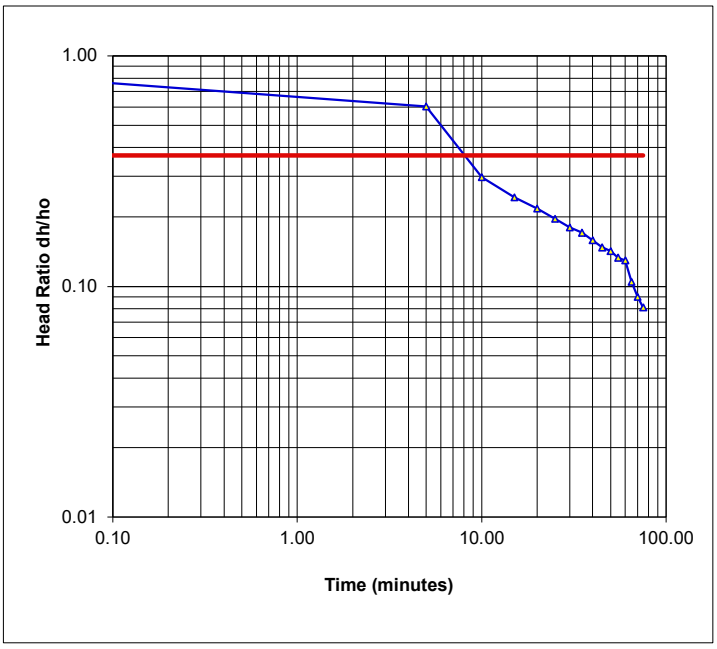
Description:	Standpipe in borehole	**Test No.**	BH105	
Material type:	Silty Clay over Siltstone	Easting:	333534	m
		Northing	6255480	m
		Surface Level:	98.1	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	5.11	m
Well screen diameter (2R)	96	mm	Depth to water at start of test	10.66	m
Length of well screen (Le)	12	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.00	10.66	5.55	1.000
5.00	8.46	3.35	0.604
10.00	6.76	1.65	0.297
15.00	6.46	1.35	0.243
20.00	6.32	1.21	0.218
25.00	6.2	1.09	0.196
30.00	6.11	1.00	0.180
35.00	6.06	0.95	0.171
40.00	5.99	0.88	0.159
45.00	5.93	0.82	0.148
50.00	5.9	0.79	0.142
55.00	5.85	0.74	0.133
60.00	5.83	0.72	0.130
65.00	5.69	0.58	0.105
70.00	5.61	0.5	0.090
75.00	5.56	0.45	0.081



To = 8 mins
480 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 =**	**3.0E-07**	m/sec
	=	**0.108**	cm/hour

WATER PRESSURE TEST RESULTS

Client :	Deicorp Pty Ltd	Field input sheet only	**Project No. :**	86645.03
Project :	Fiveways, Crows Nest		**Bore :**	BH104
Location :	8 Alexander St, Crows Nest		**Test section :**	14.5 m - 18.85 m

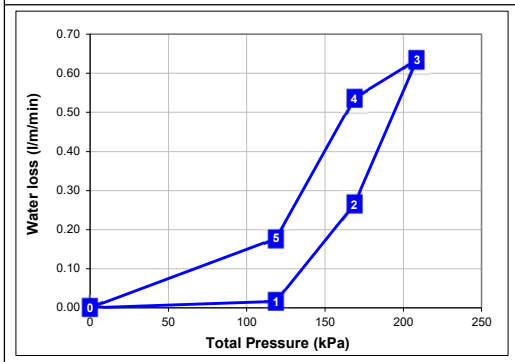
Test Details

Date:	18-May-23	Bottom of packer (m):	14.50	Height of pressure gauge (m):	1.0	Drum Area (m^2):	
Bore diameter (mm):	56	Bore depth (m):	18.85	Vertical Depth to groundwater (m):	6.0		0.264
Bore inclination (deg):	90	Section length (m):	4.35	(or depth to base of packer)			

