Aargus

Environmental - Remediation - Engineering - Laboratories - Drilling

GEOTECHNICAL DESKTOP STUDY REPORT

Nos. 9-11 Nelson Street, Chatswood, NSW 2067

Prepared for

Urbis Pty Ltd

Report No. GS8019-2A

6th October 2020

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1. Australian Standard – AS 1726-1993 Geotechnical Site Investigation.
2. Pells P.J.N, Mostyn, G. & Walker B.F., "Foundations on Sandstone and Shale in the Sydney Region", Australian Geomechanics Journal, 1998.
3. Geological Survey of New South Wales, NSW Department of Mineral Resources, Geological Map of Sydney 1:100,000 Geological Series Sheet 9130, Edition 1, dated 1983.
4. Department of Primary Industries, Office of Water, NSW Government
   - https://realtimedata.waternsw.com.au/
5. Department of Planning and Environment, NSW Government - www.majorprojects.planning.nsw.gov.au; www.planningportal.nsw.gov.au;
6. https://www.sydneymetro.info/station/chatswood-dive-site

1. INTRODUCTION

Aargus Pty Ltd has been commissioned by Urbis Pty Ltd, to carry out a geotechnical desktop study at Nos. 9-11 Nelson Street, Chatswood, NSW, 2067. A site walkover was carried out on the 22nd September 2020, and was followed by geotechnical assessment and preparation of a geotechnical desktop study report.

The geotechnical desktop study report is to accompany a Planning Proposal Application for a Strata owner group at Chatswood CBD. The site is a strata residential development and the proposed LEP changes will allow for a new residential tower(s) development.

The purpose of the desktop study was to provide information related to regional geology, sub-surface conditions including groundwater and to provide comments on the feasibility of the proposed development from a geotechnical perspective. For this project, Aargus carried out a scope of work consisting of a site walkover, desktop study, geotechnical appraisal and preparation of this report.

The following aspects have been addressed in this report:

- Site description;
- Site walkover;
- Proposed development;
- Inferred Subsurface Conditions; and
- Geotechnical Appraisal.

Inferred local subsurface and groundwater conditions for the subject site were based on local knowledge obtained from previous projects in the vicinity and publically available geotechnical information as well as information recorded during the site walkover inspection.

To assist in reading the report, reference should be made to the "Important Information About Your Geotechnical Report" attached as Appendix A.

2. AVAILABLE INFORMATION

Prior to preparation of this report, following information has been made available to Aargus by the Client:

- Sydney Metro Underground Corridor Protection Guidelines Revision 1_0, Document No. NWRLSRT-PBA-SRT-TU-REP-000008, dated 16 October 2017;
- Sydney Metro At Grade and Elevated Sections Corridor Protection Guidelines, Project No. 657578, dated September 2018;
- Commencement of compulsory acquisition of easement for rock anchors, by Transport for NSW, Reference SM-17-00113936, dated 14th December 2017.

Since this project is a planning proposal only, no such concept plans or final envelope plans have been made available by the Client to Aargus. However, the Client has informed that the

proposed development will be covering a large part of the site, most of which is currently residential apartments.

3. SCOPE OF WORK

In accordance with the brief, Aargus carried out a scope of work that consisted of the following:

- Collate and review Dial-Before-You-Dig (DBYD) plans;
- A site walk-over inspection in order to determine the overall surface conditions and to identify any relevant site features;
- Obtaining publically available geotechnical and groundwater information relevant to the site;
- Review of local geological information available in Aargus library;
- Obtaining information from nearby sites, and
- Preparation of a desktop study report (this report).

