Chameleon Geosciences Pty Ltd

GEOTECHNICAL INVESTIGATION REPORT

118 Cary Street
(114-120 Cary St, 1, 2, 3, 5 Bath St and 3 Arnott Ave)
Toronto NSW 2283

Prepared for

TORONTO INVESTMENTS NO.1 PTY LTD

Report No. GS8030-1A Rev 3

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REFERENCES

1. Australian Standard – AS 1726-2017 Geotechnical Site Investigation.
2. Australian Standard – AS 1170.4-2007 Structural Design Actions – Part 4: Earthquake actions in Australia.
3. Australian Standard – AS3798-2007 Guidelines on Earthworks for Commercial and Residential Developments.
4. Australian Standard – AS 2870-2011 Residential slabs and footings.
5. Australian Standard – AS 2159-2009 Piling - Design and installation.
6. Pells P.J.N, Mostyn, G. & Walker B.F., "Foundations on Sandstone and Shale in the Sydney Region", Australian Geomechanics Journal, 1998.
7. Site investigations for urban salinity, Department of Land and Water Conservation, 2002.
8. National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council, 2013.
9. National Acid Sulphate Soils Guide, Water Quality Australia, June 2018.

1. INTRODUCTION

Chameleon Geosciences Pty Ltd (Chameleon) has been commissioned by Toronto Investments No.1 Pty Ltd to carry out a geotechnical site investigation at 118 Cary Street, Toronto, NSW. The site investigation was carried out from 7th September 2020 to 10th September 2020 and was followed by geotechnical interpretations, assessment, and preparation of a geotechnical report. Further works were conducted to gather seasonal variations on groundwater levels plus installation of 3 more groundwater wells to determine k values for the proposed basement excavation at 6-7m as previous wells were for geotechnical purposes constructed to 13m in rock which was not representative of the permeability values for the soils proposed to be excavated. These works were conducted throughout 2021.

The investigation aimed to assess the site's existing ground conditions and feasibility, from a geotechnical perspective to provide general recommendations for the design and construction of the proposed development.

This report also presents the results of the geotechnical site investigation, laboratory testing, interpretation, and assessment of the site's existing geotechnical conditions as a basis to provide recommendations for the design and construction of ground structures for the proposed development.

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

2. AVAILABLE INFORMATION

Prior to preparation of this report, the following information was made available to Chameleon:

- Topographical Survey Map, prepared by Duggan Mather Surveyors, surveyed on 23rd September 2016 and revised again on 9th June 2021;
- Architectural drawings for Development Application, prepared by Mark Lawler Architects, including plans, elevations and sections (refer to most recent site plans)
- Geotechnical Assessment Report by JK Geotechnics, dated 13th October 2016, Reference No. 29644S Brpt.

- Councils Statement of Facts and Contentions (case #2020/00091325 dated 10 July 2020) and Amended Statement of Facts and Contentions dated May 2021.
- Various joint expert reports in response (case #2020/00091325).
- Groundwater Drawdown & Settlement Analysis (Feb 2022 revised)

3. SCOPE OF WORK

Accordance with the brief, fieldwork for the geotechnical site investigation was carried out by an Experienced Geotechnical Professional from Chameleon, following in general the guidelines provided in Australian Standard AS 1726-2017 (Reference 1) and comprised the following:

- Collection and review of the Dial-Before-You-Dig (DBYD) plans.
- A site walk-over inspection to determine the overall surface conditions and to identify any relevant site features.
- Service locating using electromagnetic detection equipment to ensure that the investigation area is free from underground services.
- Machine-drilling of nine boreholes identified as BH1 to BH9 by a drilling subcontractor to the target depths of approximately 9.0m below ground level (bgl) or until TC-bit refusal. Four of the boreholes were then core drilled for at least 3.0m in order to optimise design for the allowable bearing pressure for footings. During this drilling, collecting samples for acid sulphate soils
- Standard Penetration Tests (SPTs) conducted in the boreholes during drilling to assess the in-situ soil strength as practicable.
- Converting five boreholes into groundwater monitoring wells, developing, purging and water sampling for levels, flow direction, recovery rates and water salinity.
- Installation of 3 new groundwater wells, developing, purging and water sampling for levels and recovery rates.
- Gathering information of surrounding areas and levels for the Lake, Creek, Canal, Wetland and site including sampling water levels on pre-existing wells across the road of Cary Street near the Wetland, chemical sampling of these water bodies and interpretation of levels for modelling purposes.
- Reinstatement of the boreholes with soil cuttings.

The approximate locations of the boreholes completed during the site investigation are shown in "Figure 1 - Site Plan" attached as Appendix B.

Following the completion of the site investigation, laboratory testing was carried out on the selected soil samples, recovered rock cores from the four boreholes, and water quality testing which consisted of:

- Preliminary Acid Sulphate Soil Assessment.
- Soil Salinity & Aggressivity Assessment.
- Point Load testing.
- Chemical testing of on-site groundwater wells plus off site groundwater wells, canal, wetland and creek.

Based on the site investigation results and laboratory testing results, Chameleon carried out a geotechnical interpretation and assessment of the main potential geotechnical issues that may be associated with the proposed development. A geotechnical report (this report) was prepared to summarise the geotechnical site investigation results, interpretation, assessment, and recommendation.

4. PREVIOUS GEOTECHNICAL INVESTIGATION

A preliminary geotechnical assessment was carried out by JK Geotechnics, with details outlined in Report No. 29644SBrpt, dated 13 October 2016, in order to assist with the DA process. The assessment procedure comprised of reviewing of the previous preliminary geotechnical assessment carried out by Coffey Geosciences Pty Ltd, dated 22 March 2005 (Ref: N09456/01-AB) and also reviewing of the previous geotechnical investigation by JK Geotechnics for the site immediately to the north of the subject site.

Based on the results of the geotechnical assessment, JK Geotechnics summarised that the subsurface profile at the site is likely to comprise surface fill in parts of the site overlying predominantly silty clay and sandy clay soils which in turn overly bedrock at an unknown depth. The clays within the base of the boreholes drilled within the site to the north were of hard strength, which may indicate that rock maybe of shallow depth below the base of those boreholes, but it is possible that the hard clays may continue for several metres. Also, JKG have further mentioned that for the inferred subsurface profile as detailed above, there are some geotechnical issues for the proposed development which are detailed below:

- The site is located within the West Lake mine subsidence district. As per the reference from the Mine Subsidence Board (refer to Appendix K – Government Information), it states that:
  a) The site is not undermined,
  b) The site lies within a mine lease currently held by Centennial Coal,
  c) The site lies within an area that the board is negotiating to have removed from the district,
  d) The site lies within an area designated as being within the High Water Subsidence Control Zone.

Furthermore, the report also explains the board advised that until the area is removed from the district, the following parameters would be imposed for the design;

- Maximum vertical subsidence of 150mm,
- Maximum ground strain of plus or minus 1mm/m,
- Maximum tilt of 1mm/m.

5. SITE DESCRIPTION

The site is somewhat trapezoidal in shape comprising Lot 4-10 DP 2505 and Lot 101 DP 1110774 corner of Cary Street, Bath Street and Arnott Avenue. The street address is 114-120 Cary St, 1, 2, 3, 5 Bath St and 3 Arnott Ave Toronto (site referred to as 118 Cary St). It is bound to the west by Cary Street then a Wetland (~120m to the west) and to the east by Arnott Avenue. To the south of the site is a vacant grassed area and then Victory Parade. To the north of the site is a McDonald's business operation comprising of a single storey building. The proposed site is located about 100m to the west of Toronto Bay, which is part of Lake Macquarie, within gently to moderately undulating terrain. The ground surface within the site slopes down to the southwest and northwest with slopes generally of about 1° to 2°, but locally steeper at about 3° in the north eastern corner. At the time of site investigation, the site was vacant and covered with grass and medium sized trees.

6. PROPOSED DEVELOPMENT

With reference to Section 2, it is understood that the proposed works comprises of construction of a mixed-use development for a 5 story building with 2 level basements, therefore requiring an excavation of about 6.0mbgl with a further 1.50m excavated for lift shaft(s) as depicted on development drawings for the site.

7. SUBSURFACE CONDITIONS

7.1 Geology

Reference to the Gosford-Lake Macquarie 1:100000 Geological Series Sheet 9131 & part Sheet 9231 by the Geological Survey of New South Wales, Department of Mineral Resources, indicates that the site is underlain by bedrock of the Newcastle Coal Measures comprising conglomerate, tuff, siltstone, claystone and coal (Pnm), with Quaternary aged alluvial deposits to the west near Stoney Creek and marine mud within Lake Macquarie to the east.

Assessment of the subsurface materials, discussed in Section 6.2, confirms the published geology. It should be noted the published 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.

7.2 Ground Profile

The subsoil conditions encountered within the boreholes are summarised in Table 1 and described with detail in the attached Engineering Borehole Logs (Appendix C). References should be made to the logs and/or specific test results for the design purposes and for assessing the excavation characteristics of the ground. For specific design input, references should be made to the engineering borehole logs and/or specific test results in the Appendices in lieu of the summary in Table 1 below.

Table 1 Summary of Subsurface Conditions

Unit	Description	BH1 (m bgl)	BH2 (m bgl)	BH3 (m bgl)	BH4 (m bgl)	BH5 (m bgl)	BH6 (m bgl)	BH7 (m bgl)	BH8 (m bgl)	BH9 (m bgl)
	Approximate Ground Surface Level (m AHD)	***5.5***	***4.74***	***4.14***	***4.43***	***3.85***	***3.55***	***3.80***	***3.30***	***2.55***
FILL	Silty Sandy CLAY, medium plasticity, dark brown, soft, moist.	0.0-0.4	0.0-0.6	0.0-1.0	*0.0-0.4*	0.0-0.5	0.0-0.4	*0.0-0.4*	*0.0-0.4*	*0.0-0.6*
NATURAL SOIL	Silty CLAY, with fine gravel, medium to high plasticity, red/ brown or pale brown or pale grey, moist, soft/ stiff to very stiff in consistency.	0.4-3.8	0.6-2.4	1.0-2.5	0.4-1.7	0.5-1.5	0.4-1.0	-	-	0.6-1.0
	Silty CLAY, fine to medium gravel, medium to high plasticity, red/ brown, mottled, color changing to white grey, moist, very Stiff to hard	3.8-13.4	2.4-13.0	2.5-13.7	1.7-13.5	1.5-12.95	1.0-14.0	-	-	-
	Gravelly Silty CLAY, medium to high plasticity, pale brown, wet, soft.	-	-	-	-	-	-	0.4-2.7-	0.4-2.5	-
	CLAY, with fine gravel, high plasticity, grey/ white, mottled, with Silty Clay, red/ brown, with fine to medium gravel, moist, very Stiff to hard	-	-	-	-	-	-	2.7-14.5	2.5-14.2	1.0-14.5
BEDROCK	CONGLOMERATE, broken pieces.	13.4-14.7	-	-	-	-	-	-	-	-
	CONGLOMERATE, medium sized clasts, dark grey to pale grey, with traces of sand.	-	-	13.7-14.0	-	-	-	-	-	-
	CONGLOMERATE, rounded to sub-angular gravel sized clasts, pale grey to dark grey, traces of fine to medium grained sand in between the clasts.	-	-	14.0-16.7	-	-	-	14.5-17.0	-	14.5-15.5-

[1] Pells P.J.N, Mostyn G. & Walker B.F. Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal, 1998 (Reference 6)
[3] Defects shown in the core photographs for this class are not natural defects, and are mechanical breakages.

7.3 Groundwater

Groundwater was encountered during auger boring in all the boreholes. It is noted that the groundwater observation may have been made before water levels had stabilised. It is also noted that groundwater levels may be subject to seasonal and daily fluctuations influenced by factors such as rainfall and future development of the surrounding properties. After heavy rain, groundwater may be present in the fill due to infiltration from the surface. A plot of seasonal rainfall and groundwater levels can be found in Appendix F.

After the borehole drilling, groundwater monitoring wells were installed at BH1, BH3, BH5, BH7 and BH9. The groundwater levels were monitored in the wells at varying times throughout the year after installation with a further 3 wells installed later with a summary below in Table 2. Note, 2 large rainfall events occurred during the drilling and due to the slow recovery rates and relatively impermeable soils, no apparent effect on flow direction, levels or flow rate was observed.

Table 2: Standing Groundwater Levels:

BOREHOLE NUMBER	Well Depth (m)	Approximate Surface R.L (m AHD)	WATER LEVEL (m bgl)	DATE
BH1/GW1	13.0	5.5	4.7	10/01/2020
			4.9	10/07/2020
			4.4	10/09/2020
			4.4	16/09/2020
			4.7	01/10/2020
			4.1	07/10/2020
			4.9	09/10/2020
			4.7	01/12/2020
			4.6	17/06/2021
			4.8	24/08/2021
BH3/GW2	13.5	4.14	3.4	10/01/2020
			3.6	10/07/2020
			3.4	10/09/2020
			3.4	16/09/2020
			3.4	01/10/2020
			3.6	07/10/2020
			3.5	9/10/2020
			3.3	1/12/2020

BOREHOLE NUMBER	Well Depth (m)	Approximate Surface R.L (m AHD)	WATER LEVEL (m bgl)	DATE
			3.3	17/06/2021
			3.4	24/08/2021
BH5/GW3	9.5	3.85	2.7	10/01/2020
			2.9	10/07/2020
			2.6	10/09/2020
			2.7	16/09/2020
			2.7	01/10/2020
			2.9	07/10/2020
			3.0	09/10/2020
			2.6	1/12/2020
			3.0	17/06/2021
			2.7	24/08/2021
BH7/GW4	13.0	3.80	2.5	10/01/2020
			2.9	10/07/2020
			2.1	10/09/2020
			2.1	16/09/2020
			2.5	01/10/2020
			2.9	07/10/2020
			2.9	09/10/2020
			2.3	1/12/2020
			2.9	17/06/2021
			Not found	24/08/2021
BH9/GW5	13.0	2.55	1.9	10/01/2020
			2.0	10/07/2020

BOREHOLE NUMBER	Well Depth (m)	Approximate Surface R.L (m AHD)	WATER LEVEL (m bgl)	DATE
			1.6	10/09/2020
			1.6	16/09/2020
			1.9	01/10/2020
			2.0	07/10/2020
			2.3	09/10/2020
			1.90	01/12/2020
			2.1	17/06/2021
			1.6	24/08/2021
Well 1 (97 **Cary St**)	Approx. 4m	2.46	2.0	01/12/2020
			2.0	17/06/2021
			2.0	24/08/2021
Well 2 (97 **Cary St**)	Approx 4m	2.60	2.1	01/12/2020
			2.1	17/06/2021
			2.1	24/08/2021
BH101/GW6	6.0	3.60	1.19	07/12/2021
BH102/GW7	6.5	4.10	1.79	07/12/2021
BH103/GW8	6.0	3.20	0.66	07/12/2021

7.4 Laboratory Testing

Recovered samples from the site (and surrounds) were submitted to Chameleon's NATA accredited materials testing laboratory, and ALS & Eurofins, who are also NATA accredited, for testing. The testing comprised:

- Preliminary Acid Sulphate Soil Assessment.
- Soil Salinity & Aggressivity Assessment.

- Water Salinity Assessment.
- Point Load Tests.
- Water Quality Testing

7.4.1 Acid Sulphate Soil Assessment

Field testing was carried out with samples collected and sent to the lab for preliminary assessment of Acid Sulphate present in the soil, which showed there maybe possibility of some acid sulphate in the soils encountered.

This Acid Sulphate Soils Management Plan (ASSMP) was prepared to outline the future scope of works for the site and will cover all possible eventualities in regards to PASS and/or ASS.

The laboratory analysis indicated that the 8 TPA8 in all the samples analysed between 2m and 10m were above the action criteria indicating that the soil material has the potential to generate acid within the soil matrix. A separate report for Acid Sulphate Soil Assessment is issued and included in the Appendix G

7.4.2 Soil Salinity & Aggressivity Assessment

Six soil samples collected from boreholes BH1, BH2, BH4, BH6, BH7 and BH8 were sent to laboratory for testing.

Soil samples recovered from the boreholes have been tested for pH, chloride Cl-, Sulphate $S0_4$ content, and electrical resistivity/ conductivity. The testing was carried out by a NATA accredited laboratory. The results are assessed in conjunction with the exposure classification for soil aggressivity levels for buried concrete and steel outlined in Australian Standard AS 2159-2009. The results are represented in Appendix H.

The laboratory test results indicate that the tested soils in all four boreholes are classified as Non-saline (Reference 7, Table 6.2) with an **ECe of <2dS/m**.

Reference to AS2159-2009, “Piling – Design and Installation”, and the results of soil electrical conductivity, pH, Chloride, and Sulphate tests on soil samples collected from boreholes indicate that the soil samples tested are:

- Non-aggressive to concrete piles or structures in low permeability soils (Soil Condition B).
- Non-aggressive to steel piles or structures in low permeability soils (Soil Condition B), based on the Chloride and pH test results.

However, the Australian Standard AS2159-2009 states "pH alone may be a misleading measure of aggressivity without a full analysis of causes", and that pH may change over the lifetime of the pile. It is therefore prudent that pH is monitored at the site as part of any development works as ASS/PASS activity could cause future concerns if not managed appropriately or not in accordance with the Acid Sulphate Management Plan (ASSMP) developed.

7.4.3 Point Load tests

The test results for Point Load Tests undertaken for the rock strength assessment indicate that the unconfined compressive strength (UCS) for axial strength ranges from (5-11 mPa) are attached in Appendix E (Laboratory Test Results).

7.4.4 Water Quality Testing

The results from the chemical quality of water tests showed that the groundwater is of a much higher quality than stormwater flows into the wetland with the wetland generally fresh water.

8. GEOTECHNICAL ASSESSMENT

8.1 General

Based on the proposed bulk excavation level to a depth of about 6m bgl with lift pits to 7.50m bgl (RL (-1.50) m AHD), it is considered that the lower basement level will be founded on medium to high plasticity Silty Clayey Natural soil with traces of fine to medium gravel.

Based on the groundwater level observed during the field investigation and at the monitoring wells, it is considered that the groundwater level would be above the bulk excavation level.

Consideration needs to be given to specific geotechnical issues, including excavation support, groundwater, and foundation conditions. Geotechnical commentary regarding these geotechnical constraints and recommendations for the proposed development is presented in the following sections.

8.2 Excavation Conditions

Excavation is expected to be partially through the fill and majorly through medium to high plasticity natural silty clayey soil. Excavation within the soils is expected to be readily achieved using conventional excavation equipment, such as the buckets of hydraulic excavator.

The rock classification system in Table 1 above is intended for use in the design of foundations and should not be used to directly assess rock excavation characteristics. Contractors should refer to the engineering logs, core photographs, and point load test results when evaluating their excavation equipment's suitability.

8.3 Vibration Control

A vibration monitoring plan may be required to monitor the potential vibration effects generated during excavation and foundation works, on the adjoining properties and road reserves and carriageways along the site boundary. To ensure vibration levels remain within the acceptable levels and to minimise the potential effects of vibration, it is important to consider the Maximum Peak Particle Velocity (PPV) values.

Recommended Maximum Peak Particle Velocity (PPV) for different types of building or structure is summarised in Table 3. Induced vibrations in structures adjacent to the excavation should not be exceeded.

Table 3 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) 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 that 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".

8.4 Reuse of Excavation Material

Any waste soils being removed from the site must be classified following current regulatory authority requirements to enable appropriate disposal to an appropriately licensed landfill facility. Chameleon can provide further advice on this matter if required.

8.5 Stability for Basement Excavation

Maximum excavation for the proposed basement levels will extend approximately 7.50m below the current ground surface. The following temporary batter slopes may be considered for areas where sufficient space exists between the proposed basement and the boundaries, dependent on the slope of the adjacent existing ground, 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 batters are provided in Table 4 below.

Table 4 Recommended Batter Slopes (Temporary)

Material	Max. Batter Slope (H:V)
Residual Soils	1.5:1
Residual Soils, stiff to very stiff	1:1

[1] Subject to assessment by a Geotechnical Professional Engineer to assess stability and provide recommendations as required.

Where batter slopes are not considered appropriate, 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. Where any nearby buildings (or infrastructure) are located within a zone of influence obtained by drawing a line up at 45° from the toe of the proposed excavation, consideration may be given to inspection pits to determine the underpinning requirement in any affected adjacent properties.