Hg = gauge pressure, Hl = head loss in rods and packer, Hw = (gauge height + groundwater depth)x 9.81, Total = Hg+Hw-Hl

PRESSURE			Test	FLOW RATES								Water	Lugeons	Approx
				Flowmeter			Drum readings			Leakage	Assigned	Loss		Permeability
Hg	Hl	Total	Duration	Initial	Final	Total	Initial	Final	Equivalent		Flow		(l/m/min at	
(kPa)	(kPa)	(kPa)	(min)	(litres)	(litres)	(litres)	(mm)	(mm)	litres	(litres)	(litres)	(l/m/min)	1000 kPa)	(m/sec)
50	0	119	5	250882.2	250883.6	1.4	780.0	775.0	1		1.4	0.1	0.5	5.4E-08
50	0	119	5	250883.6	250884.1	0.5	775.0	775.0	0		0.0	0.0	0.0	0.0E+00
50	0	119	5	250884.1	250884.2	0.1	775.0	775.0	0		0.0	0.0	0.0	0.0E+00
50	0	119	6	250884.2	250884.2	0.0	775.0	775.0	0		0.0	0.0	0.0	0.0E+00
100	0	169	5	250887.0	250893.2	6.2	765.0	740.0	7		6.2	0.3	1.7	1.7E-07
100	0	169	5	250893.2	250898.5	5.3	740.0	720.0	5		5.3	0.2	1.4	1.4E-07
100	0	169	5	250898.5	250904.2	5.7	720.0	700.0	5		5.7	0.3	1.6	1.6E-07
100	0	169	5	250904.2	250910.3	6.1	700.0	690.0	3		6.1	0.3	1.7	1.7E-07
100	0	169	5	250910.3	250915.8	5.5	690.0	670.0	5		5.5	0.3	1.5	1.5E-07
140	0	209	5	250932.6	250946.9	14.3	605.0	550.0	15		14.3	0.7	3.2	3.2E-07
140	0	209	5	250946.9	250961.1	14.2	550.0	500.0	13		14.2	0.7	3.1	3.1E-07
140	0	209	5	250961.1	250974.4	13.3	500.0	460.0	11		13.3	0.6	2.9	2.9E-07
140	0	209	5	250974.4	250987.8	13.4	460.0	410.0	13		13.4	0.6	3.0	3.0E-07
100	0	169	5	250992.1	251004.1	12.0	390.0	340.0	13		12.0	0.6	3.3	3.3E-07
100	0	169	5	251004.1	251015.6	11.5	340.0	300.0	11		11.5	0.5	3.1	3.1E-07
100	0	169	5	251015.6	251027.1	11.5	300.0	260.0	11		11.5	0.5	3.1	3.1E-07
50	0	119	5	251046.5	251050.4	3.9	500.0	480.0	3		3.9	0.2	1.5	1.5E-07
50	0	119	5	251050.4	251054.2	3.8	480.0	460.0	3		3.8	0.2	1.5	1.5E-07
50	0	119	5	251054.2	251058.1	3.9	460.0	460.0	3		3.9	0.2	1.5	1.5E-07

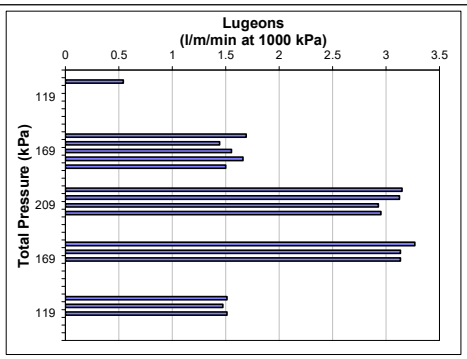
Notes



Averages			
Stage	Pressure (kPa)	Water Loss (l/m/min)	Lugeons (l/m/min at 1000kPa)
1	119	0.02	0.14
2	169	0.26	1.57
3	209	0.63	3.04
4	169	0.54	3.18
5	119	0.18	1.50