4. REVIEW OF UNDERGROUND SERVICES

Based on the review of DBYD drawings, following services were found within and vicinity of the site:

- Telecommunication: PVC conduits from Telstra are located outside and along the Gordon Avenue on the northern side and Nelson Street on the southern side of the property. Also, cables from Primus telecom are located within the property footprint on the eastern side. All of services are inferred to be within the council property; however services to the subject properties are extending from the council area into the site.
- Telecommunication: The cables from nextgen Group and 3rd party duct are located along the eastern boundary of the site.
- Telecommunication: As for TPG, an AAPT/ PowerTel Duct and AAPT/ PowerTel Pit are located along the south west corner of the property.
- Telecommunication: Conduits from Optus are also located along the eastern railway track line and along the Nelson Street on the southern boundary of the subject site.
- Telecommunication: Conduits and 2nos of pit from Vocus communications are located along the south eastern corner of the property.
- Power supply: An underground power cable from Uecomm is located along the eastern boundary of the property.
- Networking: An underground fibre assets from AARNet is located at the south eastern corner of the property.
- Power supply: High voltage cables and distribution box from Ausgrid are located at the south east corner of the property along the Nelson Street.
- Stormwater: Council stormwater node and stormwater pipe shared with or owned by another party are located along north eastern boundary of the subject site. Service is

inferred to be within the council property; however service to the subject properties is extending from the council area into the site.

- Electrical cables: Council underground electrical cables and council miscellaneous electrical assets area located within the eastern boundary of the site. Service is inferred to be within the council property and the site.
- Gas Main: Gas Main from Jemena is located outside and along the Gordon Avenue on the northern side of the property.
- Sewer and water mains: A Sydney Water sewer line runs within the property, sloping from east to western boundary of the site and also outside of the property along the Gordon Avenue on the northern boundary. As for water mains, one pipeline is located along the Gordon Avenue on the northern boundary and another one located along the Nelson Street on the southern boundary of the site.

5. REVIEW OF MAJOR PROJECTS IN THE AREA

A review of major projects planned by the NSW Government on the major projects web portal shows Chatswood dive site, Sydney Metro project by NSW Government currently on progress. The dive site is located south of Chatswood Station and north of Mowbray Road adjacent to the T1 North Shore Line at Chatswood. It borders the Pacific Highway, Mowbray Road and Nelson Street.

6. SITE CONDITIONS

6.1 Site Description

The site is located within the City of Willoughby Council. It is an irregular shaped plot with an approximate area of 4221 m2 comprising property no. SP 65120. The site is approximately 65m north east from Pacific Highway and about 1km south from Chatswood Railway Station. The property is bounded by following properties, public roads and infrastructures:

- Chatswood Station Railway tracks on the east;
- Small portion of Lot No.2, DP 1009363 on the north east corner of the site;
- Pedestrian lane/ bicycle lane along the eastern boundary;
- Property No. SP 85403 on the north west corner;
- Property No. SP 89243 on the south west corner;
- Gordon Avenue carriageway to the north of the site; and
- Nelson Street carriageway to the south of the site.

The Sydney Metro-City & Southwest, with twin running tunnels of approximately 14km in length (portal to portal), extending from a dive and portal structure at Chatswood, is registered crossing approximately diagonally away from the property at 9-11 Nelson Street.

6.2 Site Walkover

At the time of site walkover, the building at 9-11 Nelson Street comprised of a three storey apartment building with possibly one basement level. The local area surrounding the site was observed to comprise a number of apartment buildings along with a small vacant public open area on the north east corner of the property. Road works by Sydney Metro was being carried out alongside the south east corner of Nelson Street at the time of inspection.

There is no information provided regarding the foundation system of the existing buildings within the subject site. During the walkover, no construction works exists around the project site to assess the condition of the subsoil layers.

7. PROPOSED DEVELOPMENT

Based on the information provided in Section 2, it is understood that the proposed development will be covering a large part of the site, most of which is currently residential apartments.

8. INFERRED SUBSURFACE CONDITIONS

8.1 Geology

Reference to the Sydney 1:100,000 Geological Series Sheet 9130 Edition 1, dated 1983, by the Geological Survey of New South Wales, Department of Mineral Resources, indicates the site is located at a geological area underlain by Triassic Age Ashfield Shale (Rwa) of the Wianamatta Group. The Ashfield Shale is described as “black to dark grey shale and laminite”.