Based on the ground conditions encountered and the requirements of the proposed development, consideration may be given to a contiguous pile wall. We recommend a contiguous pile wall solution socketed into the underlying bedrock. The use of contiguous pile walls allows a small gap between piles, which could enable groundwater inflow during excavation. The use of strip drains behind the piles and shotcreting in weak areas susceptible to inflow during excavation may limit groundwater ingress but may be limited in its effectiveness if inflow rates are high. All vertical drains should be connected to a geofabric wrapped perimeter drain provided at the toe of the final excavation, which should discharge to the site stormwater system to provide long term drainage behind excavation walls.

For the maximum retained height being considered, a temporary anchorage system is likely to be required to provide the necessary lateral support during construction. Where two or more rows of anchors are needed to support the shoring due to increased retained height or where significant lateral movements cannot be tolerated (e.g., due to adjacent infrastructure), the shoring/basement wall should 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. A proposed shoring system can be found in Appendix L where other options such as internal bracing/ strut plank for temporary and additional capping internal beams, etc can be used (subject to structural engineer assessment).

8.6 Earth Retaining Structures

Earth retaining structures should be designed to withstand the lateral earth pressure, hydrostatic pressure and earthquake load (if applicable) pressures, and the applied surcharge loads in their zone of influence, including existing structures, traffic, and construction-related activities.

For the design of flexible retaining structures, where some lateral movement is acceptable, it is recommended the design should be based on active lateral earth pressure. Should it be critical to limit the horizontal deformation of a retaining structure, the use of an earth pressure coefficient "at rest" should be considered, such as the case when the shoring wall is in the final permanent state and is restrained by the concrete slab in its final state.

Table 5 Preliminary Geotechnical Design Parameters for Retaining Structures

Unit	Unit Weight γ (kN/m^3)	Effective Cohesion c' (kPa)	Effective Internal Friction Angle ϕ' (degrees)	Modulus of Elasticity $E_{s,h}$ (MPa)
Fill	17	0	26	6
Residual Soils, stiff to very stiff	19	5	24	15
Residual Soils, very stiff to hard	21	8	25	25
Basaltic Conglomerate	24	50	35	500

Recommended parameters for the design of earth retaining structures in the soils underlying the site are presented in Table 5.

Table 6 provides preliminary coefficients of lateral earth pressure for the soils encountered during the geotechnical site investigation. The coefficients provided are based on a horizontal ground surface and fully drained conditions.

Table 6 Preliminary Coefficients of Lateral Earth Pressure

Unit	Coefficient of Active Lateral Earth Pressure K_a	Coefficient of Lateral Earth Pressure at rest K_0	Coefficient of Passive Lateral Earth Pressure K_p
Fill	0.4	0.6	NA
Residual Soils Residual Soils, very stiff to hard	0.3	0.35	2.8
Residual Soils, very stiff to hard	0.25	0.3	3.0
Basaltic Conglomerate	0	0	5.0

- If present, adverse jointing systems in the rock may result in higher active earth pressures than those outlined above. Potential areas of the block or wedge failure should be therefore identified during construction and appropriate stabilization measures adopted.
- Coefficient of active and passive lateral earth pressure K_a, and K_p, respectively, can be calculated using Rankine's or Coulomb's equations, as appropriate.
- Coefficient of lateral earth pressure at rest K_0 can be calculated using Jacky's equation.

The Structural Project Engineer should verify the coefficients of lateral earth pressure prior to use in the design of retaining walls. Simplified calculations of lateral active (or at rest) and passive earth pressures can be carried out using Rankine's equation shown below:

$Pa = K\,\gamma\,H - 2c\sqrt{K}$ For calculation of Lateral Active or At Rest Earth Pressure

$Pp = K_p\,\gamma\,H + 2c\sqrt{K_p}$ For calculation of Passive Earth Pressure, where,

Pa = Active (or at rest) Earth Pressure (kN/m^2)

Pp = Passive Earth Pressure (kN/m^2)

γ = Bulk density (kN/m^3)

K = Coefficient of Earth Pressure (K_a or K_0)

K_p = Coefficient of Passive Earth Pressure

H = Retained height (m)

c = Effective Cohesion (kN/m^2)

8.7 Subgrade Preparation and Earthworks

The following general procedure is provided for site preparation of building platforms and pavements:

- Strip topsoil and remove any unsuitable material from the site.
- Excavate residual soils for re-use as engineered fill or remove to spoil.
- Where clayey soil is exposed at formation level, the exposed surface should be treated and moisture conditioned to within 2% of optimum moisture content (OMC) followed by proof rolling with a smooth drum roller. Soft or loose areas should be excavated and replaced with approved fill material.

The suitability of imported materials for filling should be subject to the following criteria:

- The materials should be clean (i.e., free of contaminants, deleterious or organic material), free of inclusions of >120mm in size; high plasticity material and soft material be removed and suitably conditioned to meet the design assumptions where fill material is proposed to be used.
- Material with excessive moisture content should not be used without conditioning.
- The materials should satisfy the Australian Standard AS 3798-2007 (Reference 3).

The final surface levels of all cut and fill areas should be compacted to enable the subgrade to achieve adequate strength for the proposed building platforms.

For the fill construction, the recommended compaction targets should be the following:

- Moisture content of ±2% of OMC (Optimal Moisture Content);
- Minimum density ratio of 98% of the maximum dry density for the building platforms of the proposed dwellings;
- The loose thickness of the layer should not exceed 300mm during the compaction.

The design and construction of earthworks should be carried out in accordance with Australian Standard AS 3798-2007 (Reference 3).

Inspections by the project Geotechnical Engineer will be required during earthworks, subgrade preparation, and proof rolling. The inspections should constitute as "Hold Points".

8.8 Foundations

Bulk excavation is mainly likely to expose fill and residual silty clayey soil of medium to high plasticity. Therefore, proper footings are likely to comprise cast in-situ reinforced concrete raft foundation with a thickened slab or shallow pads and strip footings to support internal columns and walls. However, given the potential for variable strength material at the 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. Other cases where piles may be required include the need to increase the resistance against lateral seismic and wind loads. The design of shallow and pile foundations should be carried out in accordance with Australian Standards AS2870-2011 (Reference 4) and AS2159-2009 (Reference 5), respectively. Table 7 provides geotechnical parameters recommended for the design of shallow and piled foundations.

Shaft adhesion may be applied to socketed piles adopted for foundations provided socket shaft lengths conform to appropriate Basaltic Conglomerate and accepted levels of shaft sidewall cleanliness and roughness. The rock socket sidewalls should be free of soil and/or crushed rock to the extent that natural rock is exposed over at least 80% of the socket sidewall. Shaft adhesion should be reduced or ignored within socket lengths that are smeared and fail to satisfy the cleanliness requirements. Additional attention to cleanliness of socket sidewalls may be required where the presence of clay seams and weathered bands is evident over socket lengths.

Table 7 Geotechnical Foundation Design Capacities

<table>
<tr><th rowspan="2">Unit</th><th colspan="2">Allowable Capacity Values (kPa)</th><th colspan="2">Ultimate Capacity Values</th></tr>
<tr><th>End Bearing Pressure[1]</th><th>Shaft Adhesion Compression (Tension)[2]</th><th>End Bearing Pressure (MPa)</th><th>Shaft Adhesion Compression (Tension)[2] (kPa)</th></tr>
<tr><td>Fill</td><td>N/A[3]</td><td>N/A</td><td>N/A[3]</td><td rowspan="3">N/A</td></tr>
<tr><td>Residual Clay Soils (stiff to very stiff)</td><td>100-150</td><td rowspan="2">10 (5)</td><td>0.3</td></tr>
<tr><td>Residual Clay Soils (Very Stiff to hard)</td><td>150-200</td><td>0.5</td></tr>
<tr><td>Basaltic Conglomerate</td><td>3000-5000</td><td>200 (100)</td><td>10-20</td><td>350-450</td></tr>
</table>

[1] With a minimum embedment depth of 1.0m for deep foundations and 0.4m for shallow foundations.
[2] Clean rock socket of roughness of at least R2 category (refer to Pells et al (1998)), grooves of depth 1mm to 4mm and width greater than 5mm at spacing of 50mm to 200mm. Shaft Adhesion in Tension is 50% of Compression, applicable to piles only.

Where the piles penetrate soils that are susceptible to shrinkage and swelling, we recommend that the shaft adhesion be ignored in the zone of seasonal moisture variations due to the potential of shrinkage cracking.

Any groundwater or surface water run-off that has accumulated at bulk excavation level, should be removed prior to concrete pouring. Any loose debris and wet soils should also be removed from excavations.

An experienced Geotechnical Professional should review footing designs to ensure compliance with the recommendations in the geotechnical report and assess foundation excavations to ensure suitable materials of appropriate bearing capacity have been reached. The presence of water within foundation excavations may negate a satisfactory examination of founding surfaces and certification of founding materials quality. Foundation inspections should only be undertaken under conditions satisfying WHS requirements.

Verification of the capacity of the shallow, and pile foundations by inspections would be required and inspections should constitute “Hold Points”.

8.9 Groundwater Management

The geotechnical site investigation results and ground water monitoring indicates that the natural groundwater levels may be present within this site in the form of seepage from the natural silty Clay, approximately 2m below the existing ground surface (perched aquifer). The site seems to exist within some aquifer boundaries with on-site groundwater found to be flowing towards the southeast direction and other locations next to the Cary Street boundary seeming to flow west and the boundary on Arnott avenue seeming to flow east towards the Lake. The southern part of the site (Bath Street boundary) seems to contain an ephemeral watercourse. Initial flow rates calculated found flow rate ranges from 1.362×10^{-5} litres per second to 7.949×10^{-5} litres per second or around 0.3-0.5m/day, within the five-groundwater boreholes that were drilled to rock thus representing the underlying conglomerate formations greater than 10m.

Three new groundwater wells were installed at the site and were drilled and founded within clays to the depth of excavation approximately 6-7m bgl. The results below (0.0026m/day) compared to our original K values of 0.3-0.5m/day are more reflective of relatively impermeable stiff clays and the current groundwater conditions within the clay soils proposed to be excavated as part of the basement excavation.

Using the Bouwer and Rice (1976) method of slug test analysis, the following permeability values (k) were calculated.

BH101 K = 0.0029 m/day

BH102 K= 0.0015 m/day

BH103 K= 0.0042m/day

There were some initial faster inflow rates in BH103/GW8 which is near the ephemeral watercourse on the site. The borehole logs show a perched groundwater table in a soft, wet Sandy Clay at 0.8m to 1.7m depth. The corresponding slug tests (Oct 2021) found the representative mean k values for wells BH101/GW6, BH102/GW7 and BH103/GW8 being 0.0026m/day which is representative of the flow rates for the excavation at 6-7mbgl.

Modelling was undertaken on groundwater wells at the site. The modelling simulation indicated that groundwater flow is easterly across the site, due to the strong controlling influence of the Lake constant-head boundary at RL 0.09 mAHD (mean of the high and low survey levels). The groundwater level at the site is within the range of groundwater levels measured in the on-site boreholes. In comparing localised groundwater contours to the modelling, Chameleon found groundwater flow moving in a south to south-easterly flow direction compared to the model which shows groundwater flow moving east. The model does show a south southeasterly direction on its northern boundary (McDonalds) where groundwater enters the site. The following information should be taken into consideration when considering variations of flow direction:

- The groundwater levels in wells may be biased by different screen depths and screen lengths, noting that groundwater pressure distribution is a 3D phenomenon, not 2D as commonly illustrated. Vertical & horizontal hydraulic gradients co-exist.
- Local groundwater level variation is common in urban sites, due to localised preferential recharge and groundwater mounding, especially at sites that have been previously cleared/demolished, such as this site occurring between 2011-2012.
- There may be nearby sub-surface infrastructure such as utility trenches that are a groundwater sink, or source. This includes sewers and stormwater mains situated on the southern boundary near Bath Street that travel underneath Cary Street to connect to the canal to the west. It is not possible to account for such factors due to insufficient information.
- Substantial changes in geology might be present that are influencing groundwater flow, that we are not aware of such as the historical filling of swamp land to prepare the rail line to the south and west of the site.

Regardless of the above, we can still simulate the effect of the drawdown due to dewatering, which is not likely to be significantly affected by the actual groundwater flow direction. Flow direction, monitoring graphs and rate calculation can be found in the attachments (App F).

From the measured groundwater levels, it is considered that groundwater levels will be encountered to above the bulk excavation level. It may be prudent to consider precautionary drainage measures in the design and construction of the proposed development.

Drainage measures could include the following:

- Strip drains or drainage materials installed behind the shoring walls in conjunction with collection trenches or pipes and pits connected to the building stormwater system. A temporary storage tank and pump system may be required.
- Depending on the inflow rate during excavation as they are low, groundwater seepage and surface water run-off may be controlled by sump and pump methods during construction.
- Natural defects in the rock may be sealed with cement grout or any suitable alternative sealant to reduce seepage inflow.

Seasonal variations (or other causes) resulting in elevated groundwater levels (e.g., heavy rainfall, broken services, etc.) may increase seepage flows through soils and weathered bedrock during the excavation in the long term during the design life of the building. These can be found in Appendix F.

To better understand the groundwater levels and reservoir of the site and the surrounding areas, Chameleon conducted permeability testing. This indicated the ground permeability, recharge of the water table, and indicative flow rates and groundwater volumes into the proposed excavation. This was initially carried out using the groundwater wells previously installed which found k values of 0.3m/day. As these wells were installed down to conglomerate rock, the connectivity of the nearby water bodies (e.g. lake <150m) was deemed to potentially influence values so a set of three new groundwater wells were installed to ascertain the k values of clay soils at the actual depth of excavation (6-7mbgl). Results showed low seepage rates (0.0026m/day) which will allow for sump and pump methods during a simultaneous excavation with shotcreting walls to stop any seepage entering the excavation pit.

Chameleon has undertaken ground water modelling, seepage analysis and settlement analysis. It was shown in the modelling that minimal to no impact was present to the wetland and its insignificance in settlement on adjoining properties. A separate report for Groundwater Drawdown and Settlement Analysis can be found in Appendix I of this report.

8.10 Further Geotechnical Input

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

- Waste classification of the excavated (stockpiled) material;
- Groundwater Monitoring and Management plan during the construction excavation.
- Piling rig working platform assessment;
- Footing and shoring pile inspections during construction;

It is recommended that a meeting be held after the initial design has been completed to confirm that these recommendations have been interpreted correctly.

8.11 Preliminary Site Earthquake Classification

The geotechnical site investigation results indicate the presence of fill and residual cohesive soils, underlain by Conglomerate bedrock of low to medium strength.

Following Australian Standard AS 1170.4-2007 (Reference 2) the site may be classified as a "Shallow soil site" (Class C_e) for the design of foundations and retaining walls embedded in the underlying residual Silty Clay soils and "Rock" (Class B_e) for foundations and retaining walls embedded into the underlying Conglomerate bedrock.

The Hazard Factor (Z) for Toronto following AS 1170.4-2007 is considered to be 0.10.

8.12 Council Requirements and Chameleons input for the Geotechnical Investigation:

Council's requirement and the work carried out by chameleon for the Geotechnical Investigation are as follows:

a) Council has requested drilling of boreholes into bedrock below the depth of the proposed excavation, chameleon has drilled 9 boreholes below the depth of the proposed excavation into rock with information available from the borehole logs (Appendix C).

b) Council has requested the installation of groundwater wells, chameleon has installed an initial five groundwater wells, plus a further 3 new wells. Recorded groundwater wells are tabulated in table 2, section 7.3 of this report.

c) Council has requested Groundwater Salinity, Chameleon has undertaken collection of groundwater samples from the wells and the test results have been attached in Appendix E of this report. A separate report for groundwater salinity has been performed by Chameleon under Job no. EC8030/3. A further set of salinity and water quality testing was undertaken on GW for the site plus the surrounding water bodies being the Canal, the Creek and Wetland.

d) Council has requested for Acid Sulphate Soil Management Plan and chameleon has prepared a separate report for the Acid sulphate soils under Job no. EC8030/2.

For and on behalf of
Chameleon Geoscience Pty Ltd

Sai Turlapati
Geotechnical Engineer
B.Tech Civil, M.Eng MIEAust

Reviewed By

Shyam Ghimire
Principal
B.Sc., M.Sc, MAIG

Peer Reviewed By

Nick Kariotoglou
Managing Director
BAppSc, GDipMan, MBS, CPM, FAMI

Attachments

Appendix A - Important Information about your report

Appendix B - Site Plans

Appendix C - Engineering Borehole Logs

Appendix D- Rock Core Photographs

Appendix E - Laboratory Test Results and Water Quality

Appendix F- Groundwater Monitoring Graph, Flow calcs, meteorological data and seasonal GW correlation

Appendix G- Acid Sulphate Soil Assessment

Appendix H – Salinity Report

Appendix I- Groundwater Modelling, Drawdown and Settlement Analysis

Appendix J – Dewatering Management Plan

Appendix K – Government Information

Appendix L – Proposed Shoring Plan

9. 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 Chameleon and 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, Chameleon Geosciences Pty Ltd be contacted immediately for further advice and any necessary review of recommendations. Chameleon does not accept any liability for site conditions not observed or accessible during the investigation or inspection.

This report and associated documentation and the information herein have been prepared solely for the use of **TORONTO INVESTMENTS NO.1 PTY LTD**, and any reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuing liability resulting from the use of the report by third parties cannot be transferred to Chameleon Geosciences Pty Ltd, directors, or employees

APPENDIX A

Information About Geotech 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.

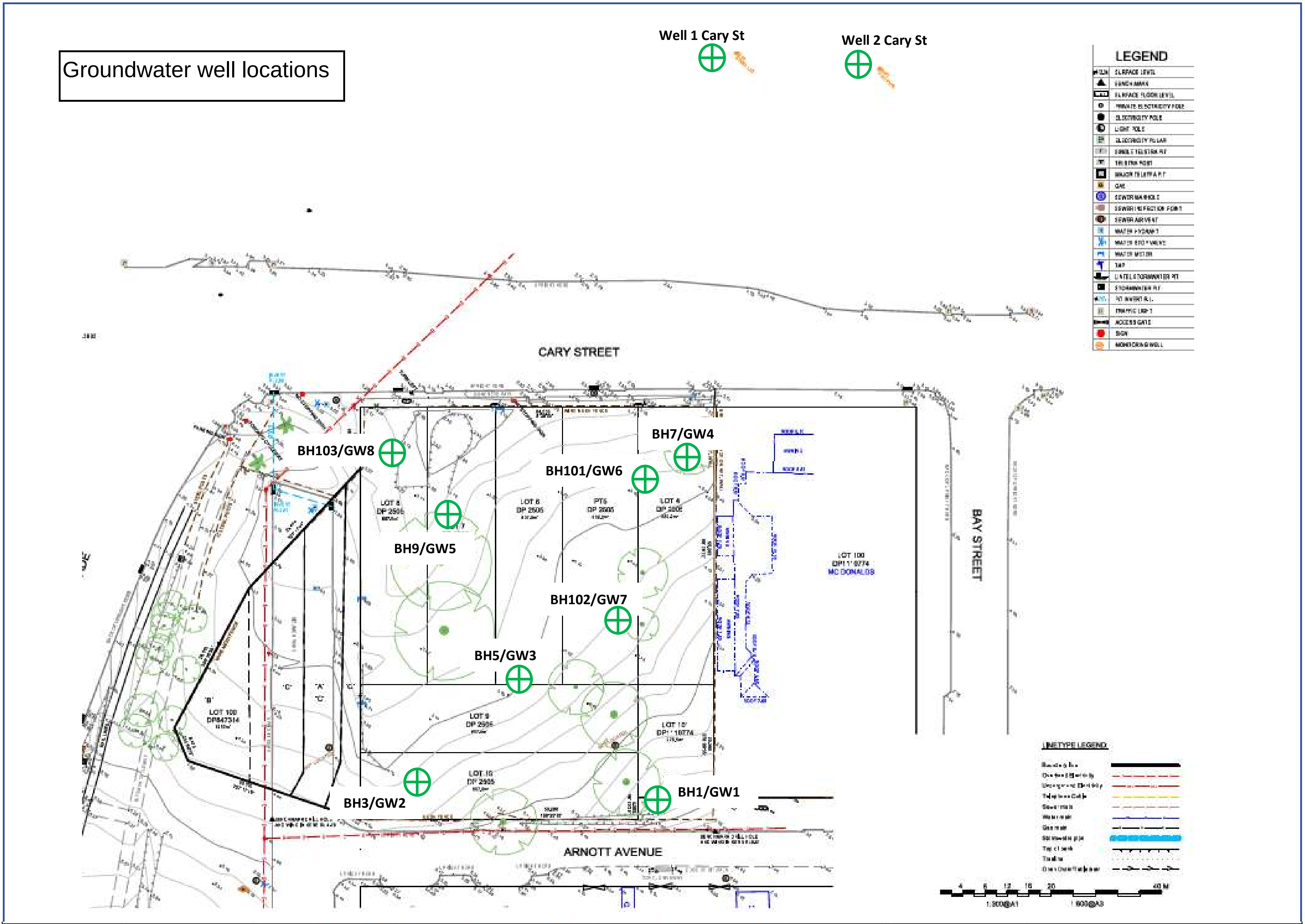
FURTHER GENERAL NOTES

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.