Note: If flowmeter readings are less than 1 litre in 5 minutes the drum readings have been used

Calculated: YB/EM
Checked:
Date:



Appendix F

Groundwater Quality Results

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86645.04	**Suburb:**	Crows Nest	**To:**	Lab name
Project Manager:	Paul Gorman	**Order Number:**		**Sampler:**	TG
					Lab address
Email:	paul.gorman@douglaspartners.com.au			**Attn:**	Name
Turnaround time:	☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day				Lab phone Lab email
Prior Storage:	☑ Fridge ☐ Freezer ☐ Esky ☐ Shelf	**Do samples contain 'potential' HBM?**	☑ No ☐ Yes	(If YES, then handle, transport and store in accordance with FPM HAZID)	

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M - Material	Container Type: G - glass P - plastic	Analytes: Combo 8 (dissolved and total)	PFAS-Short Suite	TDS/TSS	Oil &Grease	Ferrous Iron	Ferric Iron	Combo 3	BTEX				Notes/ Preservation/ Additional Requirements
1	BH103			20.6.23	W	G+P	X	X	X		X	X						
2	BH104			22.6.23	W	G+P	X	X	X	X	X	X						
3	BH105			20.6.23	W	G+P	X	X	X		X	X						
4	BD1/20230620			20.6.23	W	G+P							X					
5	Trip Spike				W	G								X				
6	Trip Blank				W	G								X				

ENVIROLAB 12 Ashley St Chatswood NSW 2067 Ph: (02) 9910 6200
Job No: 326366
Date Received: 23/06/2023
Time Received: 15:30
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None
8°C

Metals to analyse:		**LAB RECEIPT**	
Number of samples in container:	**Transported to laboratory by:** Courier	**Lab Ref. No:**	326366
Send results to: Douglas Partners Pty Ltd		**Received by:**	
Address:	**Phone:**	**Date & Time:**	23/6/2023 15:30
Relinquished by: TG	**Date:** 22.6.23 **Signed:** TG	**Signed:**	

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd
Attention	Paul Gorman

Sample Login Details

Your reference	86645.04 Crows Nest
Envirolab Reference	326366
Date Sample Received	23/06/2023
Date Instructions Received	23/06/2023
Date Results Expected to be Reported	30/06/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	6 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water	Organochlorine Pesticides in Water	OP Pesticides in Water	PCBs in Water	Total Phenolicsin Water	HM in water - dissolved	HM in water - total	Total Suspended Solids	Total Dissolved Solids(grav)	Oil & Grease (LLE)	Ferrous Iron	Ferric Iron (by calculation)	PFAS in Waters Short
BH103	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
BH104	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BH105	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
BD1/20230620	✓	✓	✓					✓	✓						
Trip Spike	✓														
Trip Blank	✓														

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

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

CERTIFICATE OF ANALYSIS 326366

Client Details

Client	Douglas Partners Pty Ltd
Attention	Paul Gorman
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**86645.04 Crows Nest**
Number of Samples	6 Water
Date samples received	23/06/2023
Date completed instructions received	23/06/2023

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	30/06/2023
Date of Issue	03/07/2023