It should be noted this geological profile does not take into account the residual soils derived from in-situ weathering of the bedrock, or the presence of fill that may have been generated from previous earthworks.

8.2 Previous Geotechnical Investigations

The following geotechnical information was gathered from past Aargus projects:

8.2.1 No.19 Nelson Street, Chatswood

This site is located just about 65m south west of the proposed site. Aargus has investigated this site on 12th February 2018 with the details outlined in the report reference No. GS7170-1A. The field investigation works previously investigated by Aargus was followed by machine drilling of one borehole to TC bit refusal to the top of the bedrock, along with the installation of one standpipe piezometer to assess the groundwater conditions. The following subsurface conditions were encountered during the previous investigation:

- Concrete pavement of 100mm thickness at the top;
- Fill layer of Clayey soil, of high plasticity, pale grey, moist in nature, approximately 0.10-0.13m bgl, over

- Another Fill layer of Silty Clayey soil, of low plasticity, red brown to black, with coarse grained sand and a trace of fine basalt gravel (<5%), moist condition with depths from 0.13-1.4m bgl, underlain by
- Residual Clayey soil of high plasticity, red brown, yellow grey, orange, with medium dark red ironstone gravel, very stiff and moist with depths varying from 1.4-4.5m bgl and becoming dark red, pale grey, mottled, with traces of tree rootlets and hard and moist in nature from 4.5-11.8m depth bgl, over
- Bedrock Shale layer, laminated, red brown, pale grey, extremely weathered, extremely low estimated strength, with traces of ironstone bands, yellow brown to red brown, sandy, medium grained sand, Class V Shale with depths varying from 11.8-11.92m bgl.

Groundwater was not encountered during augering of the boreholes. However, the SPT rods were found to be slightly wet between 1.9m and 2.5m depth. This was not considered to be significant with respect to groundwater seepage.

The groundwater level measured in the piezometer on 14th February 2018, was at 4.32m depth, two days after the installation of the piezometer.

8.3 Inferred Ground Profile

Ground conditions encountered during past projects within the general vicinity of the site, from geological map, site walkover, and from nearby locations have provided some guidance on possible ground conditions prevailing at the site. According to this information, the inferred subsurface conditions are outlined in Table 1.

Table 1 Summary of Inferred Subsurface Conditions

Unit	Description	Estimated Depth to Underside of Unit (m)
Pavement	Concrete	0.0-0.1
Fill	CLAY, high plasticity.	0.10-0.13
	Silty CLAY, low plasticity, with traces of coarse grained sand and fine basalt gravel.	0.13-1.4
Residual Soil	CLAY, high plasticity, mottled, with ironstone gravel, very stiff to becoming hard with increase in depth.	1.4-11.8
Bedrock	Class V SHALE, laminated, extremely weathered, extremely low estimated strength, with traces of ironstone bands, sandy, and medium grained sand.	11.8-11.92

[1] Pells P.J.N, Mostyn, G. & Walker B.F., "Foundations on Sandstone and Shale in the Sydney Region", Australian Geomechanics Journal, 1998.

It should be noted that the ground conditions can vary significantly within this area. Geotechnical site investigation by boreholes drilling would therefore be required to

confirm the inferred underlying subsurface profiles, the strengths and degree of weathering of the soils and rock horizons as well as configuration of any bedding and defects that may be present in the rock.

8.4 Inferred Groundwater Level

A groundwater bore search was carried out on the Natural Resources Atlas database provided by the NSW Department of Natural Resources (Reference 4). There was five closest sites within 500 metres of the subject site, with bore ID's GW112743, GW112742, GW112745, GW112744 and GW112747. However, no standing groundwater levels were provided in those groundwater well details.

Based on available information in Aargus Library, it is anticipated that the groundwater seepage may be from a depth of 4.0m bgl and in the form of seepage through the bedrock weathering.