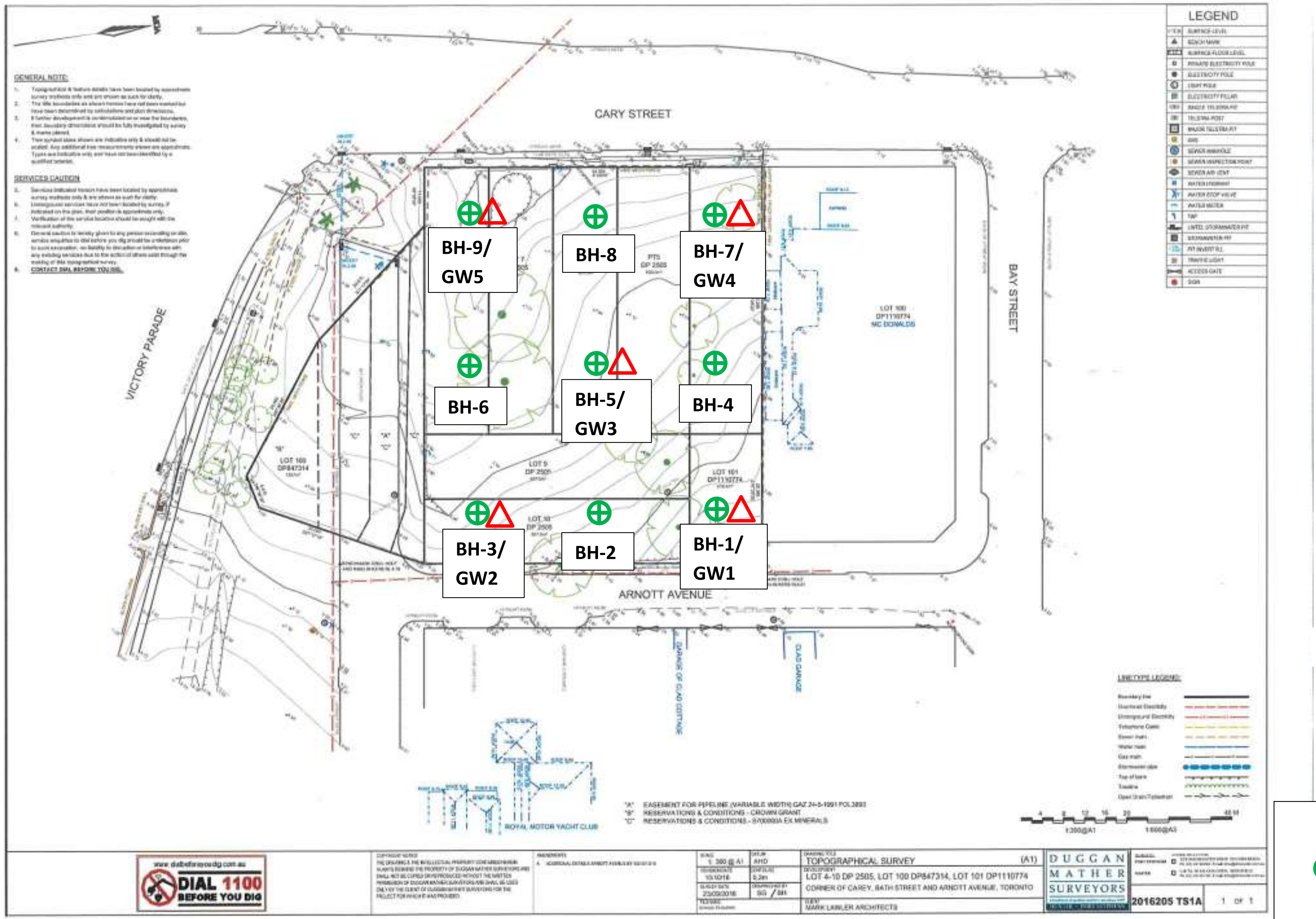
This report is subject to copyright and shall not be reproduced either totally or in part without the express permission of the Company. Where information from this report is to be included in contract documents or engineering specifications for the project, the entire report should be included in order to minimise the likelihood of misinterpretation.

APPENDIX B

Site Plan (Figure 1)



Drawn	SP	TORONTO INVESTMENTS NO.1 PTY LTD Geotechnical Investigation for New Apartment Building 118 Cary Street, Toronto, NSW, 2283	Chameleon	Figure	1
Checked	SG			Title	Site Plan
Date	January 2022				
Scale @ A3	NTS			Job No	GS8030-1A



LEGEND

⊕ Borehole locations (BH)

△ Groundwater monitoring well locations (GW)

Image Source

Drawn	SP	**TORONTO INVESTMENTS NO.1 PTY LTD** **Geotechnical Investigation for** **New Apartment Building** **118 Cary Street, Toronto, NSW, 2283**	Chameleon	Figure	**1**
Checked	SG			Title	**Site Plan**
Date	15 September 2020				
Scale @ A3	NTS			Job No	**GS8030-1A**

APPENDIX C

Engineering Borehole Logs

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH1

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 7/9/20 **COMPLETED** 7/9/20
R.L. SURFACE 5.5 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT							Silty Sandy CLAY, dark brown.		Moist	Soft	FILL
			5			CH	Silty CLAY, with fine gravel, red/ brown, medium plasticity, gravel ironstone.		Moist	Stiff	NATURAL SOIL
				1							
			4					SPT 8, 18, 20 N=38			
				2							
			3								
				3				SPT 8, 17, 19 N=36			
			2								
				4		CH	Silty CLAY, with fine to medium gravel, red/ brown, medium plasticity, with some clay, grey/ white, high plasticity, mottled through white/ grey rock.		Moist	Stiff	
			1								
				5				SPT 12, 18, 24 N=42			
			0								
				6							
			-1					SPT 8, 12, 21 N=33			
				7							
			-2								
	07/09/2020			8							

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Fax: 1300 136 638

BOREHOLE NUMBER BH1

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 7/9/20 **COMPLETED** 7/9/20
R.L. SURFACE 5.5 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-3 to -7	9 to 13		CH	Silty CLAY, medium to high plasticity, red/ brown, increasing amount of fine to medium gravel.	SPT 6, 12, 18 N=30 SPT 8, 13, 20 N=33 SPT 10, 14, 25 N=39 SPT 11, 14, 26 N=40	Wet to Saturated	Stiff to Soft	
			-8 to -10	14 to 16			Borehole BH1 continued as cored hole				

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Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH1

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 7/9/20 **COMPLETED** 7/9/20
R.L. SURFACE 5.5 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	Is(50) MPa D- diam-etral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
			-3									
				9								
			-4									
				10								
			-5									
				11								
			-6									
				12								
			-7									
				13		Continued from non-cored borehole						
NMLC Coring			-8			TC bit refusal at 13.4m. CONGLOMERATE, broken pieces.						
				14								
			-9									
						BH1 terminated at 14.7m						
				15								
			-10									
				16								

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH2

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 7/9/20 **COMPLETED** 7/9/20
R.L. SURFACE 4.74 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT						Silty Sandy CLAY, medium plasticity, dark brown.		Moist	Soft	FILL
		4	1		CH	Silty CLAY, with fine gravel, medium to high plasticity, red/ brown.		Moist	Stiff	NATURAL SOIL
		3	2				SPT 10, 15, 20 N=35			
		2	3		CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown, mottled, color changing to grey/ white, high plasticity, with white/ grey rock fragments.		Moist	Stiff	
		1	4				SPT 12, 16, 21 N=37			
		0	5							
		-1	6				SPT 10, 16, 20 N=36			
		-2	7							
	▼ 07/09/2020	-3	8				SPT 19, 26, 26 N=52			

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH2

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 7/9/20 **COMPLETED** 7/9/20
R.L. SURFACE 4.74 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT		-4	9		CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown, mottled, color changing to grey/ white, high plasticity, with white/ grey rock fragments. *(continued)*	SPT 5, 10, 15 N=25	Moist	Stiff	
		-5	10							
		-6	11				SPT 12, 15, 20 N=35			
		-7	12							
		-8	13				SPT 10, 16, 20 N=36			
						TC bit refusal at 13.0m. Borehole BH2 terminated at 13m				
		-9	14							
		-10	15							
		-11	16							

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BOREHOLE NUMBER BH3

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20
R.L. SURFACE 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			4	0.0–1.0			Silty Sandy CLAY, medium plasticity, dark brown.		Moist	Soft	FILL
			3, 2	1.0–2.5		CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown.	SPT 8, 12, 18 N=30	Moist	Stiff	NATURAL SOIL
	09/09/2020		1, 0, -1, -2, -3	2.5–8.0		CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown, mottled, color changing to white/ grey.	SPT 12, 16, 18 N=34; SPT 10, 12, 15 N=27; SPT 13, 22, 32 N=54	Moist	Stiff	

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BOREHOLE NUMBER BH3

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20 **R.L. SURFACE** 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-4			CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown, mottled, color changing to white/ grey. *(continued)*	SPT 9, 14, 19 N=33	Moist	Stiff	
			-5	9		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, color changing to white/ grey, increasing amount of fine to medium gravel wih depth.	SPT 12, 18, 20 N=38	Moist	Soft	
			-6	10							
			-7	11							
			-8	12				SPT 5, 12, Refusal			
			-9	13							
			-10	14			Borehole BH3 continued as cored hole				
			-11	15							
				16							

BOREHOLE NUMBER BH3

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CLIENT Toronto Investments No.1 Pty Ltd **PROJECT NAME** Geotechnical Investigation
PROJECT NUMBER GS8030-1A **PROJECT LOCATION** 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20 **R.L. SURFACE** 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
			-4									
			-5	9								
			-6	10								
			-7	11								
			-8	12								
			-9	13		Continued from non-cored borehole						
NMLC Coring				14		TC bit refusal at 13.7m. CONGLOMERATE, medium sized clasts, dark grey to pale grey, with traces of sand.	EW/HW					13.83-13.89m. FZ.
			-10			CONGLOMERATE, rounded to sub angular gravel sized clasts, pale grey to dark grey, traces of fine to medium grained sand in between the clasts.	MW/SW					14.15m. BP, 0-10°, RO, IR, UN.
												14.33-14.40m. FZ.
												14.50m. JT, 0-40°, RO, IR, UN.
									D 0.06 A 0.29			14.61-14.66m. FZ.
										89		14.76-14.80m. FZ.
			-11	15								
									D 0.56 A 0.68			15.31m. JT, 0-30°, RO, UN, IR.
									D 0.2 A 0.34			
				16								15.88-16.26m. FZ.

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BOREHOLE NUMBER BH3

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20
R.L. SURFACE 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
NMLC Coring			-12			CONGLOMERATE, rounded to sub angular gravel sized clasts, pale grey to dark grey, traces of fine to medium grained sand in between the clasts. *(continued)*	MW/SW		D 0.04 A 0.25	89		15.88-16.26m. FZ. 16.37-16.48m. FZ. 16.52m. BP, 2mm, RO, IR, UN. 16.63-16.70m. FZ.
						BH3 terminated at 16.7m						
			-13	17								
			-14	18								
			-15	19								
			-16	20								
			-17	21								
			-18	22								
			-19	23								
				24								

BOREHOLE NUMBER BH4

Chameleon
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CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 4.43 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT		4				Silty Sandy CLAY, medium to high plasticity, dark brown.		Moist	Soft	FILL
		3	1		CH	Silty CLAY, medium to high plasticity, pale brown, with gravel.	SPT 10, 16, 19 N=35	Moist	Stiff	NATURAL SOIL
	10/09/2020	2, 1, 0, -1, -2, -3	2, 3, 4, 5, 6, 7, 8		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel.	SPT 15, 22, Refusal; SPT 11, 12, 14 N=26; SPT 8, 11, 12 N=23	Moist to Wet	Stiff	

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BOREHOLE NUMBER BH4

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 4.43 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT		-4			CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel.		Very wet to saturated	Soft	
			9				SPT 10, 11, 14 N=25			
		-5								
			10				SPT 5, 9, 10 N=19			
		-6								
			11							
		-7					SPT 12, 12, 18 N=30			
			12							
		-8								
			13				SPT 8, 15, 16 N=31			
		-9								
						TC bit refusal at 13.5m. Borehole BH4 terminated at 13.5m				
			14							
		-10								
			15							
		-11								
			16							

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BOREHOLE NUMBER BH5

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.85 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT							Silty Sandy CLAY, medium to high plasticity, dark brown.		Wet	Soft	FILL
			3	1		CH	Silty CLAY, medium to high plasticity, pale brown, with gravel.		Moist	Soft	NATURAL SOIL
			2	2		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel.	SPT 8, 10, 10 N=20	Moist	Stiff	
			1	3				SPT 10, 14, 20 N=34			
			0	4							
			-1	5				SPT 7, 12, 14 N=26			
			-2	6				SPT 11, 17, 27 N=44			
			-3	7							
	10/09/2020		-4	8				SPT 12, 12, 15 N=27			

BOREHOLE NUMBER BH5

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CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.85 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT						CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel. *(continued)*		Moist	Stiff	
			-5	9				SPT 7, 11, 15 N=26			
			-6	10							
			-7	11				SPT 6, 15, 18 N=33			
			-8	12							
			-9	13				SPT 12, 18, 22 N=40			
							TC bit refusal at 12.95m. Borehole BH5 terminated at 12.95m				
			-10	14							
			-11	15							
			-12	16							

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BOREHOLE NUMBER BH6

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.55 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT						Silty Sandy CLAY, medium to high plasticity, dark brown.		Wet	Soft	FILL
		3			CH	Silty CLAY, medium to high plasticity, pale brown, with gravel.		Wet	Soft	NATURAL SOIL
			1		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel.		Moist	Stiff	
		2					SPT 7, 7, 9 N=16			
			2							
		1								
			3				SPT 12, 17, 22 N=39			
		0								
			4							
		-1					SPT 8, 12, 12 N=24			
			5							
		-2								
			6				SPT 10, 16, 18 N=34			
		-3								
	▼ 10/09/2020		7							
		-4								
			8							

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BOREHOLE NUMBER BH6

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.55 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT		-5, -6, -7, -8, -9, -10	9, 10, 11, 12, 13, 14		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel. *(continued)*	SPT 8, 9, 15 N=24 SPT 8, 15, 22 N=37 SPT 11, 15, 18 N=33 SPT 11, 18, 20 N=38	Moist	Stiff	
		-11, -12	15, 16			TC bit refusal at 14.0m. Borehole BH6 terminated at 14m				

BOREHOLE NUMBER BH7

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CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 **R.L. SURFACE** 3.80 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT					Sandy Silty CLAY, medium to high plasticity, dark brown.		Moist	Soft	FILL
		3	1	CH	Sandy CLAY, medium to high plasticity, pale brown, with fine gravel.	SPT 8, 8, 9 N=17	Moist	Soft	NATURAL SOIL
		2	2						
		1	3	CH	CLAY, high plasticity, grey, mottled, with fine gravel, with Silty Clay, red/ brown, fine to medium gravel.	SPT 14, 19, 25 N=44	Moist	Stiff	
		0	4						
	10/09/2020	-1	5			SPT 14, 14, 18 N=32			
		-2	6						
		-3	7			SPT 12, 15, 16 N=31			
		-4	8						

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BOREHOLE NUMBER BH7

CLIENT Toronto Investments No.1 Pty Ltd **PROJECT NAME** Geotechnical Investigation
PROJECT NUMBER GS8030-1A **PROJECT LOCATION** 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 **R.L. SURFACE** 3.80 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-5 -6 -7 -8 -9 -10	9 10 11 12 13 14		CH	CLAY, high plasticity, grey, mottled, with increasing amountof fine gravel, with Silty Clay, red/ brown, fine to medium gravel.	SPT 10, 15, 16 N=31 SPT 11, 18, 20 N=38 SPT 10, 16, 22 N=38 SPT 15, 18, 22 N=40	Wet to Saturated	Stiff to Soft	
			-11 -12	15 16			Borehole BH7 continued as cored hole				

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BOREHOLE NUMBER BH7

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.80 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diam-etral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
			-5	9								
			-6	10								
			-7	11								
			-8	12								
			-9	13								
			-10	14		Continued from non-cored borehole						
NMLC Coring			-11	15		TC bit refusal at 14.5m. CORE LOSS. 2500mm.						
			-12	16								

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BOREHOLE NUMBER BH7

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.80 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
NMLC Coring			-13	17		CORE LOSS. 2500mm. *(continued)*						
			-14, -15, -16, -17, -18, -19, -20	18, 19, 20, 21, 22, 23, 24		BH7 terminated at 17m						

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BOREHOLE NUMBER BH8

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 **R.L. SURFACE** 3.30 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT		3				Silty Sandy CLAY, medium to high plasticity, dark brown.		Moist	Soft	FILL
		2	1		CH	Gravelly Silty CLAY, medium to high plasticity, pale brown.	SPT 8, 8, 9 N=17	Wet	Soft	NATURAL SOIL
		1	2							
		0, -1, -2, -3, -4	3, 4, 5, 6, 7, 8		CH	CLAY, high plasticity, grey/ white, mottled, with fine gravel, with Silty Clay, medium to high plasticity, red/ brown, with fine to medium gravel.	SPT 10, 20, 25 N=45; SPT 21, Refusal; SPT 10, 12, 12 N=24	Moist	Stiff; Very Stiff	
	10/09/2020 (groundwater at approx. 7 m)									

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BOREHOLE NUMBER BH8

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.30 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT		-5 -6 -7 -8 -9 -10	9 10 11 12 13 14		CH	CLAY, high plasticity, grey/ white, mottled, with fine gravel, with Silty Clay, medium to high plasticity, red/ brown, with fine to medium gravel. *(continued)*	SPT 8, 15, 18 N=33 SPT 17, Refusal SPT 15, 18, 18 N=36 SPT 10, 15, 22 N=37	Moist	Stiff	
		-11 -12	15 16			TC bit refusal at 14.2m. Borehole BH8 terminated at 14.2m				

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6 Carter Street, Lidcombe, NSW, 2141
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BOREHOLE NUMBER BH9

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 2.55 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT							Silty Sandy CLAY, medium plasticity, dark brown.		Moist	Soft	FILL
			2			CH	Silty CLAY, high plasticity, pale brown/ grey.		Moist	Soft	NATURAL SOIL
				1		CH	CLAY, high plasticity, grey, mottled, with fine gravel, with Silty Clay, medium to high plasticity, red/ brown, with fine to medium gravel.		Moist to Wet	Stiff to Soft	
			1					SPT 8, 8, 10 N=18			
				2							
			0								
				3				SPT 18, 24, 26 N=50			
			-1								
				4							
			-2								
				5				SPT 10, 12, 13 N=25			
			-3								
				6							
			-4					SPT 16, 22, 28 N=50			
				7							
	10/09/2020		-5								
				8							

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BOREHOLE NUMBER BH9

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 **R.L. SURFACE** 2.55 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-6 -7 -8 -9 -10 -11	9 10 11 12 13 14		CH	CLAY, high plasticity, grey, mottled, with fine gravel, with Silty Clay, medium to high plasticity, red/ brown, with fine to medium gravel. *(continued)*	SPT 12, 16, 22 N=38 SPT 11, 16, 26 N=42 SPT 18, 20, 20 N=40 SPT 12, 18, 22 N=40	Moist to Wet	Stiff to Soft	
			-12 -13	15 16			Borehole BH9 continued as cored hole				

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BOREHOLE NUMBER BH9

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PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 2.55 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
			-6									
				9								
			-7									
				10								
			-8									
				11								
			-9									
				12								
			-10									
				13								
			-11									
				14		Continued from non-cored borehole						
NMLC Coring			-12	15		TC bit refusal at 14.5m. CORE LOSS. 1000mm.						
			-13	16		BH9 terminated at 15.5m						

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BOREHOLE NUMBER BH101

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 3.60 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT	Not encountered		3.5				FILL/TOPSOIL. Clayey Sand, dark brown, with silt and quartz, sandstone gravel.		D		TOPSOIL/FILL
			3.0	0.5		CH	Gravelly CLAY, low to high plasticity, grey to brown, trace fine to medium quartz & sandstone gravel.		D/M		RESIDUAL SOIL
			2.5	1.0							
			2.0	1.5		CH	Silty CLAY, low to medium plasticity, pale red, brown, trace fine quartz gravel, subround to subangular.		M	S-F	
			1.5	2.0		CH	Silty CLAY, low to medium plasticity, dark orange, brown, trace fine quartz gravel and fine to medium sand.		M	F-St	
			1.0	2.5							
			0.5	3.0		CH	Silty CLAY, high plastcity, pale grey, trace fine sandstone gravel.		M	VSt-H	
			0.0	3.5		CH	Silty CLAY, high plastcity, dark red, brown to plae grey.		M	St-VSt	
			-0.5	4.0							
			-1.0	4.5							
				5.0							