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

Results Approved By
Diego Bigolin, Inorganics Supervisor
Jenny He, Senior Chemist
Kyle Gavrily, Senior Chemist
Loren Bardwell, Development Chemist
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By
Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water						
Our Reference		326366-1	326366-2	326366-3	326366-4	326366-5
Your Reference	UNITS	BH103	BH104	BH105	BD1/20230620	Trip Spike
Date Sampled		20/06/2023	22/06/2023	20/06/2023	20/06/2023	20/06/2023
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	26/06/2023	26/06/2023	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	27/06/2023	27/06/2023	27/06/2023	27/06/2023	27/06/2023
TRH C_6 - C_9	µg/L	<10	<10	<10	<10	[NA]
TRH C_6 - C_{10}	µg/L	<10	<10	<10	<10	[NA]
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10	<10	[NA]
Benzene	µg/L	<1	<1	<1	<1	104%
Toluene	µg/L	<1	<1	<1	<1	105%
Ethylbenzene	µg/L	<1	<1	<1	<1	119%
m+p-xylene	µg/L	<2	<2	<2	<2	100%
o-xylene	µg/L	<1	<1	<1	<1	110%
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	112	111	121	118	101
Surrogate toluene-d8	%	110	108	118	116	107
Surrogate 4-BFB	%	104	106	107	108	109

vTRH(C6-C10)/BTEXN in Water		
Our Reference		326366-6
Your Reference	UNITS	Trip Blank
Date Sampled		20/06/2023
Type of sample		Water
Date extracted	-	26/06/2023
Date analysed	-	27/06/2023
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	119
Surrogate toluene-d8	%	120
Surrogate 4-BFB	%	104

svTRH (C10-C40) in Water					
Our Reference		326366-1	326366-2	326366-3	326366-4
Your Reference	UNITS	BH103	BH104	BH105	BD1/20230620
Date Sampled		20/06/2023	22/06/2023	20/06/2023	20/06/2023
Type of sample		Water	Water	Water	Water
Date extracted	-	26/06/2023	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	27/06/2023	27/06/2023	27/06/2023	27/06/2023
TRH C_{10} - C_{14}	µg/L	<50	<50	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	<50	<50	<50
TRH >C_{10} - C_{16}	µg/L	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH >C_{16} - C_{34}	µg/L	<100	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	<50	<50	<50
Surrogate o-Terphenyl	%	93	93	82	86

PAHs in Water					
Our Reference		326366-1	326366-2	326366-3	326366-4
Your Reference	UNITS	BH103	BH104	BH105	BD1/20230620
Date Sampled		20/06/2023	22/06/2023	20/06/2023	20/06/2023
Type of sample		Water	Water	Water	Water
Date extracted	-	26/06/2023	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	27/06/2023	27/06/2023	27/06/2023	26/06/2023
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	112	114	98	99

Organochlorine Pesticides in Water				
Our Reference	UNITS	326366-1	326366-2	326366-3
Your Reference		BH103	BH104	BH105
Date Sampled		20/06/2023	22/06/2023	20/06/2023
Type of sample		Water	Water	Water
Date extracted	-	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	27/06/2023	27/06/2023	27/06/2023
alpha-BHC	µg/L	<0.2	<0.2	<0.2
HCB	µg/L	<0.2	<0.2	<0.2
beta-BHC	µg/L	<0.2	<0.2	<0.2
gamma-BHC	µg/L	<0.2	<0.2	<0.2
Heptachlor	µg/L	<0.2	<0.2	<0.2
delta-BHC	µg/L	<0.2	<0.2	<0.2
Aldrin	µg/L	<0.2	<0.2	<0.2
Heptachlor Epoxide	µg/L	<0.2	<0.2	<0.2
gamma-Chlordane	µg/L	<0.2	<0.2	<0.2
alpha-Chlordane	µg/L	<0.2	<0.2	<0.2
Endosulfan I	µg/L	<0.2	<0.2	<0.2
pp-DDE	µg/L	<0.2	<0.2	<0.2
Dieldrin	µg/L	<0.2	<0.2	<0.2
Endrin	µg/L	<0.2	<0.2	<0.2
Endosulfan II	µg/L	<0.2	<0.2	<0.2
pp-DDD	µg/L	<0.2	<0.2	<0.2
Endrin Aldehyde	µg/L	<0.2	<0.2	<0.2
pp-DDT	µg/L	<0.2	<0.2	<0.2
Endosulfan Sulphate	µg/L	<0.2	<0.2	<0.2
Methoxychlor	µg/L	<0.2	<0.2	<0.2
Surrogate TCMX	%	106	106	93