It should be noted that elevated groundwater levels may be encountered due to seasonal and daily fluctuations influenced by factors such as rainfall and future development of the surrounding lands. Soil moisture within the site may be influenced by events within the property and the adjoining road and properties such as damage to water mains, stormwater or sewer pipes.

8.5 Acid Sulphate Soils (ASS)

Based on the provided ASS maps in Department of Planning and Environment (reference) presence of ASS is not known within the proposed development.

9. GEOTECHNICAL APPRAISAL

9.1 General

The main geotechnical aspects that may be associated with the proposed development are assessed to include the following:

- Excavation conditions.
- Vibration monitoring
- Stability of Excavation.
- Foundations.
- Groundwater.

An appraisal of the main geotechnical aspects above based on available information from the development site is presented in the following sections. It is considered that the groundwater is likely to be present below the bulk excavation level and is likely to be within the Shale bedrock.

Consideration needs to be given to specific geotechnical issues as outlined above. Preliminary geotechnical commentary regarding these geotechnical constraints and recommendations for the proposed development is presented in the following sections.

9.2 Excavation Conditions

As per the Inferred Ground Profile in Section 7.3, it is understood that the expected excavation for the proposed development will be majorly through the fill layer followed by high plasticity and very stiff to hard residual Clayey soil to an approximate depth of 11.8m bgl and possibly through Class V Shale upto 11.9m depth bgl. Excavation within soils and Class V Shale is expected to be readily achieved using a large hydraulic excavator down to the level of medium or stronger bedrock. However, localised use of rock breaking equipment or ripping may be required where high strength bands are encountered.

For medium or greater strength rock (if encountered), excavation will require the use of heavy ripping and/or hydraulic rock hammers together with the use of rock sawing to minimise vibrations to surrounding developments. Excavation for foundations or trenches will require the use of hydraulic hammers and possibly a rock saw. Both noise and vibration will be generated by the proposed excavation work within these bedrock materials. The use of rock sawing at the site perimeter (where relevant) will assist in managing vibration transmission to adjacent developments.

It is recommended that a vibration monitoring plan is developed to monitor the potential vibration effects from the demolition and excavation works on existing buildings within adjoining properties and road reserves and carriageways along the site boundary. Vibration monitoring and rock sawing practices are considered industry standard practice in managing adverse excavation impacts to adjacent neighbouring developments.

9.3 Vibration Control

Consideration may be given to a vibration monitoring plan, which is developed to monitor the potential vibration effects during excavation and from the demolition works, on existing buildings within directly adjoining properties along the site boundary.

To ensure vibration levels remain within acceptable levels and to minimise the potential effects of vibration, if required, excavation into medium strength bedrock or stronger should be complemented with saw cutting or other appropriate methods prior to excavation. Rock saw cutting should be carried out using an excavator mounted rock saw, or similar, so as to minimise transmission of vibrations to any directly adjoining properties that may be affected. Hammering is not recommended adjacent directly neighbouring developments. However, if necessary, hammering should be carried out horizontally along bedding planes of (pre-cut) broken rock blocks or boulders where possible and at the required operational limit to ensure noise levels are restricted to limits acceptable to adjacent residents.

Recommended Maximum Peak Particle Velocities (PPV) for different buildings or structures are summarised in Table 2. Induced vibrations in structures adjacent to the excavation should not be exceeded.

Table 2 Recommended Maximum Peak Particle Velocity

Type of Building or Structure	Max. PPV (mm/sec)

Historical or structures in sensitive conditions	2
Residential and low rise buildings	5
Brick or unreinforced structures in good condition	10
Commercial and industrial buildings or structures of reinforced concrete or steel construction.	25

It is recommended that monitoring is carried out during excavation using a vibration monitoring instrument (seismograph) or similar monitoring system and alarm levels (being the appropriate PPV) selected in accordance with the type of structures present within the zone of influence of the proposed excavation.

If vibrations in adjacent structures exceed the above values or appear excessive during construction, excavation should cease and the project Geotechnical Engineer should be contacted immediately for appropriate reviews.