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PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 3.60 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-1.5			CH	Silty CLAY, high plastcity, dark red, brown to plae grey. *(continued)*		M	St-VSt	
			-2.0	5.5		CH	Silty CLAY, high plastcity, dark red, brown to pale grey, grey, with fine to medium quartz and granite gravel, rounded to angular.		M	St-VSt	
			-2.5	6.0			Borehole BH101 terminated at 6m				
			-3.0	6.5							
			-3.5	7.0							
			-4.0	7.5							
			-4.5	8.0							
			-5.0	8.5							
			-5.5	9.0							
			-6.0	9.5							
				10.0							

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BOREHOLE NUMBER BH102

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 4.10 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	RL (m)	Depth (m)	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT	Not encountered	4.0	0.0		FILL. Silty Clay to Clayey Silt, low plasticity, green-grey.		D		TOPSOIL/FILL
		3.5	0.5		FILL. Silty Clay to Clayey Silt, low plasticity, green-grey, , with medium to coarse quartz gravel.		D		
		3.0	1.0	CH	Sandy CLAY, high plasticity, grey brown to orange, trace fine to medium quartz gravel, rounded to angular (broken rounded gravel).		M	F-St	RESIDUAL SOIL
			1.8	CL	Silty CLAY, low plasticity, pale grey to pale green.		M	St	
			1.9	CH	Silty CLAY, high plasticity, pale grey to pale grey-brown.		M	St	
		2.0	2.0	CH	Silty CLAY, high plasticity, orange, with fine sand, trace coarse grained quartz sand & fine quartz gravel.		M	St	
		1.0	2.8	CH	Silty CLAY, high plasticity, dark orange and pale grey, trace fine quartz gravel.		M	St-VSt	
		0.5	3.5	CH	Silty CLAY, high plasticity, pale grey, trace angular quartz gravel.		M	H	
		0.0	3.8	CH	Silty CLAY, high plasticity, dark orange-brown to pale grey, trace fine grained sand and fine rounded quartz gravel.		M	VSt-H	
		-0.5	5.0						

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BOREHOLE NUMBER BH102

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 4.10 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-1.0 -1.5 -2.0	5.5 6.0 6.5		CH	Silty CLAY, high plasticity, dark orange-brown to pale grey, trace fine grained sand and fine rounded quartz gravel. *(continued)*		M	VSt-H	
			-2.5 -3.0 -3.5 -4.0 -4.5 -5.0 -5.5	7.0 7.5 8.0 8.5 9.0 9.5 10.0			Borehole BH102 terminated at 6.5m				

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BOREHOLE NUMBER BH103

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21
R.L. SURFACE 3.40 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd
SLOPE 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig
HOLE LOCATION Refer to Site Plan
HOLE SIZE 100 mm
LOGGED BY RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT							FILL. Silty SAND, fine grained, dark brown.		M/W		TOPSOIL/FILL
			3.0	0.5			FILL. Gravelly Clay, high plasticity, orange, pale grey, dark orange, trace quartz gravel.		M/W		
	Water table		2.5	1.0		CH	Sandy CLAY, low to medium plasticity, brown, with silt, trace fine to medium quartz, basal and sandstone gravel, angular to subangular.		W	S	RESIDUAL SOIL
			2.0	1.5							
			1.5	2.0		CH	Gravelly CLAY, high plasticity, dark orange to red, with fine to coarse grained sand & fine rounded quartz gravel, trace angular basalt gravel, moist.		M	VSt-H	
			1.0	2.5							
			0.5	3.0							
			0.0	3.5		CH	Sandy CLAY, high plasticity, pale grey, with fine to medium grained sand, trace fine quartz gravel, rounded to subangular.		M	H	
			-0.5	4.0							
			-1.0	4.5							
			-1.5	5.0							

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BOREHOLE NUMBER BH103

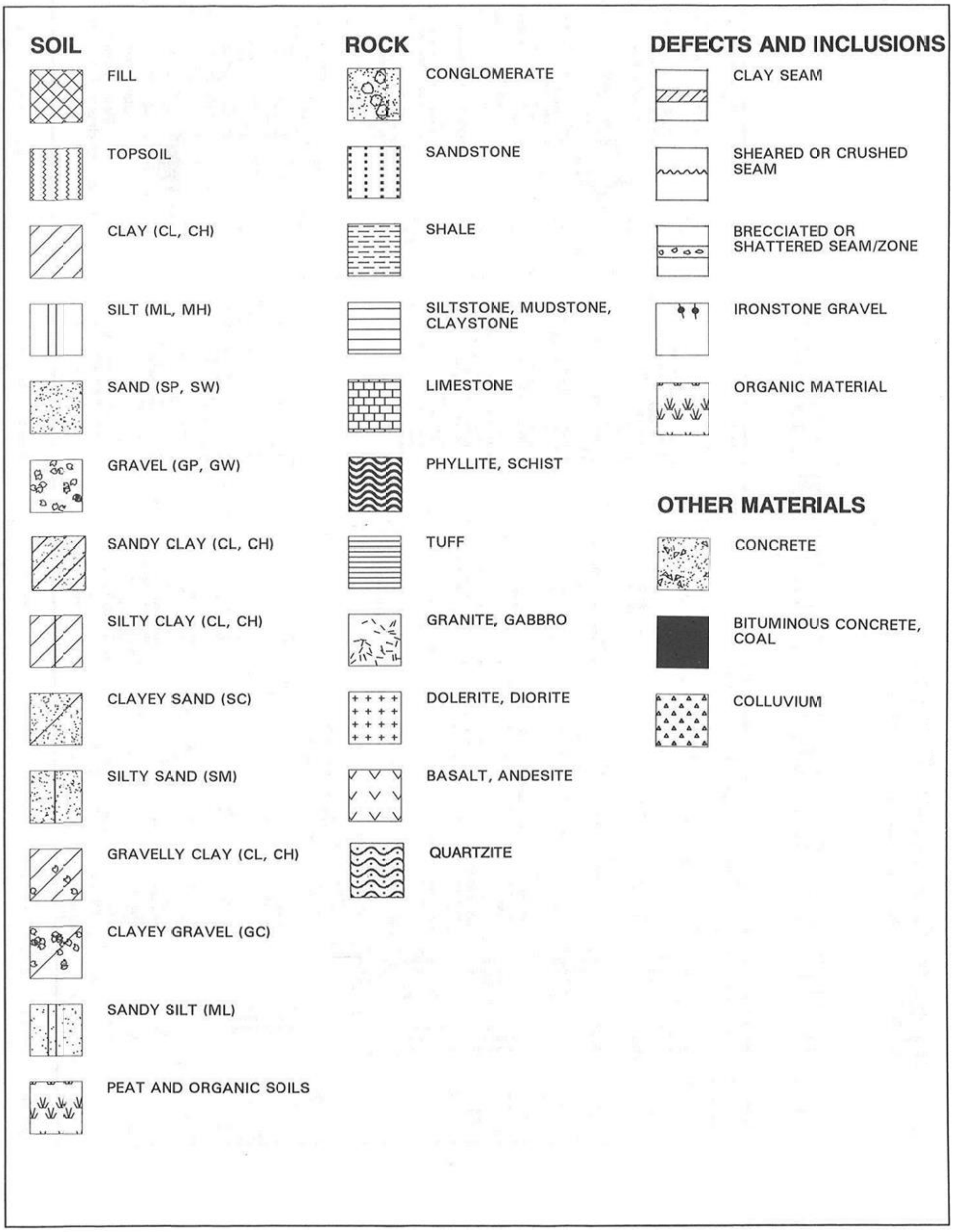
CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21
R.L. SURFACE 3.40 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd
SLOPE 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig
HOLE LOCATION Refer to Site Plan
HOLE SIZE 100 mm
LOGGED BY RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-2.0 -2.5	5.5 6.0		CH	Sandy CLAY, high plasticity, pale grey, with fine to medium grained sand, trace fine quartz gravel, rounded to subangular. *(continued)*		M	H	
			-3.0 -3.5 -4.0 -4.5 -5.0 -5.5 -6.0 -6.5	6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0			Borehole BH103 terminated at 6m				

GRAPHIC LOG SYMBOLS FOR SOIL AND ROCK

The following information is intended to assist in the interpretation of terms and symbols used in geotechnical borehole logs, test pit logs and reports issued by or for Aargus Pty Ltd. More detailed information relating to specific test methods is available in the relevant Australian



Standard AS1726-2017.

Soil Description

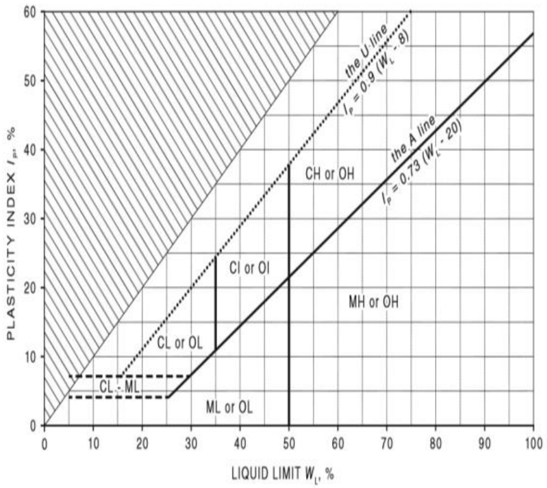
Description and Classification of Soils for Geotechnical Purposes: Refer to AS1726-2017 (Clause 6.1.6)

The following chart (adapted from AS1726-2017, Clause 6.1.6, Table A1) is based on the Unified Soil Classification System (USCS). Table 1

Major Divisions		Particle size mm	USCS Group Symbol	Typical Names	Field classification of sand and gravel	Laboratory Classification				
COARSE GRAINED SOILS (more than 65% of soil excluding oversize fraction is greater than 0.075 mm)	BOULDERS	200				% < 0.075 mm	Plasticity of fine fraction	$C_u = \frac{D_{60}}{D_{10}}$	$C_u = \frac{(D_{30})^2}{(D_{10})(D_{60})}$	NOTES
	COBBLES	63				Use the gradation curve of material passing 63 mm for classification of fractions				
	GRAVELS (more than half of coarse fraction is larger than 2.36 mm)		GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	—	>4	Between 1 and 3	(1) Identify fines by the method given for fine-grained soils.
		coarse	GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	—	Fails to comply with above		
		20 medium	GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Below 'A' line or PI<4	—	Fines behave as silt	(2) Borderline classifications occur when the percentage of fines (fraction smaller than 0.075 mm size) is greater than 5% and less than 12%. Borderline classifications require the use of SP-SM, GW-GC.
		6 fine	GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Above 'A' line and PI>7	—	Fines behave as clay	
	SANDS (more than half of coarse fraction is smaller than 2.36 mm)	2.36	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	—	>6	Between 1 and 3	
		coarse 0.6	SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	—	Fails to comply with above		
		medium 0.2	SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Below 'A' line or PI<4	—	—	
		fine 0.075	SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Above 'A' line and PI>7		—	

Classification of fine-grained soils

Major Divisions		USCS Group Symbol	Typical Names	Field classification of sand and gravel: Dry Strength	Dilatancy	Toughness	Laboratory classification: % < 0.075 mm
FINE GRAINED SOILS (more than 35% of soil excluding oversize fractions is less than 0.075 mm)	SILT and CLAY (low to medium plasticity, %) (Liquid Limit ≤50%)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silts and clays of low plasticity	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity) (Liquid Limit >50%)	MH	Inorganic silts, mic- aceous or diato-maceous fine sands or silts, elastic silts	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clays of high plasticity, fat clays	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils	-	-	-	-



Soil Colour: Is described in the moist condition using black, white, grey, red, brown, orange, yellow, green or blue. Borderline cases can be described as a combination of two colours, with the weaker followed by the stronger. Modifiers such as pale, dark or mottled, can be used as necessary. Where colour consists of a primary colour with secondary mottling, it should be described as follows: (Primary) mottled (Secondary). Refer to AS 1726-2017, Clause 6.1.5

Soil Moisture Condition: Is based on the appearance and feel of soil. Refer to AS 1726-2017, Clause 6.1.7

Term	Description
Dry (D)	Cohesive soils; hard and friable or powdery, well dry of plastic limit. Granular soils; cohesionless and free-running.
Moist	Soil feels cool, darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	Soil feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hands when handling. Granular soils tend to cohere and free water forms on hands when handling.

Consistency of Cohesive Soils: May be estimated using simple field tests, or described in terms of a strength scale. In the field, the undrained shear strength (s_u) can be assessed using a simple field tool appropriate for cohesive soils, in conjunction with the relevant calibration. Refer to AS 1726-2017, Table 11.

Consistency - Essentially Cohesive Soils					
Term	Field Guide	Symbol	SPT "N" Value	Undrained Shear Strength s_u (kPa)	Unconfined Compressive Strength q_u (kPa)
Very soft	Exudes between the fingers when squeezed in hand	VS	0-2	<12	<25
Soft	Can be moulded by light finger pressure	S	2-4	12-25	25-50
Firm	Can be moulded by strong finger pressure	F	4-8	25-50	50-100
Stiff	Cannot be moulded by fingers	St	8-15	50-100	100-200
Very stiff	Can be indented by thumb nail	VSt	15-30	100-200	200-400
Hard	Can be indented with difficulty by thumb nail.	H	>30	>200	>400
Friable	Can be easily crumbled or broken into small pieces by hand	Fr	-	-	-

Soil Particle Sizes	
Term	Size Range
BOULDERS	>200 mm
COBBLES	63-200 mm
Coarse GRAVEL	20-63 mm
Medium GRAVEL	6-20 mm
Fine GRAVEL	2.36-6 mm
Coarse SAND	0.6-2.36 mm
Medium SAND	0.2-0.6 mm
Fine SAND	0.075-0.2 mm
SILT	0.002-0.075 mm
CLAY	<0.002 mm

Note: SPT - N to q_u correlation from Terzaghi and Peck, 1967. (General guide only).

Consistency of Non-Cohesive Soils: Is described in terms of the density index, as defined in AS 1289.0-2014. This can be assessed using a field tool appropriate for non-cohesive soils, in conjunction with the relevant calibration. Refer to AS 1726-2017, Table 12

Consistency - Essentially Non-Cohesive Soils				
Term	Symbol	SPT N Value	Field Guide	Density Index (%)
Very loose	VL	0-4	Foot imprints readily	0-15
Loose	L	4-10	Shovels Easily	15-35
Medium dense	MD	10-30	Shoveling difficult	35-65
Dense	D	30-50	Pick required	65-85
Very dense	VD	>50	Picking difficult	85-100

Standard Penetration Test (SPT): Refer to. AS 1289.6.3.1-2004 (R2016). Example report formats for SPT results are shown below:

Test Report	Penetration Resistance (N)	Explanation / Comment
4, 7, 11	N=18	Full penetration; N is reported on engineering borehole log
18, 27, 32	N=59	Full penetration; N is reported on engineering borehole log
4, 18, 30/15 mm	N is not reported	30 blows causes less than 100 mm penetration (3rd interval) – test discontinued
30/80 mm	N is not reported	30 blows causes less than 100 mm penetration (1st interval) – test discontinued
rw	N<1	Rod weight only causes full penetration
hw	N<1	Hammer and rod weight only causes full penetration
hb	N is not reported	Hammer bouncing for 5 consecutive blows with no measurable penetration – test discontinued

Rock Descriptions

Refer to AS 1726-2017 Clause 6.2.3 for the description and classification of rock material composition, including:

(a) Rock name (Table 15, 16, 17, 18)
(b) Grain size
(c) Texture and fabric
(d) Colour (describe as per soil)
(e) Features, inclusion and minor components.
(f) Moisture content
(g) Durability

The condition of a rock material refers to its weathering characteristics, strength characteristics and rock mass properties.
Refer to AS 1726-201 7Clause 6.2.4 Tables 19, 20 and 21).

Weathering Condition (Degree of Weathering):

The degree of weathering is a continuum from fresh rock to soil. Boundaries between weathering grades may be abrupt or gradational.

Rock Material Weathering Classification

Weathering Grade		Symbol		Definition
Residual Soil (Note 1)		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 Rock (Note 2)		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 Rock (Note 2)	Distinctly Weathered (Note 2)	HW	DW	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 recognizable. 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
Moderately Weathered Rock (Note 2)		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 recognizable, but shows little or no change of strength from fresh rock.
Slightly Weathered Rock		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock
Fresh Rock		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

Notes:

1. Minor variations within broader weathering grade zones will be noted on the engineering borehole logs.
2. Extremely weathered rock is described in terms of soil engineering properties.
3. Weathering may be pervasive throughout the rock mass, or may penetrate inwards from discontinuities to some extent.
4. Where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock the term 'Distinctly Weathered' may be used. 'Distinctly Weathered' is defined as follows: '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 weathering products in pores. There is some change in rock strength.

Strength Condition (Intact Rock Strength):

Strength of Rock Material

(Based on Point Load Strength Index, corrected to 50 mm diameter – $I_{s(50)}$. Field guide used if no tests available. Refer to AS 4133.4.1-2007 (R2016).

Term	Sym	Point Load Index (MPa) $I_{s(50)}$	Field Guide to Strength
Extremely Low	EL	≤0.03	Easily remoulded by hand to a material with soil properties.
Very Low	VL	>0.0 ≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low	L	>0.1 ≤0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.

Medium	M	>0.3	≤1.0	Readily scored with a knife; broken by hand with difficult a piece of core 150 mm long by 50 mm diameter can be y.
High	H	>1	≤3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	VH	>3	≤10	pick after more than one blow; rock rings under hammer.
Extremely High	EH	>10		Specimen requires many blow rock ring with geological pick to break through intact material; under hammer

Notes:

1. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considerably weaker due to the effect of rock defects.
2. Anisotropy of rock material samples may affect the field assessment of strength.

Discontinuity Description: Refer to AS 1726-2017, Table 22.

Anisotropic Fabric	
BED	Bedding
FOL	Foliation
LIN	Mineral lineation
Defect Type	
LP	Lamination Parting
BP	Bedding Parting
FP	Cleavage / Foliation Parting
J, Js	Joint, Joints
SZ	Sheared Zone
CZ	Crushed Zone
BZ	Broken Zone
HFZ	Highly Fractured Zone
AZ	Alteration Zone
VN	Vein

Roughness (e.g. Planar, Smooth is abbreviated Pl / Sm)		Class
Stepped (Stp)	Rough or irregular (Ro)	I
	Smooth (Sm)	II
	Slickensided (Sl)	III
Undulating (Un)	Rough (Ro)	IV
	Smooth (Sm)	V
	Slickensided (Sl)	VI
Planar (Pl)	Rough (Ro)	VII
	Smooth (Sm)	VIII
	Slickensided (Sl)	IX

Aperture		**Infilling**		
Closed	CD	No visible coating or infill	Clean	Cn
Open	OP	Surfaces discoloured by mineral/s	Stain	St
Filled	FL	Visible mineral or soil infill <1mm	Veneer	Vr
Tight	TI	Visible mineral or soil infill >1mm	Coating	Ct

Other	
Cly	Clay
Fe	Iron
Co	Coal
Carb	Carbonaceous
Sinf	Soil Infill Zone
Qz	Quartz
CA	Calcite
Chl	Chlorite
Py	Pyrite
Int	Intersecting
Inc	Incipient
DI	Drilling Induced
H	Horizontal
V	Vertical

Note: Describe 'Zones' and 'Coatings' in terms of composition and thickness (mm).

Discontinuity Spacing: On the geotechnical borehole log, a graphical representation of defect spacing vs depth is shown. This representation takes into account all the natural rock defects occurring within a given depth interval, excluding breaks induced by the drilling / handling of core. Refer to AS 1726-2017, BS5930-2015.

Defect Spacing			**Bedding Thickness (Sedimentary Rock**	
Spacing/Width (mm)	**Descriptor**	**Symbol**	**Descriptor**	**Spacing/Width (mm)**
			Thinly Laminated	< 6
<20	Extremely Close	EC	Thickly Laminated	6 – 20
20 – 60	Very Close	VC	Very Thinly Bedded	20 – 60
60 – 200	Close	C	Thinly Bedded	60 – 200
200 – 600	Medium	M	Medium Bedded	200 – 600
600 – 2000	Wide	W	Thickly Bedded	600 – 2000
2000 – 6000	Very Wide	VW	Very Thickly Bedded	> 2000
>6000	Extremely Wide	EW		

Defect Spacing in 3D	
Term	**Description**
Blocky	Equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section

Defect Persistence (areal extent)
Trace length of defect given in metres

Chameleon

Symbols

The list below provides an explanation of terms and symbols used on the geotechnical borehole, test pit and penetrometer logs.