OP Pesticides in Water				
Our Reference		326366-1	326366-2	326366-3
Your Reference	UNITS	BH103	BH104	BH105
Date Sampled		20/06/2023	22/06/2023	20/06/2023
Type of sample		Water	Water	Water
Date extracted	-	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	27/06/2023	27/06/2023	27/06/2023
Dichlorvos	µg/L	<0.2	<0.2	<0.2
Dimethoate	µg/L	<0.2	<0.2	<0.2
Diazinon	µg/L	<0.2	<0.2	<0.2
Chlorpyriphos-methyl	µg/L	<0.2	<0.2	<0.2
Ronnel	µg/L	<0.2	<0.2	<0.2
Fenitrothion	µg/L	<0.2	<0.2	<0.2
Malathion	µg/L	<0.2	<0.2	<0.2
Chlorpyriphos	µg/L	<0.2	<0.2	<0.2
Parathion	µg/L	<0.2	<0.2	<0.2
Bromophos ethyl	µg/L	<0.2	<0.2	<0.2
Ethion	µg/L	<0.2	<0.2	<0.2
Azinphos-methyl (Guthion)	µg/L	<0.2	<0.2	<0.2
Surrogate TCMX	%	106	106	93

PCBs in Water				
Our Reference		326366-1	326366-2	326366-3
Your Reference	UNITS	BH103	BH104	BH105
Date Sampled		20/06/2023	22/06/2023	20/06/2023
Type of sample		Water	Water	Water
Date extracted	-	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	27/06/2023	27/06/2023	27/06/2023
Aroclor 1016	µg/L	<2	<2	<2
Aroclor 1221	µg/L	<2	<2	<2
Aroclor 1232	µg/L	<2	<2	<2
Aroclor 1242	µg/L	<2	<2	<2
Aroclor 1248	µg/L	<2	<2	<2
Aroclor 1254	µg/L	<2	<2	<2
Aroclor 1260	µg/L	<2	<2	<2
Surrogate TCMX	%	106	106	93

Total Phenolics in Water				
Our Reference		326366-1	326366-2	326366-3
Your Reference	UNITS	BH103	BH104	BH105
Date Sampled		20/06/2023	22/06/2023	20/06/2023
Type of sample		Water	Water	Water
Date extracted	-	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	26/06/2023	26/06/2023	26/06/2023
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05

HM in water - dissolved					
Our Reference		326366-1	326366-2	326366-3	326366-4
Your Reference	UNITS	BH103	BH104	BH105	BD1/20230620
Date Sampled		20/06/2023	22/06/2023	20/06/2023	20/06/2023
Type of sample		Water	Water	Water	Water
Date prepared	-	26/06/2023	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	26/06/2023	26/06/2023	26/06/2023	26/06/2023
Arsenic-Dissolved	µg/L	5	13	31	6
Cadmium-Dissolved	µg/L	<0.1	0.1	1.6	0.1
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	1	6	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	22	41	73	23
Zinc-Dissolved	µg/L	300	65	460	300

HM in water - total					
Our Reference		326366-1	326366-2	326366-3	326366-4
Your Reference	UNITS	BH103	BH104	BH105	BD1/20230620
Date Sampled		20/06/2023	22/06/2023	20/06/2023	20/06/2023
Type of sample		Water	Water	Water	Water
Date prepared	-	26/06/2023	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	26/06/2023	26/06/2023	26/06/2023	26/06/2023
Arsenic-Total	µg/L	5	16	50	5
Cadmium-Total	µg/L	<0.1	0.3	2.0	<0.1
Chromium-Total	µg/L	<1	4	<1	<1
Copper-Total	µg/L	<1	17	10	<1
Lead-Total	µg/L	2	6	1	3
Mercury-Total	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Total	µg/L	21	56	82	22
Zinc-Total	µg/L	300	180	530	320