It is recommended a dilapidation survey of the existing buildings within adjoining properties and infrastructure is conducted. Preparation of dilapidation survey report and vibration monitoring plan together with vibration monitoring should constitute as "Hold Points".

9.4 Stability of Excavation

Temporary batter slopes may be considered in areas where sufficient space exists between the toe of the excavation and the site boundary and where any adjacent buildings (or infrastructure) are located outside a zone of influence obtained by drawing a line up at 45° from the toe of the proposed excavation. Recommended maximum slopes for temporary and permeant batters are provided in Table 3 below.

Table 3 Recommended Batter Slopes (Temporary)

Material	Max. Batter Slope (H:V)
Fill	1.5:1
Residual Sands	1:1 (if no groundwater)
Class V Shale	0.75:1
Class IV Shale	0.5:1
Class III Shale	Semi-vertical[1]

[1] Subject to inspection by an Experienced Geotechnical Engineer and carry out any remedial works as recommended (e.g. shotcrete, rock bolting, etc.)

Since the proposed development has not been provided by the Client yet, the use of temporary batter slopes may be unsuitable and therefore temporary shoring should be provided. Shoring design should consider both short term (construction) and permanent conditions as well as the presence of adjacent buildings and roads.

All vertical drains should be connected to a perimeter drain provided at the toe of the final excavation, which should discharge to the site stormwater system to provide long term drainage behind retaining walls.

For the maximum retained height being considered, a temporary anchorage system is likely to be required to provide lateral support during construction. As two or more rows of anchors are likely to be required to support the shoring due to significant retained height or where significant lateral movements cannot be tolerated (e.g. due to adjacent infrastructure), the shoring/basement wall could be designed as a braced structure. Anchor designs should be based on allowing effective bonding to be developed behind an 'active zone' determined by drawing a line at 45° from the base of the wall to intersect the ground surface behind the excavated face. It is considered that basement floor slabs will provide permanent restraint to the retaining walls where these are incorporated into the permanent works. Anchors are therefore considered to be temporary but depending on the sensitivity of the adjacent infrastructure, it may be necessary to incorporate the temporary anchors into the permanent works to control deflections. Alternatively, internal strutting may be provided in lieu of anchoring where appropriate.

A dilapidation survey will be required prior to excavation for the existing buildings within the adjoining properties and the section of road carriageway and road reserve adjoining the site.

Detailed construction supervision, monitoring and inspections will be required during piling and subsequent bulk excavation and should be carried out by an experienced Geotechnical Engineer, in addition to inspection of the structural elements by the Project Structural Engineer. The inspections should constitute as "Hold Points".

9.5 Foundations

Bulk excavation is mainly likely to expose extremely low to very low strength Shale bedrock potentially comprising Class V Shale. Suitable footings are therefore likely to comprise cast in-situ reinforced concrete raft foundation with thickened slab footings to support internal columns and walls.

However, given the potential for variable strength bedrock at bulk excavation level, it is recommended that all footings be founded on consistent bedrock. This could be achieved by strip or pad footings where suitable bedrock is exposed at bulk excavation level and pile foundations elsewhere. Installation of piles is expected to be required in cases where axial loads on columns and walls exceed the bearing pressure of the bedrock present at bulk excavation level. Design of shallow and pile foundations should be carried out in accordance with Australian Standards AS2870-2011 and AS2159-2009, respectively.

Table 4 provides typical geotechnical parameters recommended for design of shallow and piled foundations. It should be noted that the parameters in Table 4 should not be used for design purposes until they can be confirmed following detailed geotechnical investigation.

Table 4 Typical Geotechnical Foundation Design Capacities

Unit	Allowable Capacity Values (kPa)	
	End Bearing Pressure	**Shaft Adhesion Compression (Tension)**
Fill[2]	N/A[1]	N/A[1]
Residual Clay[2]	200	N/A[1]
Class IV/ V Shale[2,3]	700	50(25)
Class III Shale or better class	3,000	100(50)

[1] N/A, Not Applicable, not recommended for the proposed building of this development.
[2] The actual depth of the underlying ground profile should be confirmed by geotechnical investigation.
[3] Allowable bearing capacity values are from Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region".