Test Results			
PI	Plasticity Index	c'	Effective Cohesion
LL	Liquid Limit	c_u	Undrained Cohesion
LI	Liquidity Index	c'_R	Residual Cohesion
DD	Dry Density	ϕ'	Effective Angle of Internal Friction
WD	Wet Density	ϕ_u	Undrained Angle of Internal Friction
LS	Linear Shrinkage	ϕ'_R	Residual Angle of Internal Friction
MC	Moisture Content	c_v	Coefficient of Consolidation
OC	Organic Content	m_v	Coefficient of Volume Compressibility
WPI	Weighted Plasticity Index	$c_{\alpha\varepsilon}$	Coefficient of Secondary Compression

Test Symbols	
DCP	Dynamic Cone Penetrometer
SPT	Standard Penetration Test
CPTu	Cone Penetrometer (Piezocone) Test
PANDA	Variable Energy DCP
PP	Pocket Penetrometer Test
U50	Undisturbed Sample 50 mm (nominal diameter)
U100	Undisturbed Sample 100mm (nominal diameter)
UCS	Uniaxial Compressive Strength
Pm	Pressuremeter

Test Results			
WLS	Weighted Linear Shrinkage	e	Voids Ratio
DoS	Degree of Saturation	ϕ'_{cv}	Constant Volume Friction Angle
APD	Apparent Particle Density	q_t / q_c	Piezocone Tip Resistance (corrected / uncorrected)
s_u	Undrained Shear Strength	q_d	PANDA Cone Resistance
q_u	Unconfined Compressive Strength	$I_{s(50)}$	Point Load Strength Index
R	Total Core Recovery	*RQD*	Rock Quality Designation

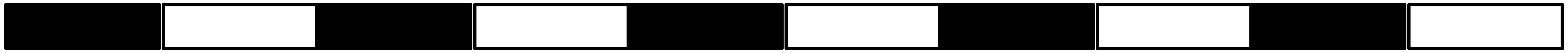
Test Symbols	
FSV	Field Shear Vane
DST	Direct Shear Test
PR	Penetration Rate
A	Point Load Test (axial)
D	Point Load Test (diametral)
L	Point Load Test (irregular lump)

28/11/19 Groundwater level on the date shown	Water Inflow	Water Outflow

APPENDIX D

Rock Core Photographs

Rock Core Photographs: BH3, 13.70m-16.70m.



Aargus ENVIRONMENTAL - ENGINEERING - DRILLING - LABORATORIES - ASBESTOS

Drawn	SP	**Toronto Investments No.1 Pty Ltd** **Geotechnical Site Investigation** **118 Cary Street, Toronto, NSW**	Chameleon	Figure	**2**
Checked	SG			Title	**BH3 Rock Core Photograph**
Date	16 September 2020				
Scale	As shown			Job No	**GS8030-1A**

APPENDIX E

Laboratory Test Results

CHAMELEON POINT LOAD STRENGTH INDEX REPORT

Client:	Toronto Investments No.1 Pty Ltd	**Date Tested:**	16/09//2020
Address:	118 Cary Street, Toronto, NSW	**Job No:**	GS8030-1A

Borehole ID	**Depth (m)**	**Sample Description**	**Test Type**	**Point Load Index Is(50)**	**UCS (MPa)**	**Notes**
BH3	14.63	CONGLOMERATE	Diametral	0.06	1.10	Moist Sample
			Axial	0.29	5.80	Moist Sample
BH3	15.36	CONGLOMERATE	Diametral	0.56	11.10	Moist Sample
			Axial	0.68	13.60	Moist Sample
BH3	15.48	CONGLOMERATE	Diametral	0.20	3.9	Moist Sample
			Axial	0.34	6.8	Moist Sample
BH3	16.59	CONGLOMERATE	Diametral	0.04	0.7	Moist Sample
			Axial	0.25	4.9	Moist Sample

Comments: UCS –Unconfined Compressive Test. Multiplication Factor of 20 was used to calculate UCS.	Sheet 1 of 1	Tested By:	SC
		Checked By:	SG

Chameleon Geosciences Pty Ltd. ACN 086 993 937

6 Carter Street, Lidcombe NSW 2141 Australia. Tel: 1300 137 038 Fax: 1300 136 038
Email: admin@chameleon-geosciences.net

<u>Water Quality Testing Results</u>

A sample set was taken for water quality purposes to review the subject property groundwater quality against potential receptors and background areas.

- GW1 is groundwater sample from site
- W2 is Cary St (Kerry St) sample from stormwater entering off Cary Street (see picture)
- W3 is water sample from wetland close to Oak Street (Labelled incorrectly as Hill Street) stormwater exit point
- W4 is inside the wetland near Stoney Creek
- W5 is canal location as sampled, south of the walking track and rail line
- W6 is sample from Stoney Creek as sampled

The canal and wetland are not connected. The only potential is for underlying seepage through stiff clays via groundwater. The canal is joined to the creek as is the wetland. At high tide, the creek water comes upto and into the wetland and canal although flow pathway is towards Stoney Creek.

Water Sample Locations

Inferred surface water flow paths

Surveyed Mean Water Levels

Below are the surveyed levels for the lake, wetland, creek and drainage canal.

Location	High Tide	Low Tide
Lake	0.11	0.07
Wetland	0.54	0.56
Canal	0.41	0.46
Creek	0.13	0.09

Summary of Laboratory Results

Character measured mg/L	GW1 Site	W2 Cary St	W3 Oak (Hill)	W4 Wetland	W5 Canal	W6 Creek
Ammonia	0.11	0.26	0.35	1.6	0.64	0.05
DO	8.6	8.7	5.1	8.0	3.8	9.3
Oil & grease	<10	12	<10	<10	17	14
pH	7.0	7.3	7.5	7.1	6.6	7.6
Phosphate	0.02	0.36	1.6	3.2	0.46	0.03
Salinity	480	370	290	350	100	36000
TDS	570	360	350	390	130	34000
Nitrogen	0.7	0.8	2.1	4.2	1.7	0.4
SS	180	70	1000	24	220	13
Arsenic	<0.001	0.001	0.002	0.001	<0.001	0.002
Cadmium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	0.006	<0.001	<0.001	<0.001	<0.001	0.001
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mercury	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Nickel	0.003	0.003	<0.001	<0.001	0.001	<0.001
Zinc	0.071	<0.005	<0.005	<0.005	0.006	0.005

W2 Sample location where stormwater run off from Cary Street flows next to a residential dwelling which then flows into the Wetland

W3 Sample where Oak Street stormwater runs down into the Wetland

AARGUS PTY LTD

6 Carter Street
Lidcombe, NSW 2141

P O Box 398 Tel: 1300 137 038
DRUMMOYNE NSW 1470 Fax: 1300 136 038

Email reports: cynthia@aargus.net; saad@aargus.net; mark.kelly@aargus.net;sara@aargus.net; nick@aargus.net
Email invoices: anika@aargus.net; cynthia@aargus.net; saad@aargus.net; mark.kelly@aargus.net; sara@aargus.net

Laboratory Test Request / Chain of Custody Record

TO: MGT EUROFINS
UNIT F3, BUILDING F
16 MARS ROAD
LANE COVE WEST NSW 2066

PH: 028215 6222 **FAX:** 02 9420 2977
ATTN:

Sampling Date: 27.10.2021 **Job No:** GS8030
Sampled By: NK **Project:** Water Analysis
Project Manager: NK **Location:** Toronto

Sampling details | **Sample type** | **Results required by: STANDARD**

Location	Depth (m)	Date	Water (Filled Up)	Metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn)	TPH	BTEXN	PAH	OCP	OP	Turbidity	pH	Salinity	Nitrogen, Phosphorus & Ammoia	DO	Oil & Grease	TDS	TSS	Analysis Suite(s)	KEEP SAMPLE?
GW1 - Ground Water		27.10.2021	WG.WP,OTH	✓							✓	✓	✓	✓	✓	✓	✓		YES
W2 - Kerry Street Stormwater		27.10.2021	WG.WP,OTH	✓							✓	✓	✓	✓	✓	✓	✓		YES
W3 - Hill Street Stormwater		27.10.2021	WG.WP,OTH	✓							✓	✓	✓	✓	✓	✓	✓		YES
*W4 - Wetlands		27.10.2021	WG.WP,OTH	✓							✓	✓	✓	✓	✓	✓	✓		YES
W5 - Canal		27.10.2021	WG.WP,OTH	✓							✓	✓	✓	✓	✓	✓	✓		YES
W6 - Stoney Creek		27.10.2021	WG.WP,OTH	✓							✓	✓	✓	✓	✓	✓	✓		YES
				FILTER SAMPLES															

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Saad	SBS	28.10.2021	ROOPESH · R		28/10/2021

Legend:

WG	Water sample, glass bottle	USG	Undisturbed soil sample (glass j	DSP	Disturbed soil sample (small plastic bag)
WP	Water sample, plastic bottle	DSG	Disturbed soil sample (glass jar)	✓	Test required
GV	Glass vial	OTH	Other	ACAN	Air sample, canister

@ mole H+/tonne

837227

Asim Khan

From: Amay Balkrishna Latwadekar <amay@aargus.net>
Sent: Monday, 24 January 2022 4:22 PM
To: Asim Khan
Cc: #AU04_Enviro_Sample_NSW; Mark Kelly; Mahbub Hasan
Subject: GS8030: Toronto - Relabelling of samples
Attachments: 837227-W_report.pdf

EXTERNAL EMAIL*

Hi,

Thank you for the lab results for the order GS8030. However, due to some issues with the sample labelling from our side, we kindly request you to re-issue another report with corrections as below on the sample names Kerry to Cary and Hill to Oak as below:

GW1 - Ground Water
W2 - Kerry Street Stormwater
W3 - Hill Street Stormwater
W4 - Wetlands
W5 - Canal
W6 - Stoney Creek

Into

GW1 - Ground Water
W2 - Cary Street Stormwater
W3 - Oak Street Stormwater
W4 - Wetlands
W5 - Canal
W6 - Stoney Creek

I have attached the previous report (837227-W) for your reference. Thank you

Kind Regards,

Amay Latwadekar
Environmental Engineer

Sample Receipt Advice

Company name:	Aargus Pty Ltd
Contact name:	Nick Kariotoglou
Project name:	WATER ANALYSIS
Project ID:	GS8030
Turnaround time:	5 Day
Date/Time received	Oct 28, 2021 3:29 PM
Eurofins reference	837227

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- ✓ Sample containers for volatile analysis received with zero headspace.
- ✗ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Asim Khan on phone : or by email: AsimKhan@eurofins.com

Results will be delivered electronically via email to Nick Kariotoglou - nick@aargus.net.

Global Leader - Results you can trust

eurofins Environment Testing

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
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Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Oct 28, 2021 3:29 PM
Address:	6 Carter Street Lidcombe NSW 2141	**Report #:**	837227	**Due:**	Nov 4, 2021
		Phone:	02 9568 6159	**Priority:**	5 Day
		Fax:	02 9566 6179	**Contact Name:**	Nick Kariotoglou
Project Name:	WATER ANALYSIS				
Project ID:	GS8030				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						Ammonia (as N)	Dissolved Oxygen	Oil & Grease (HEM)	pH (at 25 °C)	Phosphate total (as P)	Salinity (determined from EC)*	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Metals M8 filtered	Total Dissolved Solids Dried at 180°C ± 2°C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217															
Brisbane Laboratory - NATA # 1261 Site # 20794															
Mayfield Laboratory - NATA # 1261 Site # 25079															
Perth Laboratory - NATA # 2377 Site # 2370															
External Laboratory															
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**										
1	GW1-GROUND WATER	Oct 27, 2021		Water	S21-No04413	X	X	X	X	X	X	X	X	X	X
2	W2_CARY STREET STORMWATER	Oct 27, 2021		Water	S21-No04414	X	X	X	X	X	X	X	X	X	X
3	W3_OAK STREET STORMWATER	Oct 27, 2021		Water	S21-No04415	X	X	X	X	X	X	X	X	X	X
4	W4_WETLAN	Oct 27, 2021		Water	S21-No04416	X	X	X	X	X	X	X	X	X	X

eurofins Environment Testing

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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NATA # 1261 Site # 18217

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NATA # 1261 Site # 20794

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Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

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Rolleston, Christchurch 7675
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IANZ # 1290

Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Oct 28, 2021 3:29 PM
Address:	6 Carter Street Lidcombe NSW 2141	**Report #:**	837227	**Due:**	Nov 4, 2021
		Phone:	02 9568 6159	**Priority:**	5 Day
		Fax:	02 9566 6179	**Contact Name:**	Nick Kariotoglou
Project Name:	WATER ANALYSIS				
Project ID:	GS8030				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						Ammonia (as N)	Dissolved Oxygen	Oil & Grease (HEM)	pH (at 25 °C)	Phosphate total (as P)	Salinity (determined from EC)*	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Metals M8 filtered	Total Dissolved Solids Dried at 180°C ± 2°C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217															
Brisbane Laboratory - NATA # 1261 Site # 20794															
Mayfield Laboratory - NATA # 1261 Site # 25079															
Perth Laboratory - NATA # 2377 Site # 2370															
External Laboratory															
	DS														
5	W5_CANALS	Oct 27, 2021		Water	S21-No04417	X	X	X	X	X	X	X	X	X	X
6	W6_STONEY CREEK	Oct 27, 2021		Water	S21-No04418	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6

Certificate of Analysis

Environment Testing

Aargus Pty Ltd
6 Carter Street
Lidcombe
NSW 2141

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Nick Kariotoglou**

Report	**837227-W-V2**
Project name	WATER ANALYSIS
Project ID	GS8030
Received Date	Oct 28, 2021

Client Sample ID			**GW1-GROUND WATER**	**W2_CARY STREET STORMWATER**	**W3_OAK STREET STORMWATER**	**W4_WETLANDS**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**S21-No04413**	**S21-No04414**	**S21-No04415**	**S21-No04416**
Date Sampled			**Oct 27, 2021**	**Oct 27, 2021**	**Oct 27, 2021**	**Oct 27, 2021**
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	0.11	0.26	0.35	1.6
Dissolved Oxygen	0.01	mg/L	8.6	8.7	5.1	8.0
Oil & Grease (HEM)	10	mg/L	< 10	12	< 10	< 10
pH (at 25 °C)	0.1	pH Units	7.0	7.3	7.5	7.1
Phosphate total (as P)	0.01	mg/L	0.02	0.36	1.6	3.2
Salinity (determined from EC)*	20	mg/L	480	370	290	350
Total Dissolved Solids Dried at 180°C ± 2°C	10	mg/L	570	360	350	390
Total Nitrogen (as N)	0.2	mg/L	0.7	0.8	2.1	4.2
Total Suspended Solids Dried at 103–105°C	5	mg/L	180	70	1000	24
Heavy Metals						
Arsenic (filtered)	0.001	mg/L	< 0.001	0.001	0.002	0.001
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.006	< 0.001	< 0.001	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.003	< 0.001	< 0.001	< 0.001
Zinc (filtered)	0.005	mg/L	0.071	< 0.005	< 0.005	< 0.005

Client Sample ID			**W5_CANALS**	**W6_STONEY CREEK**
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**S21-No04417**	**S21-No04418**
Date Sampled			**Oct 27, 2021**	**Oct 27, 2021**
Test/Reference	LOR	Unit		
Ammonia (as N)	0.01	mg/L	0.64	0.05
Dissolved Oxygen	0.01	mg/L	3.8	9.3
Oil & Grease (HEM)	10	mg/L	17	14
pH (at 25 °C)	0.1	pH Units	6.6	7.6
Phosphate total (as P)	0.01	mg/L	0.46	0.03
Salinity (determined from EC)*	20	mg/L	100	36000

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Client Sample ID			W5_CANALS	W6_STONEY CREEK
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**S21-No04417**	**S21-No04418**
Date Sampled			**Oct 27, 2021**	**Oct 27, 2021**
Test/Reference	LOR	Unit		
Total Dissolved Solids Dried at 180°C ± 2°C	10	mg/L	130	34000
Total Nitrogen (as N)	0.2	mg/L	1.7	0.4
Total Suspended Solids Dried at 103–105°C	5	mg/L	220	13
Heavy Metals				
Arsenic (filtered)	0.001	mg/L	< 0.001	0.002
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.001	< 0.001
Zinc (filtered)	0.005	mg/L	0.006	0.005

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Ammonia (as N)	Melbourne	Nov 04, 2021	28 Days
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Dissolved Oxygen	Melbourne	Nov 05, 2021	28 Days
- Method: APHA 4500-O B, C, G using Dissolved Oxygen analyser			
Oil & Grease (HEM)	Melbourne	Nov 04, 2021	28 Days
- Method: LTM-INO-4180 Oil and Grease (APHA 5520B)			
pH (at 25 °C)	Melbourne	Nov 04, 2021	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Phosphate total (as P)	Melbourne	Nov 04, 2021	28 Days
- Method: LTM-INO-4040 Phosphate by CFA			
Salinity (determined from EC)*	Melbourne	Nov 09, 2021	0 Days
- Method: LTM-INO-4030			
Total Nitrogen (as N)	Melbourne	Nov 11, 2021	7 Days
- Method: LTM-INO-4040 Phosphate and Nitrogen in waters			
Total Suspended Solids Dried at 103–105°C	Melbourne	Nov 04, 2021	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			
Metals M8 filtered	Melbourne	Nov 04, 2021	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Dissolved Solids Dried at 180°C ± 2°C	Melbourne	Nov 04, 2021	28 Days
- Method: LTM-INO-4170 Total Dissolved Solids in Water			

Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Oct 28, 2021 3:29 PM
Address:	6 Carter Street Lidcombe NSW 2141	**Report #:**	837227	**Due:**	Nov 4, 2021
		Phone:	02 9568 6159	**Priority:**	5 Day
		Fax:	02 9566 6179	**Contact Name:**	Nick Kariotoglou
Project Name:	WATER ANALYSIS				
Project ID:	GS8030				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						Ammonia (as N)	Dissolved Oxygen	Oil & Grease (HEM)	pH (at 25 °C)	Phosphate total (as P)	Salinity (determined from EC)*	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Metals M8 filtered	Total Dissolved Solids Dried at 180°C ± 2°C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217															
Brisbane Laboratory - NATA # 1261 Site # 20794															
Mayfield Laboratory - NATA # 1261 Site # 25079															
Perth Laboratory - NATA # 2377 Site # 2370															
External Laboratory															
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**										
1	GW1-GROUND WATER	Oct 27, 2021		Water	S21-No04413	X	X	X	X	X	X	X	X	X	X
2	W2_CARY STREET STORMWATER	Oct 27, 2021		Water	S21-No04414	X	X	X	X	X	X	X	X	X	X
3	W3_OAK STREET STORMWATER	Oct 27, 2021		Water	S21-No04415	X	X	X	X	X	X	X	X	X	X
4	W4_WETLAN	Oct 27, 2021		Water	S21-No04416	X	X	X	X	X	X	X	X	X	X

eurofins Environment Testing

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NATA # 1261 Site # 18217

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NATA # 1261 Site # 20794

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Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Oct 28, 2021 3:29 PM
Address:	6 Carter Street Lidcombe NSW 2141	**Report #:**	837227	**Due:**	Nov 4, 2021
		Phone:	02 9568 6159	**Priority:**	5 Day
		Fax:	02 9566 6179	**Contact Name:**	Nick Kariotoglou
Project Name:	WATER ANALYSIS				
Project ID:	GS8030				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						Ammonia (as N)	Dissolved Oxygen	Oil & Grease (HEM)	pH (at 25 °C)	Phosphate total (as P)	Salinity (determined from EC)*	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Metals M8 filtered	Total Dissolved Solids Dried at 180°C ± 2°C
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217															
Brisbane Laboratory - NATA # 1261 Site # 20794															
Mayfield Laboratory - NATA # 1261 Site # 25079															
Perth Laboratory - NATA # 2377 Site # 2370															
External Laboratory															
	DS														
5	W5_CANALS	Oct 27, 2021		Water	S21-No04417	X	X	X	X	X	X	X	X	X	X
6	W6_STONEY CREEK	Oct 27, 2021		Water	S21-No04418	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.4
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Ammonia (as N)			mg/L	< 0.01			0.01	Pass	
Oil & Grease (HEM)			mg/L	< 10			10	Pass	
Phosphate total (as P)			mg/L	< 0.01			0.01	Pass	
Total Dissolved Solids Dried at 180°C ± 2°C			mg/L	< 10			10	Pass	
Total Nitrogen (as N)			mg/L	< 0.2			0.2	Pass	
Total Suspended Solids Dried at 103–105°C			mg/L	< 5			5	Pass	
Method Blank									
Heavy Metals									
Arsenic (filtered)			mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)			mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)			mg/L	< 0.001			0.001	Pass	
Copper (filtered)			mg/L	< 0.001			0.001	Pass	
Lead (filtered)			mg/L	< 0.001			0.001	Pass	
Mercury (filtered)			mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)			mg/L	< 0.001			0.001	Pass	
Zinc (filtered)			mg/L	< 0.005			0.005	Pass	
LCS - % Recovery									
Ammonia (as N)			%	96			70-130	Pass	
Oil & Grease (HEM)			%	89			70-130	Pass	
Phosphate total (as P)			%	96			70-130	Pass	
Total Dissolved Solids Dried at 180°C ± 2°C			%	105			70-130	Pass	
Total Nitrogen (as N)			%	103			70-130	Pass	
Total Suspended Solids Dried at 103–105°C			%	90			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Phosphate total (as P)	B21-No03070	NCP	%	105			70-130	Pass	
Total Nitrogen (as N)	B21-No03070	NCP	%	102			70-130	Pass	
Total Suspended Solids Dried at 103–105°C	M21-No13135	NCP	%	79			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	S21-Oc64681	NCP	%	102			75-125	Pass	
Cadmium (filtered)	S21-Oc64681	NCP	%	99			75-125	Pass	
Chromium (filtered)	S21-Oc64681	NCP	%	101			75-125	Pass	
Copper (filtered)	S21-Oc64681	NCP	%	97			75-125	Pass	
Lead (filtered)	S21-Oc64681	NCP	%	96			75-125	Pass	
Mercury (filtered)	S21-Oc64681	NCP	%	96			75-125	Pass	
Nickel (filtered)	S21-Oc64681	NCP	%	98			75-125	Pass	
Zinc (filtered)	S21-Oc64681	NCP	%	101			75-125	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	S21-No04415	CP	%	99			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Dissolved Oxygen	N21-No03630	NCP	mg/L	8.5	8.4	1.0	30%	Pass	
Oil & Grease (HEM)	M21-Oc59220	NCP	mg/L	< 10	< 10	<1	30%	Pass	
pH (at 25 °C)	M21-No09780	NCP	pH Units	6.0	6.0	pass	30%	Pass	
Phosphate total (as P)	M21-Oc62393	NCP	mg/L	4.0	4.1	3.0	30%	Pass	
Total Nitrogen (as N)	M21-Oc62393	NCP	mg/L	29	28	4.0	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	S21-Oc64681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	S21-Oc64681	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	S21-Oc64681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	S21-Oc64681	NCP	mg/L	0.003	< 0.001	150	30%	Fail	Q15
Lead (filtered)	S21-Oc64681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	S21-Oc64681	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	S21-Oc64681	NCP	mg/L	0.004	0.004	<1	30%	Pass	
Zinc (filtered)	S21-Oc64681	NCP	mg/L	0.011	0.013	14	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	S21-No04415	CP	mg/L	0.35	0.38	7.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Dissolved Solids Dried at 180°C ± 2°C	S21-No04417	CP	mg/L	130	76	51	30%	Fail	Q15
Duplicate									
				Result 1	Result 2	RPD			
Total Suspended Solids Dried at 103–105°C	S21-No04418	CP	mg/L	13	15	16	30%	Pass	

Comments

This report has been revised (V2) to amend the sample name for S21-No04414 and S21-No04415.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Asim Khan	Analytical Services Manager
Scott Beddoes	Senior Analyst-Inorganic (VIC)
Emily Rosenberg	Senior Analyst-Metal (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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APPENDIX F

Groundwater Information

Re: Correlation of Surface Waterflow, Groundwater flow and Rainfall data

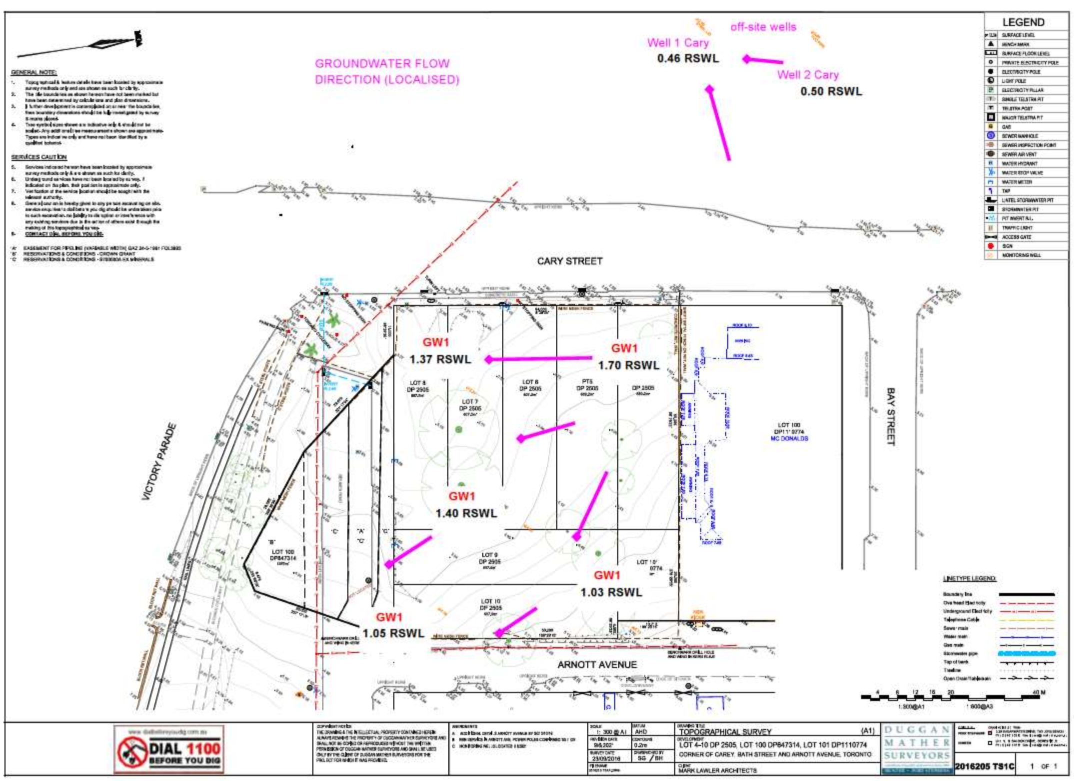
This report is to provide general information pertaining localised surface water flow and groundwater levels vs rainfall data where was some clarity was required for groundwater flow directions moving to the south and southeast with the area closest to the wetland off Cary Street showing groundwater flow towards the wetland (west) and modelling showing flows to the east. Further correlation with rainfall data and groundwater data has been provided to confirm seasonal fluctuations in groundwater depths and the potential affects of rising or lowering of the groundwater table due to rain.

The following information shows the surrounding areas of the property during a rainfall event depicting the surface water natural flows following the regional slopes and landforms. The surface waters on Cary Street run south on roadway gutters downgradient of its surrounds and entering into stormwater channels. The stormwater runoff from the left side of Cary Street facing north would travel down gutters and it is shown where the entry point of water flow enters the wetland area (ref: Photo 2) across the road from the McDonalds restaurant and upgradient of our subject property. Stormwater running south down Cary Street (Photo 1) and the stormwater pipes travel underneath Cary Street (Photo 5) and originating from the area closest to our site (across the intersection of Victoria Parade). It can be seen here that the surface water flows through stormwater pipes, travels into the canal downgradient from the wetland which is a tributary of Stoney Creek which then enters the Bay. The immediate thought would be that the surface water flow from the site would move towards the closest water receptor being Toronto Bay only 100m east from our site, yet the surface water flow directions show that it is moving south down Arnott Avenue towards Bath Street and ponding, thereafter travelling down the stormwater system around Cary Street and Victoria Parade.

The water flow coming south down Arnott Avenue (Photo: 3) then ends up ponding down near Bath Street (Photo 4). It should be noted that Arnott Avenue is higher than Cary Street in elevation and it has also been noted that no stormwater drains exist on Arnott Avenue.

The groundwater contours generally follow the surface water flows of the surrounding areas. It should be noted that both Cary Street and Arnott Avenue have a gradient declining south. The Cary Street stormwater system captures the rainfall and water travels either into the first outlet across the road from McDonalds (Photo: 2) to the wetland (upgradient from our property) or underneath Cary Street towards the dual stormwater pipe opposite Victoria Parade and into the Canal (Photo 5).

Groundwater contour map presented below from latest and compiled levels



The subject property contains some previous drainage pipes from former residential properties that were connected to stormwater drains travelling below Cary Street towards the wetland but it can be seen through the location of the red dot below on the below picture that the site still would have surficial flows moving downgradient with the red dot showing that it is downgradient from the wetland (see above contour of levels). Flows seen entering the wetland from surface flows are from road surfaces and gutters. Road surfaces are generally considered to have a higher potential risk of contaminants than that of water run-off from roofs and gutters of dwellings due to oil, grease and fuel depositions along with general rubbish (as depicted in the pictures taken).

Photo 1: Slope down Cary Street

Photo 2: Water run-off from Cary Street

Photo 3: Gradient down Arnott Ave

Photo 4: Ponding at Bath Street

Photo 5: Outlet under Cary Street to Canal

Rainfall data with correlation against time and groundwater depths

The below chart provides the average rainfall in the region across all months. Using this data and correlating with the recent rainfall data used when sampling, in both cases, the highest rainfall occurs between the months January to March with the lowest rainfall around May to September with the months of June July containing a spike.

Climate statistics for Australian locations

Monthly climate statistics - graph

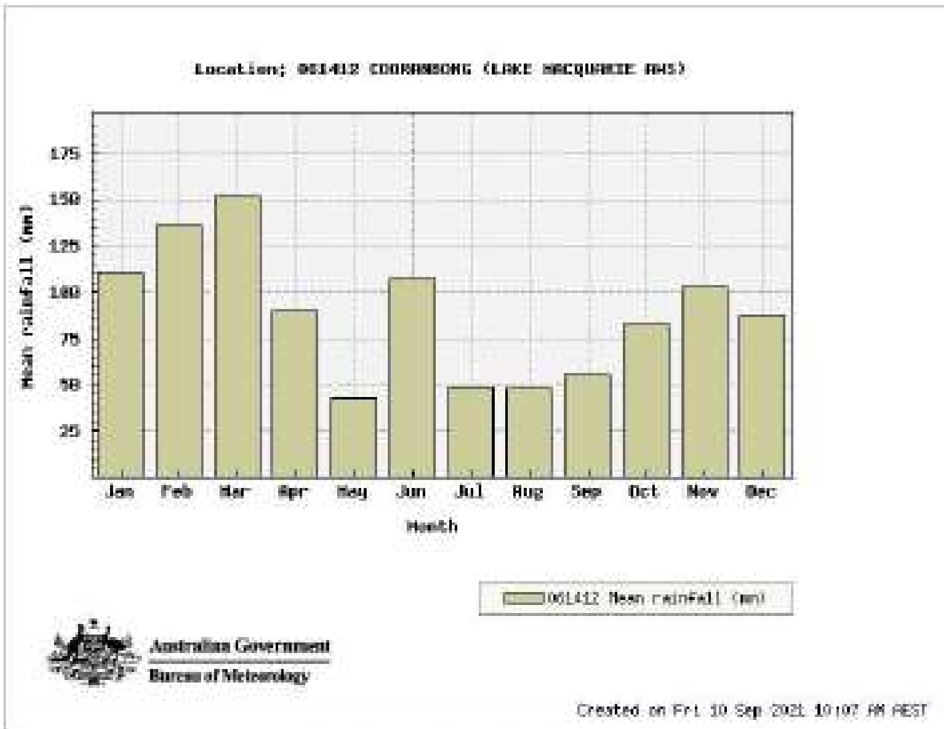
COORANBONG (LAKE MACQUARIE AWS)

Mean rainfall (mm)

Site details

Site name: COORANBONG (LAKE MACQUARIE AWS) **Site number:** 061412 **Commenced:** 2008

Latitude: 33.09 °S **Longitude:** 151.46 °E **Elevation:** 6 m **Operational status:** Still Open



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean rainfall (mm) for years 2008 to 2021	110.7	136.7	151.8	90.3	42.9	107.6	49.3	48.6	56.0	82.9	102.3	87.6	1061.0	13

Additional information

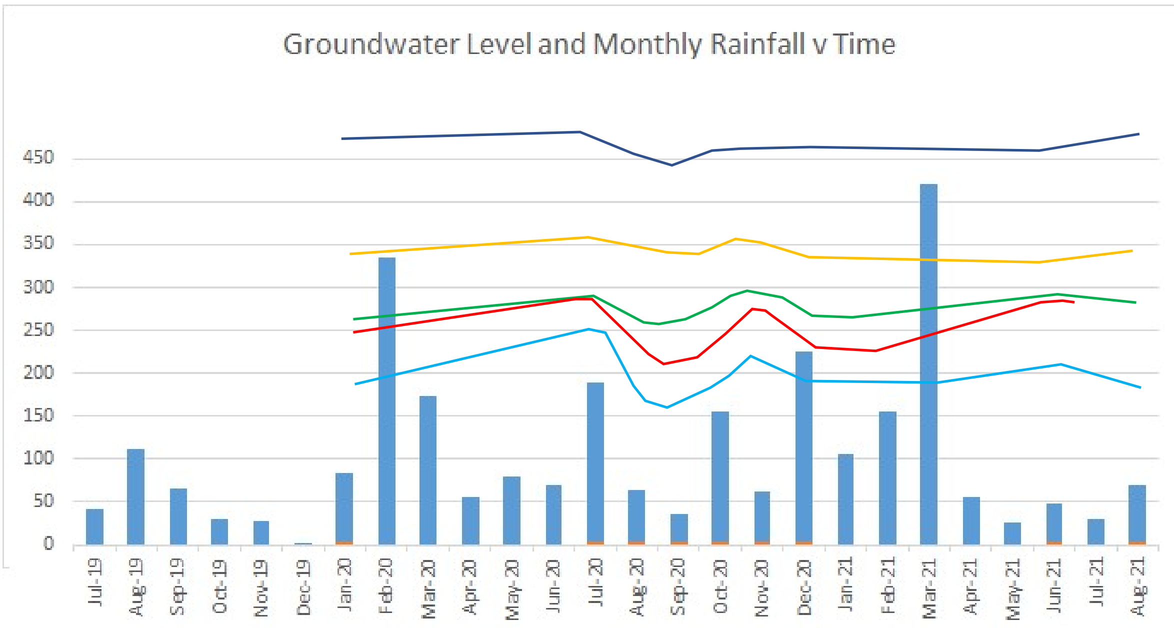
Related Links

- Summary statistics and locational map for this site: http://www.bom.gov.au/climate/averages/tables/cw_061412.shtml
- About climate averages: http://www.bom.gov.au/climate/cdo/about/about-stats.shtml
- Definitions of the individual statistical elements: http://www.bom.gov.au/climate/averages/tables/definitions.shtml
- Climate Data Online home page URL: http://www.bom.gov.au/climate/data/index.shtml
- Bureau of Meteorology website: http://www.bom.gov.au

12.3 = Not quality controlled

Page created: Fri 10 Sep 2021 10:07:38 AM AEST

We have plotted the data of rainfall against groundwater depths and confirm that the groundwater follows a similar pattern in rising for approximately 3 months after rainfall and falling approximately 3 months after a dry period. In all cases, the groundwater levels return to there seasonal depths. It would be expected that during uncommon seasonal weather, such as a high rainfall year. The groundwater levels would remain higher for longer and reciprocal for a dry season where groundwater levels will remain lower.



Legend: GW1 GW2 GW3 GW4 GW5

The 3 wells adjoining the wetland have only 3 dates of measurements taken thus not plotted.

It can be seen from the above graph that the months of January to June starts to increase, July to September decreases, September to November increases and November to February decreases signifying a general seasonal fluctuation in groundwater depths between 0.2 to 0.8m.

Groundwater extra readings

	GW1	GW2	GW3	GW4	GW5	Well 1	Well 2	Well 3*
10/01/20	4.7	3.4	2.7	2.5	1.9			
10/07/20	4.9	3.6	2.9	2.9	2.0			
10/09/20	4.4	3.4	2.6	2.1	1.6			
16/09/20	4.4	3.4	2.7	2.1	1.6			
01/10/20	4.7	3.4	2.7	2.5	1.9			
07/10/20	4.1	3.6	2.9	2.9	2.0			
09/10/20	4.7	3.5	3.0	2.9	2.3			
01/12/20	4.7	3.3	2.6	2.3	1.9	2.0	2.1	
17/06/21	4.6	3.3	3.0	2.9	2.1	2.0	2.1	
24/08/21	4.8	3.4	2.7	-	1.6	2.0	2.1	1.24

Note Well 3 was a new well found with a gatic cover separate from all initial wells surveyed. A series of 5 extra wells were discovered within trees and shrubs yet the construction methodology and location of some of these being in the middle of trees plus the fact that 4-5 wells were either dry, bent or inaccessible.

Permeability Specification Sheet

Permeability

Three new groundwater wells were installed at the site in October 2021 and were not drilled through clays into the underlying rock, but were founded within clays to the depth of excavation approximately 7m bgl. The results compared to our original K values of 0.5 are more reflective of the current groundwater conditions within the clay soils proposed to be excavated as part of the basement excavation as the former wells were constructed for geotechnical purposes and not for detailed hydraulic conductivity for permeability values in clays at basement levels.

Using the Bouwer and Rice (1976) method of slug test analysis, the following permeability values (k) were calculated.

BH101 K = 0.0029 m/day

BH102 K= 0.0015 m/day

BH103 K= 0.0042m/day

There were some initial faster inflow rates in BH103 which is near the ephemeral watercourse on the site. The borehole logs show a perched groundwater table in a soft, wet Sandy Clay at 0.8m to 1.7m depth. Below this level is a Very Stiff to Hard Gravelly Clay (1.7-3.5m depth), with a Hard Sandy Clay below this to termination depth at 6.0m.