Miscellaneous Inorganics				
Our Reference	UNITS	326366-1	326366-2	326366-3
Your Reference		BH103	BH104	BH105
Date Sampled		20/06/2023	22/06/2023	20/06/2023
Type of sample		Water	Water	Water
Date prepared	-	23/06/2023	23/06/2023	23/06/2023
Date analysed	-	23/06/2023	23/06/2023	23/06/2023
Total Suspended Solids	mg/L	40	540	50
Total Dissolved Solids (grav)	mg/L	1,200	1,500	1,300
Oil & Grease (LLE)	mg/L	[NA]	<5	[NA]
Ferrous Iron	mg/L	19	64	33
Ferric Iron (by calculation)	mg/L	<1	<1	<1

PFAS in Waters Short				
Our Reference	UNITS	326366-1	326366-2	326366-3
Your Reference		BH103	BH104	BH105
Date Sampled		20/06/2023	22/06/2023	20/06/2023
Type of sample		Water	Water	Water
Date prepared	-	26/06/2023	26/06/2023	26/06/2023
Date analysed	-	26/06/2023	26/06/2023	26/06/2023
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	100	98	105
Surrogate $^{13}C_2$ *PFOA*	%	106	104	108
Extracted ISTD $^{18}O_2$ *PFHxS*	%	109	107	106
Extracted ISTD $^{13}C_4$ *PFOS*	%	115	112	104
Extracted ISTD $^{13}C_4$ *PFOA*	%	128	118	112
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	139	114	108
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	100	111	121
Total Positive PFHxS & PFOS	µg/L	<0.01	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	<0.01	<0.01	<0.01
Total Positive PFAS	µg/L	<0.01	<0.01	<0.01

Method ID	Methodology Summary
Inorg-003	Oil & Grease - determine gravimetrically following extraction with Hexane, in accordance with APHA latest edition, 5520-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:- TDS = EC * 0.6
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-076	Ferrous Iron is determined colourimetrically by discrete analyser. Waters samples are filtered on receipt prior to analysis.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	[NT]
Date analysed	-			27/06/2023	1	27/06/2023	27/06/2023		27/06/2023	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	1	<10	<10	0	109	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	1	<10	<10	0	109	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	98	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	111	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	109	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	113	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	111	[NT]
Naphthalene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	105	1	112	110	2	103	[NT]
Surrogate toluene-d8	%		Org-023	99	1	110	95	15	104	[NT]
Surrogate 4-BFB	%		Org-023	104	1	104	104	0	106	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	[NT]
Date analysed	-			26/06/2023	1	27/06/2023	27/06/2023		26/06/2023	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	1	<50	<50	0	112	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	1	<100	<100	0	116	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	1	<100	<100	0	86	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	1	<50	<50	0	112	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	1	<100	<100	0	116	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	1	<100	<100	0	86	[NT]
Surrogate o-Terphenyl	%		Org-020	77	1	93	85	9	77	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	326366-2
Date extracted	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Date analysed	-			27/06/2023	1	27/06/2023	27/06/2023		27/06/2023	27/06/2023
Naphthalene	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	87	90
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	90	93
Fluorene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	85	87
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	86	88
Anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	91	95
Pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	93	97
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	94	96
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	107	111
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	99	1	112	102	9	104	107

QUALITY CONTROL: Organochlorine Pesticides in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	326366-2
Date extracted	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Date analysed	-			27/06/2023	1	27/06/2023	27/06/2023		27/06/2023	27/06/2023
alpha-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	87	88
HCB	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
beta-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	89	93
gamma-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Heptachlor	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	77	93
delta-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Aldrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	90	92
Heptachlor Epoxide	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	91	93
gamma-Chlordane	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
alpha-Chlordane	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Endosulfan I	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDE	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	99	103
Dieldrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	102	107
Endrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	94	104
Endosulfan II	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDD	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	97	105
Endrin Aldehyde	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDT	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	93	107
Methoxychlor	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	85	1	106	95	11	107	101