9.6 Groundwater Management

The risk of groundwater seepage occurring during excavation will depend on actual groundwater levels at the site, ground conditions and the type of shoring adopted for excavation support. Based on available information within the vicinity of the site, groundwater seepages are likely to occur during bulk excavation. It would therefore be prudent to give a consideration to precautionary drainage measures including strip drains and sump and pump methods to collect and divert any seepage water away from the works.

However the expected groundwater inflow has not been assessed so the adequacy of sump and pump methods cannot be confirmed. Further investigation and assessment of groundwater is required after demolition of the existing infrastructure and prior to commencement of bulk excavation.

9.7 Proposed development constraints

9.7.1 Due to existing Rail corridor and Dive Structure

With reference to Section 2, the extent of zones that have been established to protect the protect the feasibility of planned metro infrastructure, defined as "Protection Reserves", are categorised as either the 'first reserve' or 'second reserve'. Figure 1 and 2 below represent the zones that form the first reserve and the second reserve around the underground infrastructure.

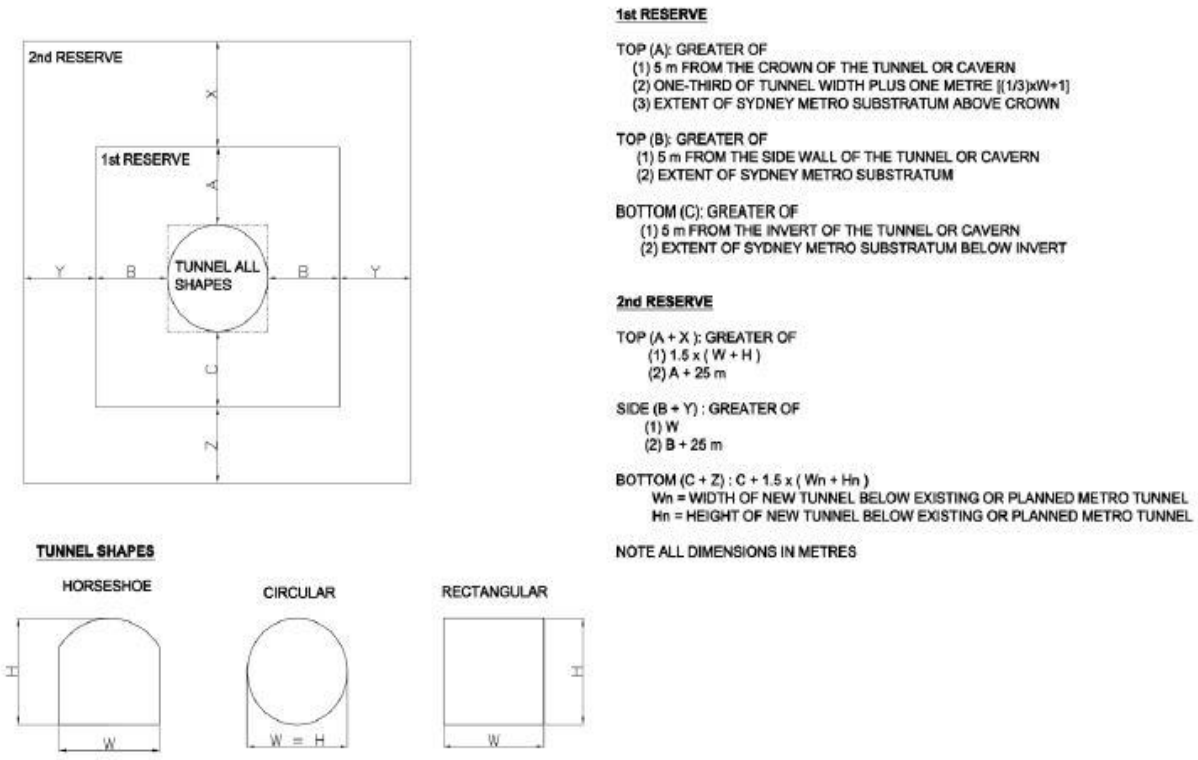

Figure 1 Protection reserves for metro tunnels

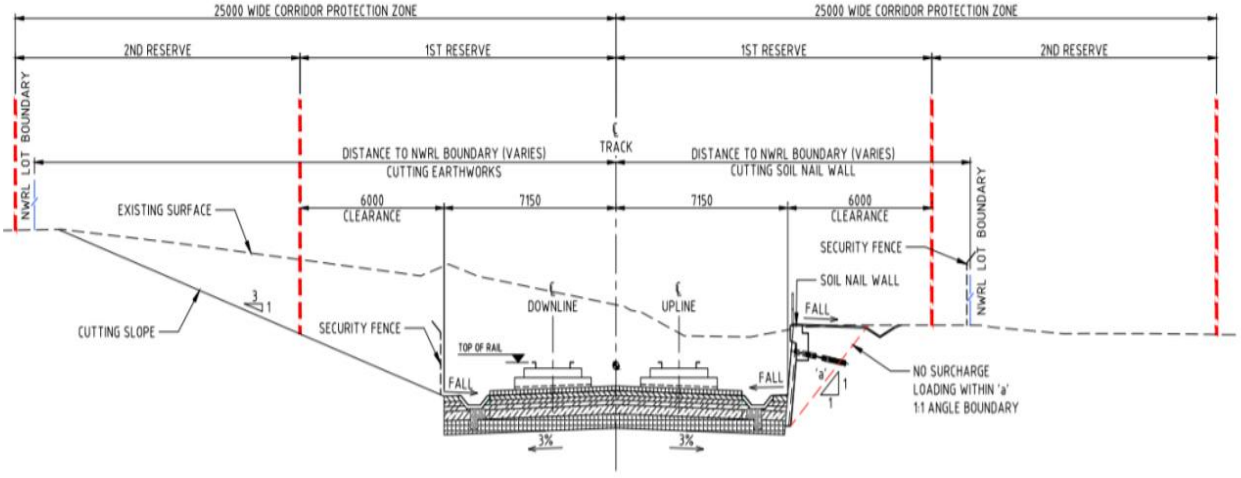

FIGURE 3.2 – SECTION IN CUTTING PROTECTION ZONE (NTS)