Below are the logs for the 3 new wells (GW6, GW7 & GW8) and the original permeability calculations for the deeper wells which are representative of the groundwater conditions within the conglomerates >10m on the site

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH101

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 3.60 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT	Not encountered		3.5				FILL/TOPSOIL. Clayey Sand, dark brown, with silt and quartz, sandstone gravel.		D		TOPSOIL/FILL
			3.0	0.5		CH	Gravelly CLAY, low to high plasticity, grey to brown, trace fine to medium quartz & sandstone gravel.		D/M		RESIDUAL SOIL
			2.5	1.0							
			2.0	1.5		CH	Silty CLAY, low to medium plasticity, pale red, brown, trace fine quartz gravel, subround to subangular.		M	S-F	
			1.5	2.0							
			1.0	2.5		CH	Silty CLAY, low to medium plasticity, dark orange, brown, trace fine quartz gravel and fine to medium sand.		M	F-St	
			0.5	3.0		CH	Silty CLAY, high plastcity, pale grey, trace fine sandstone gravel.		M	VSt-H	
			0.0	3.5		CH	Silty CLAY, high plastcity, dark red, brown to plae grey.		M	St-VSt	
			-0.5	4.0							
			-1.0	4.5							
				5.0							

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BOREHOLE NUMBER BH101

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21
R.L. SURFACE 3.60 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd
SLOPE 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig
HOLE LOCATION Refer to Site Plan
HOLE SIZE 100 mm
LOGGED BY RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-1.5			CH	Silty CLAY, high plastcity, dark red, brown to plae grey. *(continued)*		M	St-VSt	
			-2.0	5.5		CH	Silty CLAY, high plastcity, dark red, brown to pale grey, grey, with fine to medium quartz and granite gravel, rounded to angular.		M	St-VSt	
			-2.5	6.0			Borehole BH101 terminated at 6m				
			-3.0	6.5							
			-3.5	7.0							
			-4.0	7.5							
			-4.5	8.0							
			-5.0	8.5							
			-5.5	9.0							
			-6.0	9.5							
				10.0							

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BOREHOLE NUMBER BH102

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 4.10 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT	Not encountered		4.0	0.0–0.5			FILL. Silty Clay to Clayey Silt, low plasticity, green-grey.		D		TOPSOIL/FILL
			3.5	0.5–1.0			FILL. Silty Clay to Clayey Silt, low plasticity, green-grey, , with medium to coarse quartz gravel.		D		
			3.0	1.0–1.8		CH	Sandy CLAY, high plasticity, grey brown to orange, trace fine to medium quartz gravel, rounded to angular (broken rounded gravel).		M	F-St	RESIDUAL SOIL
				1.8–1.9		CL	Silty CLAY, low plasticity, pale grey to pale green.		M	St	
				1.9–2.0		CH	Silty CLAY, high plasticity, pale grey to pale grey-brown.		M	St	
			2.0	2.0–2.8		CH	Silty CLAY, high plasticity, orange, with fine sand, trace coarse grained quartz sand & fine quartz gravel.		M	St	
			1.0	2.8–3.5		CH	Silty CLAY, high plasticity, dark orange and pale grey, trace fine quartz gravel.		M	St-VSt	
			0.5	3.5–3.8		CH	Silty CLAY, high plasticity, pale grey, trace angular quartz gravel.		M	H	
			0.0 / -0.5	3.8–5.0		CH	Silty CLAY, high plasticity, dark orange-brown to pale grey, trace fine grained sand and fine rounded quartz gravel.		M	VSt-H	

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BOREHOLE NUMBER BH102

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 4.10 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-1.0 -1.5 -2.0	5.5 6.0 6.5		CH	Silty CLAY, high plasticity, dark orange-brown to pale grey, trace fine grained sand and fine rounded quartz gravel. *(continued)*		M	VSt-H	
			-2.5 -3.0 -3.5 -4.0 -4.5 -5.0 -5.5	7.0 7.5 8.0 8.5 9.0 9.5 10.0			Borehole BH102 terminated at 6.5m				

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BOREHOLE NUMBER BH103

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 3.40 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT							FILL. Silty SAND, fine grained, dark brown.		M/W		TOPSOIL/FILL
			3.0	0.5			FILL. Gravelly Clay, high plasticity, orange, pale grey, dark orange, trace quartz gravel.		M/W		
	Water table		2.5	1.0		CH	Sandy CLAY, low to medium plasticity, brown, with silt, trace fine to medium quartz, basal and sandstone gravel, angular to subangular.		W	S	RESIDUAL SOIL
			2.0	1.5							
			1.5	2.0		CH	Gravelly CLAY, high plasticity, dark orange to red, with fine to coarse grained sand & fine rounded quartz gravel, trace angular basalt gravel, moist.		M	VSt-H	
			1.0	2.5							
			0.5	3.0							
			0.0	3.5		CH	Sandy CLAY, high plasticity, pale grey, with fine to medium grained sand, trace fine quartz gravel, rounded to subangular.		M	H	
			-0.5	4.0							
			-1.0	4.5							
			-1.5	5.0							

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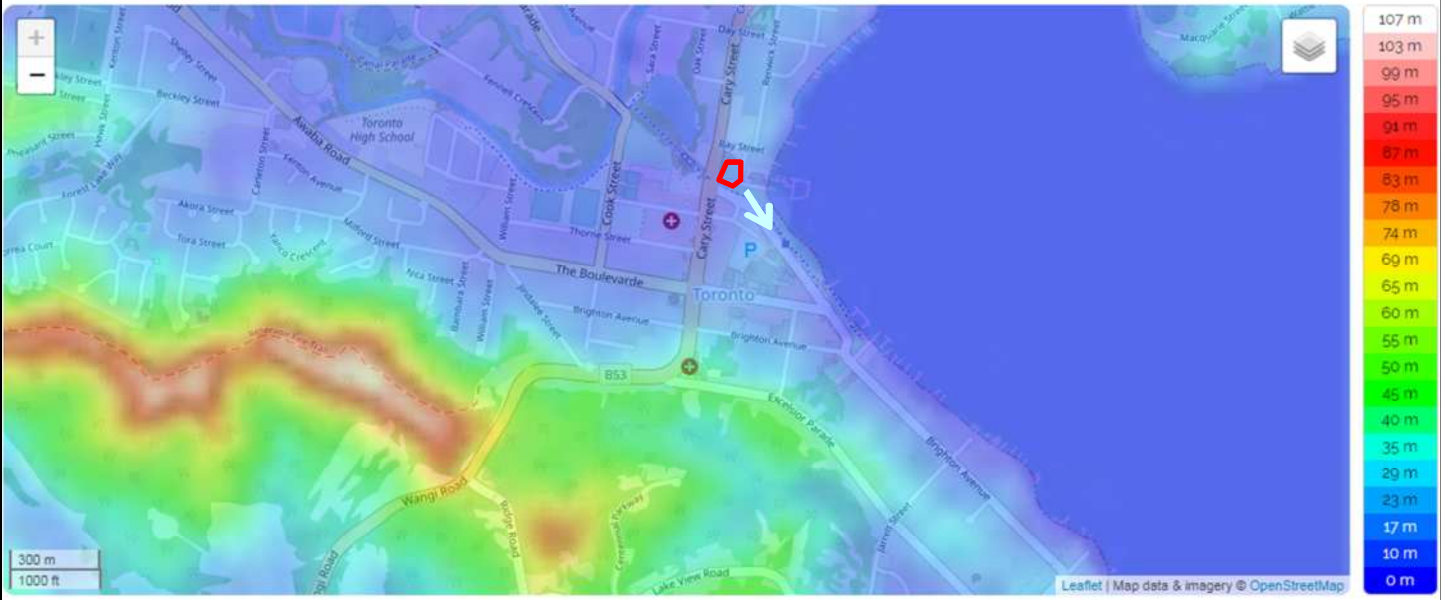
BOREHOLE NUMBER BH103

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-7A
PROJECT LOCATION 114-120 Cary Street, Toronto, NSW 2283

DATE STARTED 06/10/21 **COMPLETED** 06/10/21 **R.L. SURFACE** 3.40 **DATUM** m AHD
DRILLING CONTRACTOR Aargus Pty Ltd **SLOPE** 90° **BEARING** ---
EQUIPMENT Excavator mounted small rig **HOLE LOCATION** Refer to Site Plan
HOLE SIZE 100 mm **LOGGED BY** RF **CHECKED BY** RF
NOTES Surface levels and depths of lithological units are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-2.0 -2.5	5.5 6.0		CH	Sandy CLAY, high plasticity, pale grey, with fine to medium grained sand, trace fine quartz gravel, rounded to subangular. *(continued)*		M	H	
			-3.0 -3.5 -4.0 -4.5 -5.0 -5.5 -6.0 -6.5	6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0			Borehole BH103 terminated at 6m				

GROUNDWATER FLOW DIRECTION



SITE FEATURES - LEGEND

Inferred Groundwater Flow Direction

Site Boundary

PROJECT DETAILS			**DRAWING DETAILS**			
Project Title	Acid Sulfate Soils Management Plan	Chameleon	**Figure No.**	4	**Rev No.**	0
Project No.	EC8030-2		**Scale**	As above	**Size**	A4
Client	Toronto Investments No.1 Pty Ltd		**Drawn by**	SP	**Date**	07.10.2020
Site Address	114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW		**Approved by**	MK	**Date**	07.10.2020

APPENDIX G

Acid Sulphate Soil Assessment

Chameleon
Geosciences Pty Ltd

ACID SULFATE SOILS MANAGEMENT PLAN

114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW

Prepared for

Toronto Investments No.1 Pty Ltd

9th October 2020

Chameleon Geosciences Pty Ltd. ACN 086 993 937
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DOCUMENT HISTORY

Revision No.	Revision Date	Description
0	09/10/2020	Initial Issue

Issued By: Mark Kelly
Date: 9th October 2020

CONTENTS

APPENDICES

Preface

An Acid Sulphate Soils Management Plan (Ref EC8030/2 dated 9 October 2020) has been prepared and outlines the strategies employed for management of Acid Sulphate Soils.

The ASSMP indicates no current acidic conditions exist on site yet there is potential for soil material to generate acid within the soil matrix. Section 10 of the ASSMP details the measures undertaken to manage, treat and dispose of on-site soils and water in the construction process and this methodology has been used extensively and successfully on many occasions. It is understood that concerns arise for the potential for off-site impacts of ASS/PASS so measures will be put in place to alleviate any concerns that may arise from any works being undertaken.

ASS/PASS materials need oxygen to commence acidification. This in effect means that any soils under the water table will not be allowed to oxidise and any soils that are exposed (i.e. drill cuttings) will be treated in accordance with the ASSMP. The use of contiguous or secant piling will allow a barrier between on and off-site soil materials from being exposed unnecessarily. ASS/PASS materials cannot be allowed to be left to the atmosphere more than 24 hours as this commences the oxidation process. Any materials potentially exposed for this duration must be assessed and treated in accordance with the ASSMP.
To provide comfort that no exposure to excavated sidewalls occur, the construction process (refer to geotechnical information) will involve the following:

- Secant or contiguous piling to occur to provide a water proof barrier when excavation occurs
- ASS/PASS soils commence at 2m to approximately 10m. The proposed excavation will be down to 6m with peering occurring to a depth 2.5m into rock at about 12m wit lift shafts founded at around 7.5m
- Dewatering may commence once the piling is in place and subsequent shotcreting occurs to provide a water tight barrier between the excavation and supporting geology behind the waterproof walls
- Even during dewatering, the soils that are beneath the surface are still not exposed to air thus restricting the oxidation process.
- Monitoring wells will be constructed around the perimeter to enable effective monitoring of receiving waters up and downgradient for pH.
- Aligning linear infrastructure so that natural water flows are not blocked

Further to this, the National Acid Sulphate Soils Guide, Water Quality Australia, June 2018 will be referenced which specifically deals with Guidance for the dewatering of acid sulfate soils in shallow groundwater environments.

EXECUTIVE SUMMARY

Chameleon Geosciences Pty Ltd (Chameleon) was commissioned by Toronto Investments No.1 Pty Ltd to conduct an Acid Sulfate Soils Management Plan (ASSMP) within the property located at 114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW (the "site"). The site is located within the Lake Macquarie Council area.

The Acid Sulfate Soil Investigation for the site was undertaken to determine the Potential for Acid Sulfate Soils (PASS) and Actual Acid Sulfate Soils (AASS) and therefore determine any management requirements for the excavation and disposal of the soil.

The field tests indicated that the soils from which the samples were collected did not contain ASS or PASS. Following field tests, fourteen (14) soil samples were submitted to the NATA certified laboratory of MGT Eurofins for the SPOCAS tests. The soil was assessed against the guidelines set out in Acid Sulfate Soils Management Advisory Committee (ASSMAC) (1998) *Acid Sulfate Soils Assessment Guidelines*.

The laboratory analysis indicated that the TPA in all the samples analysed between 2m and 10m were above the action criteria indicating that the soil material has the potential to generate acid within the soil matrix. Based on the TPA & TSA results it is indicated that the clayey soil materials from a depth of 0.4m BGL had generated acid within the soil matrix.

Therefore, ***PASS is a concern to the proposed development***, the soils should be treated in accordance with the Management Plan in Section 10.0.

1.0 INTRODUCTION

Chameleon Geosciences Pty Ltd (Chameleon)was commissioned by Toronto Investments No.1 Pty Ltd to conduct an Acid Sulfate Soils Management Plan (ASSMP) within the property located at 114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW (the “site”). The site is located within the Lake Macquarie Council area.

The need to assess for the presence or absence of Acid Sulfate Soils (ASS) has been warranted since the site has been identified through fieldwork as having Potential Acid Sulfate Soil (PASS). In such cases, it is essential to assess for the presence of PASS to ensure the appropriate disposal and management of the soil as the disturbance of PASS can result in the formation of acid products, which can damage ecological systems and certain infrastructure.

It is to be noted that those who excavate soils from the subject site should take care to note changes in the soil profile. The presence of grey to greenish blue clays is a common indicator of ASS. It is recommended excavation be halted and that a suitably qualified environmental scientist be contacted should these clays be discovered.

1.1 What Are Acid Sulfate Soils?

Acid Sulfate soil is the common name given to a range of soil types containing iron sulfides and/or their oxidation products.

As the sea level rose and inundated land, sulfate in the sea water mixed with land sediments containing iron oxides and organic matter. The resulting chemical reaction produced large quantities of iron sulfides in the waterlogged sediments. When exposed to air, these sulfides oxides to produce sulfuric acid, hence the name acid sulfate soils.

Acid sulfate soils are generally found in:

- Coastal lowlands, embayments and estuarine floodplains;
- Areas where the level of land is below 5m Australian Height Datum (AHD);
- Holocene Sediments (~10,000 years old or younger).

The sulfuric acid produced by oxidation of iron sulfides affects soil and water and can severely damage the environment. As sulfuric acid moves through the soil, it mobilises iron, aluminium, manganese and other heavy metals from mineral sources. Acidic and metal-rich waters can be highly detrimental to flora and fauna.

Aquatic life, such as fish and crustaceans are extremely sensitive to acid drainage. In some situations brought about by a combination of weather and hydrology, fish and crustaceans are not able to avoid the effluent and large kills over entire estuaries may result.

Acid waters can also corrode engineering works and infrastructure such as culverts, bridges and weirs, which are in contact with these waters. The precipitation of iron hydroxide/oxide flocs from acidic, iron-rich waters can cause the blocking of drains, wells and the reduction of aquifer recharge.

2.0 OBJECTIVES OF THE ACID SULFATE MANAGEMENT PLAN (ASSMP)

The objective of this ASSMP is to consider both the existing and potential future environmental impacts relating to PASS material in and around the project site and to detail mitigation measures to minimise the potential impacts within the surrounding areas.

The control measures in this ASSMP to mitigate the environmental impacts of the proposed excavations to acceptable levels have been developed to achieve the following objectives:

- Control and, where possible, minimisation of disturbance of acid sulfate soils;
- Confirmation of the success of impact control measures by the means of validation monitoring;
- Compliance with statutory requirements, and
- Preservation of water quality on an ongoing basis.

Each environmental protection measure is based upon a proven and Industry Best Practice methodology.

The ASSMP is designed for the excavation phase of the development. It is based on tabulated checklists for management measures, maintenance, reporting, failure identification and corrective action for each identified issue.

The control measures proposed in this ASSMP are for:

- Assessment Procedures for PASS utilising a sampling protocol, set criteria to measure and agreed standards for those criteria to evaluate acid potential;
- Treatment of water accumulating within the site to an acceptable water quality for discharge (if required);
- Ongoing Monitoring Programme, if required; and
- Treatment of potential acid sulfate soils if encountered and control structures to prevent leachate discharge off-site without meeting specified target water quality criteria.

3.0 SCOPE OF WORKS

The scope of works for the assessment involved:

- Site Inspection to identify likelihood of soil types (Desktop Study);
- Targeted Soil Sampling;
- Field testing;
- Interpretation of SPOCAS Test Analysis and Findings; and
- Report generation in accordance with corresponding Assessment Guidelines and governing criteria.

4.0 DESKTOP STUDY

To determine whether there is a potential for acid sulphate soils to be present within a site, reference was made to the NSW Department of Land & Water Conservation (DLWC) Acid Sulfate Soil Risk Map (Edition Two, December 1997, Scale 1:25,000), specifically Map No. 74 – "Swansea". The map shows that there is "No Known Occurrence" in the site.

The NSW Government Planning & Environment website states that the site is in a Class 5 area on the Acid Sulfate Soil Map. Class 5 are located within 500 metres on adjacent class 1, 2, 3 or 4 lands. (https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address).

The decision to classify certain areas as Acid Sulfate Soils (ASS) is based on a number of geomorphic conditions and site criteria. The following points are used to determine if ASS are likely to exist (extracted from ASSMAC (1998) Acid Sulfate Soils Assessment Guidelines):

- Sediments of recent geological age (Holocene) ~ 10 000 y.o.
- Soil horizons less than 5m AHD (Australian Height Datum).
- Marine or estuarine sediments and tidal lakes.
- In coastal wetlands or back swamp areas; waterlogged or scalded areas; interdune swales or coastal sand dunes.
- In areas where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation.
- In areas identified in geological descriptions or in maps bearing sulfide minerals, coal deposits or former marine shales/sediments.
- Deeper older estuarine sediments >10m below the ground surface, Holocene or Pleistocene age.

5.0 SITE INFORMATION

5.1 Site Walk Over

The initial investigation of the subject site was focused on understanding the context of the site in its surrounding environment while identifying visual and olfactory ASS cues.

5.2 Site Identification

The site is currently registered as Lots 4-10 in Section 6 in DP2505, Lot 100 in DP847314 & Lot 101 in DP1110774, and is located at 114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW. The site is in the Lake Macquarie area and occupies an area of approximately 6,023m^2.

5.2 Site Description

The site visit was carried out on the 7th September 2020 by a Chameleon field scientist to undertake the field works for this investigation. At the time of the site inspection, the following observations were made:

- The site was irregular in shape and vacant grass covered land.
- Access to site was along Cary Street along the western boundary, Bath Street along the southern boundary and Arnott Avenue along the eastern boundary.
- The site had a slight slope from the north west towards the south east.
- A concrete covered driveway was observed in the southern portion of the site.
- No surface standing water was noticed at the site.

Reference may be made to Figure 2 in Appendix A for the site features.

5.3 Surrounding Properties

The uses of land adjacent to the site are listed below.

North ⇒ McDonald's Toronto, then Bay Street

South ⇒ Vacant land, then Victory Parade

East ⇒ Arnott Avenue, then Royal Motor Yacht Club & low density residential

West ⇒ Cary Street, then Vacant land

5.4 Proposed Development

Chameleon was informed that the site is proposed for the development of six-storey mixed use building with two-level basement car park with a maximum excavation depth of 6m below the existing ground level with further 1.50m excavated for lift shafts.

5.5 Groundwater

The nearest down-gradient watercourses are:

- Toronto Bay approximately 110m to the east.
- Stony Creek approximately 370m to the west.

During the Chameleon *Geotechnical Investigation*, the standing water level beneath the site was measured at a depth between 1.6m and 4.7m BGL. Based on the reduced SWL, groundwater flow would have a prevalent flow direction to the south/southeast direction (Refer: GW Reference Level Plan in Appendix A).

6.0 SOIL BORING AND SAMPLING

A soil sampling and analysis program was used to consolidate the nature and degree of Acid Sulfate Soils present in the surface and subsurface geology. Samples were collected from three (3) boreholes using a drill rig within the area of the proposed development. The boreholes were excavated to a maximum depth of 10m below ground level (the borehole locations are presented in Appendix A – Figure 3). Samples were collected at either 1m intervals within the soil profile or at depths of different soil profile.

Field analysis was performed on the collected samples for pH_f and pH_{fox} in accordance with the required sampling techniques of the *ASSMAC (1998) Assessment Guidelines* (see Appendix D – ASSMAC (1998) Field pH and peroxide test protocol).

6.1 Health & Safety

Standard Health and Safety procedures were observed. Latex gloves were worn to prevent contamination of samples. Breathing apparatus and PPE suits were supplied but not worn.

6.2 Quality Assurance/Quality Control (QA/QC)

Standard QA/QC procedures were followed. The decontamination of sampling equipment was achieved by washing the trowel with phosphate-free detergent and tap water, followed by final rinsing with distilled water. This was conducted after the collection of samples. Standard sampling and analysing procedures are in accordance with and set out in *NSW ASSMAC Acid Sulfate Soils Assessment Guidelines* (1998).

7.0 FIELD RESULTS

7.1 Soil observations

Based on information from the borehole, the surface and sub-surface profile across the site is generalised as follows:

- TOPSOIL - Sandy Silty Clay, medium to high plasticity, medium grained, dark brown/red
- NATURAL – Silty CLAY, medium to high plasticity, red/dark brown/grey

Reference should be made to Appendix C for a copy of the borehole logs.

7.2 Field pH results

The results of field pH tests are presented in Table 1 below.

Table 1: Summary of field analysis results

Location	Depth	pH_{H2O}	pH_f	pH_{H2O2}	pH_{fox}
BH3	1	7.83	7.01	4.80	5.3
	2	7.83	7.11	4.80	5.18
	3	7.83	7.15	4.80	5.1
	4	7.83	6.9	4.80	4.7
	5	7.83	6.4	4.80	4.5
	6	7.83	6.12	4.80	4.42
	7	7.83	5.82	4.80	4.31
	8	7.83	5.99	4.80	4.28
	9	7.83	6.01	4.80	4.13
	10	7.83	5.32	4.80	3.86
BH5	1	6.98	6.84	4.80	5.08
	2	6.98	7.11	4.80	5.1
	3	6.98	7.08	4.80	4.65
	4	6.98	6.99	4.80	4.42
	5	6.98	6.97	4.80	4.47
	6	6.98	6.5	4.80	4.46
	7	6.98	6.6	4.80	4.26
	8	6.98	6.63	4.80	4.21
	9	6.98	6.04	4.80	3.87
	10	6.98	6.01	4.80	3.84
BH7	1	6.98	6.30	4.80	4.91
	2	6.98	5.85	4.80	3.76
	3	6.98	5.83	4.80	3.7
	4	6.98	5.54	4.80	4.01
	5	6.98	5.50	4.80	3.9
	6	6.98	5.45	4.80	3.9
	7	6.98	5.42	4.80	3.91
	8	6.98	5.78	4.80	3.97
	9	6.98	5.70	4.80	3.94
	10	6.98	5.70	4.80	4.08

To investigate the pH of the soils (pH_{fox}) distilled water was added to the soil samples. The pH_f of the investigated samples was well above 4. This indicates the soils from which the samples were collected did not contain Actual Acid Sulfate Soil (ASS). Further testing was required in order to determine the extent of acid sulfate soils.