QUALITY CONTROL: OP Pesticides in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	326366-2
Date extracted	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Date analysed	-			27/06/2023	1	27/06/2023	27/06/2023		27/06/2023	27/06/2023
Dichlorvos	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	111	114
Dimethoate	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Diazinon	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Chlorpyriphos-methyl	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Ronnel	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	93	95
Fenitrothion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	130	139
Malathion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	110	130
Chlorpyriphos	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	105	110
Parathion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	125	128
Bromophos ethyl	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Ethion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	107	132
Azinphos-methyl (Guthion)	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	85	1	106	95	11	107	101

QUALITY CONTROL: PCBs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	326366-2
Date extracted	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Date analysed	-			27/06/2023	1	27/06/2023	27/06/2023		27/06/2023	27/06/2023
Aroclor 1016	µg/L	2	Org-021	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1221	µg/L	2	Org-021	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1232	µg/L	2	Org-021	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1242	µg/L	2	Org-021	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1248	µg/L	2	Org-021	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1254	µg/L	2	Org-021	<2	1	<2	<2	0	114	101
Aroclor 1260	µg/L	2	Org-021	<2	1	<2	<2	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	85	1	106	95	11	107	101

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			26/06/2023	[NT]	[NT]	[NT]	[NT]	26/06/2023	[NT]
Date analysed	-			26/06/2023	[NT]	[NT]	[NT]	[NT]	26/06/2023	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	[NT]
Date analysed	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	5	[NT]		92	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		94	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		88	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		89	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		94	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	114	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	22	[NT]		89	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	300	[NT]		92	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	326366-2
Date prepared	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Date analysed	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Arsenic-Total	µg/L	1	Metals-022	<1	1	5	5	0	90	89
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	91	96
Chromium-Total	µg/L	1	Metals-022	<1	1	<1	<1	0	88	94
Copper-Total	µg/L	1	Metals-022	<1	1	<1	<1	0	89	92
Lead-Total	µg/L	1	Metals-022	<1	1	2	2	0	89	91
Mercury-Total	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	100	78
Nickel-Total	µg/L	1	Metals-022	<1	1	21	22	5	88	91
Zinc-Total	µg/L	1	Metals-022	<1	1	300	320	6	91	#

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	326366-2
Date prepared	-			23/06/2023	1	23/06/2023	23/06/2023		23/06/2023	23/06/2023
Date analysed	-			23/06/2023	1	23/06/2023	23/06/2023		23/06/2023	23/06/2023
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	40	[NT]		108	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	1200	[NT]		110	[NT]
Oil & Grease (LLE)	mg/L	5	Inorg-003	<5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Ferrous Iron	mg/L	0.05	Inorg-076	<0.05	1	19	19	0	101	[NT]
Ferric Iron (by calculation)	mg/L	0.05		<0.05	1	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	326366-2
Date prepared	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Date analysed	-			26/06/2023	1	26/06/2023	26/06/2023		26/06/2023	26/06/2023
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	105	101
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	103	99
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	106	102
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	105	97
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	97	100
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	102	1	100	96	4	102	98
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	1	106	108	2	106	105
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	107	1	109	105	4	103	109
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	109	1	115	116	1	108	116
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	117	1	128	128	0	112	118
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	124	1	139	145	4	113	113
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	82	1	100	117	16	100	116

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

8 HM in water - total - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

MISC_INORG Ferric Iron (by calculation): PQLs for samples have been raised due to sample matrix interference.