Figure 2 Protection reserves for metro Dive Structure and rail Corridor

Table 5 below provides the construction restrictions that are applied to each reserve zone as shown in Fig 1 above.

Table 5 Construction restrictions

Types of construction	First reserve	Second Reserve
Excavation for basements, footings	Not allowed	Allowed, subject to assessment and impact report
Shallow footings or pile foundations	Not allowed	Allowed, subject to load restrictions. Assessment required.
Tunnels and underground excavations	Not allowed	Allowed, subject to assessment.
Ground anchors	Not allowed	Allowed, subject to assessment.
Demolition of existing subsurface structures	Not allowed	Allowed, subject to assessment.
Penetrative subsurface investigations	Allowed away from support zone, assessment required	Allowed, subject to assessment.

Clause 86 of the NSW Infrastructure SEPP (2007) defines a 'Protection Zone' related to excavation in, above, below or adjacent to rail corridors as being 'within 25m (measured horizontally) of a rail corridor'.

With reference to the location of the easement rock anchor plan by BG&E "CHATSWOOD DIVE ANCHOR SECTIONS" SK001 RA DWN 23/10/2017, the part of the easement denoted by (X1) on the southern boundary of the proposed site along the Nelson Street, is 37m from the inner face of the proposed ramp wall, limited in depth to the horizontal plane at RL 77.6m AHD and limited in height to the horizontal plane at RL 86.7 AHD.

Also, the part of the easement denoted by (X2) on the eastern and south-eastern corner of the property along the North Shore Railway track is 22m from the inner face of the proposed western retaining structure of the Sydney Metro, limited in depth to the horizontal plane at RL 74.5m AHD and limited in height to the horizontal plane at RL 86.9m AHD.

However, as per the 'Proposed Acquisition Notice' by the Transport for NSW (TfNSW), Annexure "A", Clause 1.3, the easement will expire on the earlier to occur of 1st December 2021 and as soon as practicable after the date on which the Sydney Metro no longer requires the rights under this easement.

9.8 Further Geotechnical Work

Below is a summary of the additional works that should be carried out:

- It is recommended geotechnical investigation for the, drilling of at least six boreholes, 3 Augers holes terminated at rock depth and 3 core holes 15m deep from the surface including rock coring and point load testing on rock samples to provide preliminary design parameters;

- Installation of 3 groundwater monitoring wells around the site and hydrogeological Assessment for the proposed development.

- A Detail an Engineering Impact Assessment is to be carried out in accordance with the Sydney Metro Corridor Protection Guidelines available on www.sydneymetro.info (including 1st and 2nd reserves as defined within the same protection guidelines) with the reference of the proposed development.

- Preparation of a Geotechnical ground movement monitoring plan (GMP) to satisfy Metro requirements (where relevant);

10. LIMITATIONS

The geotechnical assessment of the subsurface profile and geotechnical conditions within the proposed development area and the conclusions and recommendations presented in this report have been based on available information obtained during the work carried out by Aargus and in the provided documents listed in Section 2 of this report. Inferences about the nature and continuity of ground conditions away from and beyond the locations of field exploratory tests are made, but cannot be guaranteed.

It is recommended that should ground conditions including subsurface and groundwater conditions, encountered during construction and excavation vary substantially from those presented within this report, Aargus Pty Ltd be contacted immediately for further advice and any necessary review of recommendations. Aargus does not accept any liability for site conditions not observed or accessible during the time of the inspection.

This report and associated documentation and the information herein have been prepared solely for the use of **Urbis Pty Ltd** and any reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuing liability resulting from use of the report by third parties cannot be transferred to Aargus Pty Ltd, directors or employees.

For and on behalf of

Aargus Pty Ltd

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Reviewed by

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Attachment

Appendix A: Important information about your geotechnical report

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include the general nature of the structure involved, its size and configuration, the location of the structure on the site and its orientation, physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program.

To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should NOT be used:*

- when the nature of the proposed structure is changed: for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an un-refrigerated one,
- when the size or configuration of the proposed structure is altered,
- when the location or orientation of the proposed structure is modified,
- when there is a change of ownership, or

for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

Geotechnical reports present the results of investigations carried out for a specific project and usually for a specific phase of the project. The report may not be relevant for other phases of the project, or where project details change.

The advice herein relates only to this project and the scope of works provided by the Client.

Soil and Rock Descriptions are based on AS1726-1993, using visual and tactile assessment except at discrete locations where field and/or laboratory tests have been carried out. Refer to the attached terms and symbols sheets for definitions.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how

qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact. For this reason, most experienced owners retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions, and thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

Subsurface conditions can change with time and can vary between test locations. Construction activities at or adjacent to the site and natural events such as flood, earthquake or groundwater fluctuations can also affect the subsurface conditions.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems.
No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professional develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

The interpretation of the discussion and recommendations contained in this report are based on extrapolation/interpretation from data obtained at discrete locations. Actual conditions in areas not sampled or investigated may differ from those predicted

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings because drafters may commit errors or omissions in the

transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimise the likelihood of boring log misinterpretation, give contractors ready access in the complete geotechnical engineering report prepared or authorized for their use. Those who do not provide such access may proceed under mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are not exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

FURTHER GENERAL NOTES

Groundwater levels indicated on the logs are taken at the time of measurement and may not reflect the actual groundwater levels at those specific locations. It should be noted that groundwater levels can fluctuate due to seasonal and tidal activities.