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Table J3 : Summary of Groundwater Laboratory Results

		METALS (DISSOLVED)								METALS (TOTAL)								TRH				BTEX										
		Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	F1 (>C6-C10) -BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene	Total Xylenes	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Naphthalene
	PQL	1	0.1	1	1	1	0.05	1	1	1	0.1	1	1	1	0.05	1	1	10	50	100	100	1	1	1	1	2	1	0.1	0.1	0.1	0.1	0.2
ANZG (2018) 95% LOP Fresh		24	0.2	1	1.4	3.4	0.06	11	8	24	0.2	1	1.4	3.4	0.06	11	8					950	180	80	350	75				0.01		16
HEPA (2018) 99% LOP Fresh																																
NEPC (2013) HSL 4-8m																		1000	1000			800					NL					NL
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH103	20/06/23	5	<0.1	<1	<1	<1	<0.05	22	**300**	5	<0.1	<1	<1	2	<0.05	21	**300**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.2
BD1/20230620		6	0.1	<1	<1	<1	<0.05	23	**300**	5	<0.1	<1	<1	3	<0.05	22	**320**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.2
BH104	22/06/23	13	0.1	<1	1	<1	<0.05	41	**65**	16	**0.3**	**4**	**17**	**6**	<0.05	56	**180**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.2
BH105	20/06/23	31	1.6	<1	**6**	<1	<0.05	73	**460**	50	2	<1	**10**	1	<0.05	82	**530**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.2

Notes:

*	QA/QC replicate of sample listed directly below the primary sample
PQL	Practical quantitation limit
-	No criterion / not defined / not tested / not applicable
	Shaded cell is exceedance of guideline value
	Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded
	ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection
	NHMRC (2018) Australian Drinking Water Guidelines 6 2011, drinking water aesthetic-based criteria
	HEPA PFAS National Environmental Management Plan (NEMP) (HEPA, 2020)

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Table J3 : Summary of Groundwater Laboratory Results

		PAH										OCP																										
		Benzo(a)pyrene (BaP)	Benzo(b,j+k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	Aldrin	alpha-BHC	alpha-Chlordane	beta-BHC	DDE	DDT	delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulphate	Endrin	gamma-Chlordane	Heptachlor	Heptachlor Epoxide	Hexachlorobenzene	Lindane	Methoxychlor	DDD	ORGANOCHLORINE PESTICIDES	Aldrin + Dieldrin (calculated)	Azinphos methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon
	PQL	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
ANZG (2018) 95% LOP Fresh		0.1					1			0.6		0.001					0.006		0.01				0.01		0.01				0.005	0.006					0.01		0.01
HEPA (2018) 99% LOP Fresh																				1824	31																	
NEPC (2013) HSL 4-8m																																						
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH103	20/06/23	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BD1/20230620	20/06/23	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH104	22/06/23	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH105	20/06/23	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

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Table J3 : Summary of Groundwater Laboratory Results

		OPP								PCB								VOC	PFAS						Inoganics					
		Dichlorvos	Dimethoate	Ethion	Ronnel (fenchlorphos)	Fenitrothion	Malathion	Parathion	ORGANOPHOSPHORUS PESTICIDES	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	Aroclor 1260	POLYCHLORINATED BIPHENYLS	VOLATILE ORGANIC COMPOUNDS	PFOS	PFOA	PFHxS	Sum of PFHxS and PFOS	8:2 FTS	PFAS	Total Suspended Solids (TSS)	Total Dissolved Solids (TDS)	Oil & Grease	Ferrous Iron	Ferric Iron
	PQL	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2	2	2	2	2	2	2	2	1	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02
ANZG (2018) 95% LOP Fresh			0.15			0.2	0.05	0.04					0.3		0.01				0.00023	19										
HEPA (2018) 99% LOP Fresh																														
NEPC (2013) HSL 4-8m																														
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH103	20/06/23	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<2	<2	<2	<2	<2	<2	<2	<1	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	40000	1200000	-	19000	<1000
BD1/20230620	20/06/23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-
BH104	22/06/23	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<2	<2	<2	<2	<2	<2	<2	<1	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	540000	1500000	<5000	64000	<1000
BH105	20/06/23	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<2	<2	<2	<2	<2	<2	<2	<1	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	50000	1300000	.	33000	<1000