To investigate the presence of PASS, 30% peroxide (H_2O_2) was added to soil samples and the resulting pH of the mixture was measured (field test protocols are presented in Appendix D – ASSMAC (1998) Field pH and peroxide test protocol). The pH of the soil peroxide solution (pH_{fox}) did not decrease below 3 pH units. All samples had no other indicators of acid sulfate soils indicating the lack of unoxidised sulfates.

The natural CLAY soil samples were sent to the laboratory for further testing.

8.0 LABORATORY ANALYSIS RESULTS

The soils were assessed against the guidelines set out in Acid Sulfate Soils Management Advisory Committee (ASSMAC) (1998) *Acid Sulfate Soils Assessment Guidelines*.

The soils described below most closely resemble the *"Fine Texture"* soils described in Table 4.4, Assessment Guidelines of the NSW Acid Sulfate Soil Management Advisory Committee (ASSMAC) *"Acid Sulfate Soil Manual"* (August 1998).

The action criteria selected was based on if there will be more than 1,000 tonnes of soils disturbed within the site. The action criteria are:

- Sulfur Trail (S_{pos}) = 0.03%
- Acid Trail (TPA) = 18 mol H^+/tonne

Following the field tests, fourteen (14) samples were submitted to the NATA certified laboratory of MGT Eurofins for the recommended suspension peroxide oxidation combined acidity and sulfate (SPOCAS) testing suite. A summary of the results are shown below in Table 2 with the laboratory certificates in Appendix E.

Table 2: Laboratory SPOCAS analysis results

Sample	S-POS (%) (sulfur trail)	TAA (mol H^+/ tonne)	TPA (mol H^+/ tonne) (acid trail)	TSA (mol H^+/tonne) (acid trail)	Lime Calculation (kg $CaCO_3$/T)
BH3 3m	<0.02	8	**23**	15	1.0
BH3 4m	<0.02	52	**75**	**23**	5.0
BH3 6m	<0.02	44	**64**	**19**	4.0
BH3 10m	<0.02	44	**62**	**19**	4.0
BH5 3m	<0.02	42	**68**	**26**	5.0
BH5 5m	<0.02	36	**57**	**21**	3.0
BH5 7m	<0.02	37	**55**	18	3.0
BH5 9m	<0.02	37	**53**	16	4.0
BH5 10m	<0.02	44	**61**	17	5.0
BH7 2m	<0.02	34	**48**	15	3.0
BH7 3m	<0.02	43	**59**	<2	4.0
BH7 5m	<0.02	83	**110**	26	8.0
BH7 7m	<0.02	60	**82**	22	5.0
BH7 9m	<0.02	46	**65**	19	4.0
ASSMAC Guidelines	***0.1***		***18***	***18***	

When comparing the results summarised above in Table 2 to Table 4.4 (ASSMAC) for fine Texture soils it can be determined that the percentage of oxidisable Sulfur (SPOS or equivalent TPA/TSA) in all the samples analysed between 2m and 10m were above the action criteria (TPA) indicating that the soil material has the potential to generate acid within the soil matrix. Based on the TPA & TSA results it is indicated that the clayey soil materials from a depth of 0.4m BGL had generated acid within the soil matrix.

Therefore, ***PASS is a concern to the proposed development***, the soils should be treated in accordance with the Management Plan below.

9.0 SUMMARY

Field pH tests indicated that soil samples collected were not acidic and well above the ASSMAC (1998) guideline of pH≤4, which indicated the soils from which the samples were collected did not contain Actual Acid Sulfate Soil (ASS).

Acid trail (TAA, TPA and TSA) results indicate that potential acid sulfate soils are present in the underlying soils with results above the action criteria of 18 moles H^+/t even though the Sulfur trail (S-POS) (i.e. soil with unoxidised pyrite) were below the action criteria, the soil has "in situ acid buffering (neutralising) capacity" (e.g. the soil may contain alkaline components/inclusions such as shell fragments).

The laboratory analysis indicated that the TPA in all the samples analysed between 2m and 10m were above the action criteria indicating that the soil material has the potential to generate acid within the soil matrix. Based on the TPA & TSA results it is indicated that the clayey soil materials from a depth of 0.4m BGL had generated acid within the soil matrix.

Therefore, ***PASS is a concern to the proposed development***, the soils should be treated in accordance with the Management Plan in Section 10.0.

10.0 PROPOSED ACID SULFATE MANAGEMENT STRATEGY

As acidity is transported by water, excavations should be conducted during dry periods as far as possible as this will minimise the risk associated with sudden or heavy rain, allows better control of treated waters for discharge, and provides some safety margin for unattended weekend or holiday periods. The following provides the proposed acid sulfate management methodology.

10.1 Areas of PASS

Management and disposal of PASS soils is to be undertaken in accordance with section 10.6 within this report. However should soils be found not to be acceptable within this soil profile then the following management strategies will need to be undertaken.

Neutralisation of PASS is considered likely to comprise mixing of excavated material with lime, with quantities to be calculated on the basis of SPOCAS testing, and guidelines provided in ASSMAC Management Guidelines (1998), as described in Tables 4.5 & 4.6 of the ASMACC Guidelines.

Application of these procedures indicates that a dosing rate of lime per tonne of soil, based on a worst case scenario from the S-POCAS testing, is 8.0kg / tonne. Therefore, for every tonne of actual ASS to be treated, 8.0kg of lime is required. The lime used should have a neutralising value of at least 95% (aglime is recommended for this purpose).

10.2 Acid Sulfate Soil Treatment

On-site Treatment – In general, if on-site treatment neutralisation of the AASS/PASS material were to be adopted and that material is to remain stockpiled for over one week, material containing AASS/PASS should ideally be stockpiled separately on a liming pad/stockpiling site and mixed with lime at the above dosage rate. Appropriate monitoring and leachate control is to be adopted.

Once AASS/PASS material has been placed in the treatment areas, it should be dosed with aglime in accordance with the calculated dosing rate, that being 26kg / tonne. This will be followed by thorough mixing of the soil/aglime mixture with site machinery to treat the soil. Additional quantities of aglime above the calculated dosing rate may be required to allow for difficulties in mixing. The effectiveness of the adopted dosing rate should be confirmed by the regular screening of the treated material using pH and peroxide pH field tests.

It should be noted that as a precautionary measure, treatment works involving aglime should not be conducted during windy conditions, unless the material can be appropriately conditioned to prevent dust generation.

Off-site Treatment - No off-site treatment is envisaged.

10.3 Treatment Pad Design Features

For treatment of large volumes of material, neutralisation should be carried out on a treatment or liming pad. The following issues should be considered in the treatment pad design.

A guard layer of neutralising agent should be spread onto the soil surface of the treatment pad area prior to the placement of soils. Alternatively a layer of high density plastic sheeting may be used. These methods will reduce risk by neutralising acidic leachate generated in the treatment pile and not neutralised during the treatment process. This is especially relevant to the first layer of PASS that is placed for treatment prior to application of the neutralising agent. The guard layer will also assist in protecting groundwater quality.

To further reduce risk, a layer of compacted non-ASS clayey material (0.3–0.5 m thick) might be placed on the surface of the treatment pad and below the guard layer to restrict infiltration from the material being treated. In fully contained situations a physical barrier may be used as an alternative to a guard layer of neutralising agent as a means of protecting groundwater quality and preventing infiltration of acidic water; e.g. a bunded concrete slab, paved area or layer of bitumen may be placed under a temporary treatment pad.

Treatment areas should be located as far away from any watercourses as possible. Appropriate sediment controls should be used in order to prevent the escape of any potential acid sulfate soils from the treatment area.

10.4 Leachate Control

Any leachate generated during the treatment operations must be directed to collection ponds and properly treated. In addition, a truck wash down area comprising a hardstand of base coarse with drainage should be constructed adjacent to a leachate pond so that truck wash down water can be collected for treatment. It is recommended that leachate collection ponds be constructed to accommodate the leachate/water that would be generated by rainfall over a three day period. This is to account for rainfall/surface water runoff which may occur during a standard non-work period (i.e. weekend).

Should leachates be intended for reuse on-site, water quality should be regularly monitored and assessed against discharge criteria (ASSMAC).

PASS/AASS materials should be monitored for pH during dewatering. Materials should be lightly conditioned/moistened to prevent oxidation if lowered pH is observed and treated with a calcium hydroxide solution (e.g. quicklime) if required (i.e. pH <5.5). Disposal of leachate requires approval of the appropriate consent authorities (e.g. Council, Sydney Water). An appropriate water quality management plan should be implemented to maintain water quality to a standard appropriate for disposal into the stormwater system (with appropriate consent/approvals). Regular monitoring should be conducted to ensure water quality meets guideline criteria. If leachate does not meet the consent conditions for disposal into the stormwater system, then arrangements may need to be made for treatment or discharge into the sewerage system (including consent of the appropriate authorities).

10.5 Monitoring

Monitoring of Acid Sulfate potential and effectiveness of neutralisation may be undertaken as prescribed in Table 3 below.

Table 3: Suggested monitoring frequencies and target levels

Material	Test	Frequency	Target Level
Ponded leachate Water (both leachate and groundwater) ponded in the excavation	pH	Daily, following rain events and non work periods	- pH 6.5 - 8.5, but not less than 5.5
Discharged leachate (irrigation into subsoil)	pH*	Daily checks of pH during discharge period.	- pH 6.5 - 8.5
	TSS	- Daily visual checks, (with measurements taken if turbidity is observed) - weekly monitoring	- TSS <50 NTU
Soils to be disposed of	Field pH Peroxide pH	During and after treatment (prior to disposal).	- pH 6.0 - 12.0 - No change in colour - No effervescence - No release of sulfurous odour - No depression in pH below field H

DO and TSS also required if discharged to stormwater. The DO and TSS should be confirmed by weekly sampling and analysis during the discharge period

It is considered that, given the treatment method to be adopted, field pH and peroxide pH testing should be conducted on treated materials prior to disposal. If material fails the pH and peroxide pH testing, further dosing with aglime should be conducted prior to disposal of the material until it meets the pH testing criteria.

10.6 PASS Disposal

The NSW EPA *Waste Classification Guidelines:* Part 4: *Acid Sulfate Soils (2014)* provides two options for disposal of PASS soils to landfill, those being above or below the water table.

PASS must be kept wet at all times during excavation and subsequent handling, transport and storage until they can be disposed of safely. They must be received at the proposed disposal point within 16 hours of being dug up.

***10*.6.1 Disposal *below* the Water Table**

PASS must be disposed of in water below the permanent water table, provided:

- This occurs before they have had a chance to oxidise, i.e. within 24 hours of excavation.
- They meet the definition of ‘virgin excavated natural material’ (VENM) under the *Protection of the Environment Operations Act 1997*, even though they may contain sulfidic ores or soils.

Landfills must be licensed by EPA to dispose of potential ASS below the water table.

Documentation must be kept by the occupier of the landfill for each truckload of potential ASS received, indicating that the soil's excavation, transport and handling have been in accordance with the *Acid Sulfate Soil Manual*, thus preventing the generation of acid.

10.6.2 Disposal *above* the Water Table

Where PASS cannot be classified as VENM or a suitable underwater disposal site at a landfill is not available, the soil must be treated in accordance with the neutralising techniques in the *Acid Sulfate Soil Manual*. After treatment the soil should be chemically assessed in accordance with Step 5 in Part 1 of the W*aste Classification Guidelines*. Reference should be made to Section – 10.7.

10.7 Actual Acid Sulfate Soils (AASS) Disposal

AASS must be treated by the generator of the waste before they can be considered for disposal. Treatment should be in accordance with the neutralising techniques in the *Acid Sulfate Soil Manual*.

The following is a summary of the procedures to be followed for the excavation, treatment, classification and disposal of AASS materials.

- All AASS material will be excavated and re-located to the relevant treatment pad area, and then treated with the correct lime dosage.
- The correct lime dosage rate, based on a worst case scenario from the S-POCAS testing, is 8.0kg / tonne. Therefore, for every tonne of actual ASS to be treated, 8.0kg of lime is required.
- Field pH tests will then be carried out to determine if the treatment process has been successful.
- If treatment was unsuccessful, then further treatment would be required.

- If treatment was successful, the generator of the waste must chemically assess the soil in accordance with Step 5 in Part 1 of the W*aste Classification Guidelines*.
- The soils will be then be classified and disposed of to the relevant landfill licensed to accept such materials.

Landfills must be licensed by EPA to accept this waste and must be informed that the AASS has been treated in accordance with the neutralising techniques in the *Acid Sulfate Soil Manual* and that the waste has also been classified in accordance with Part 1 of the W*aste Classification Guidelines*.

10.8 Validation of Acid Sulfate Soil Management Procedures

In order to understand if the management plan has been successfully implemented the following validation measures should be undertaken:

- All testing is to be undertaken in compliance with the relevant guidelines.
- Due to the scale of the development and the potential for Acid Sulfate Soils it is recommended that on site supervision of excavation be undertaken.
- Field testing and/or SPOCAS Testing will be undertaken in order to provide confidence that all acid sulfate material will be treated and removed successfully. In the event of a failure further treatment will be undertaken and then further field testing will be undertaken.
- Should any of the monitoring not conform with criteria outlined in section 10.5 then corrective action will be undertaken and further testing will be undertaken.
- All non-conformances will be documented and provided to the contractor to rectify prior to further excavation being undertaken.

11.0 RESPONSIBILITIES OF THE SUB-CONTRACTOR

The sub-contractor should be responsible for the correct implementation of the ASS management protocols presented in this ASSMP. The sub-contractor is not empowered to vary any specific management protocols or procedures, unless explicit written approval has been given by the project manager. Where ambiguity or conflict exists as to the procedure to be followed, it is the subcontractor's responsibility to seek clarification from the project manager, in writing if necessary.

If AASS are identified, the main contractor should appoint a representative to undertake appropriate monitoring, who should be appropriately trained by an environmental consultant. As a minimum, daily monitoring requirements may be undertaken by the main contractor, or his nominated representative, with weekly verification checks by the environmental consultant. Daily logs of such monitoring should be kept by the sub-contractor, and signed copies should be forwarded to the project manager weekly, or as requested.

It is the sub-contractor's responsibility to inform the project manager immediately on discovery of non-compliances of the ASSMP or exceedances of monitoring trigger levels, and with the latter's approval, implement immediate remedial measures. A report of such incidents should be prepared for retention by the Project Manager.

It is anticipated that the independent environmental consultant will inspect and monitor the site(s) on both a regular and random basis, and carry out such sampling and/or in-situ measurements as are necessary to check compliance with the ASSMP. The sub-contractor must offer appropriate assistance/co-operation to the consultant.

The requirements of ASS management are in addition to, but do not override any other standard procedures such as safety considerations. Where conflict results, or may result from the implementation of ASSMP as against other performance criteria, it is the sub-contractor's responsibility to obtain specific directives from the project manager.

12.0 CONCLUSIONS

This Acid Sulfate Soils Management Plan (ASSMP) was prepared to outline the future scope of works for the site and will cover all possible eventualities in regards to PASS and/or ASS.

The laboratory analysis indicated that the 8 TPA8 in all the samples analysed between 2m and 10m were above the action criteria indicating that the soil material has the potential to generate acid within the soil matrix. Based on the TPA & TSA results it is indicated that the clayey soil materials from a depth of 0.4m BGL had generated acid within the soil matrix.

Therefore, ***PASS is a concern to the proposed development***, the soils should be treated in accordance with the Management Plan in Section 10.0.

Please do not hesitate to contact us on the contact details provided if you have any questions.

For and on behalf of
Chameleon Geosciences Pty Ltd

Gokul Balakrishnan
Environmental Engineer

Reviewed By

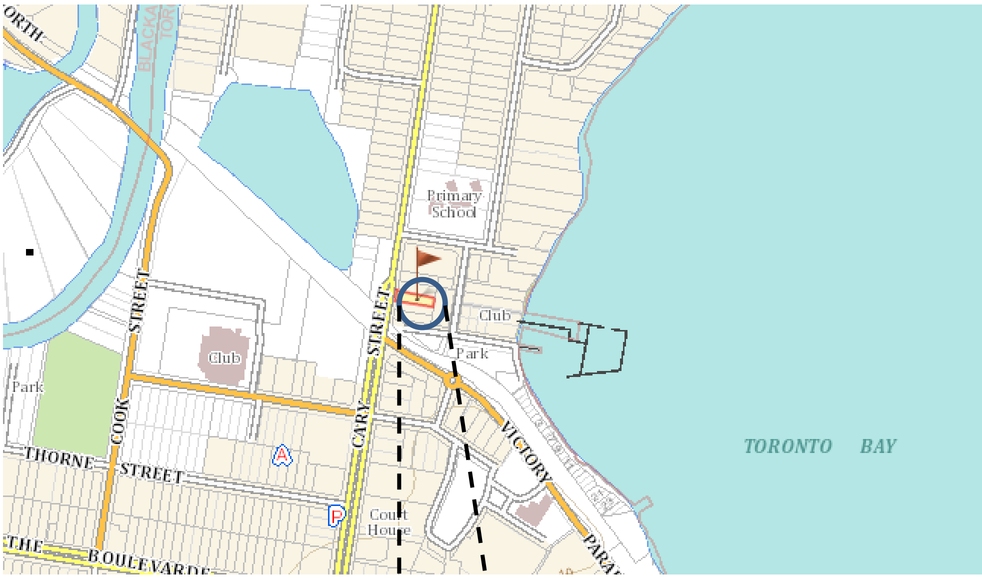
Mark Kelly
Environmental Manager

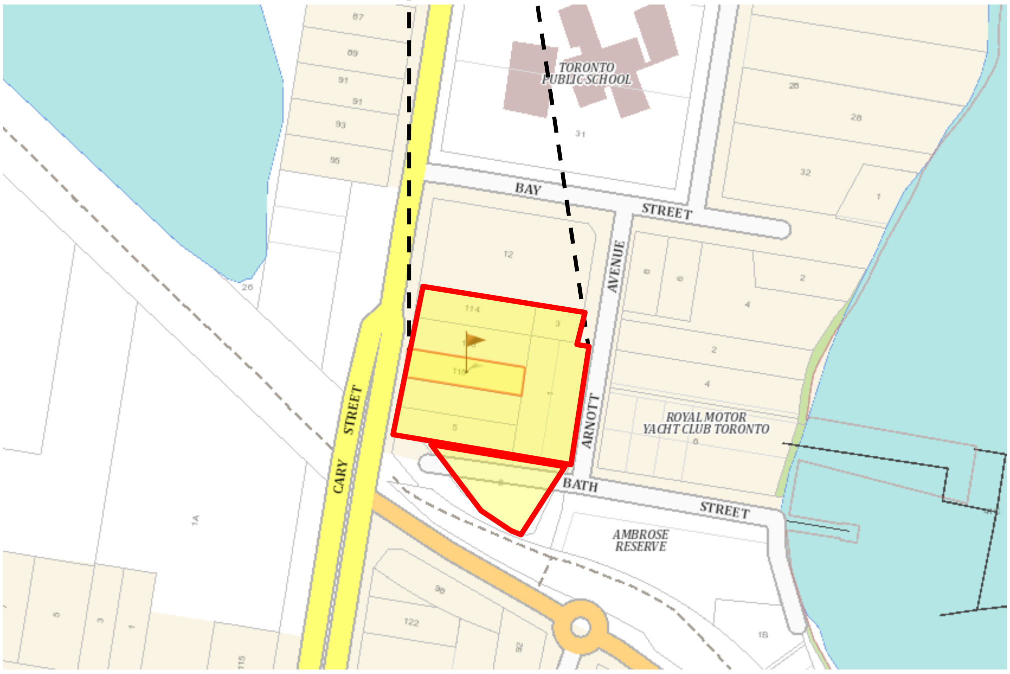
Although the information provided by a Preliminary Assessment can reduce exposure to risks, no assessment, however diligently carried out, can eliminate them. It must be noted that these findings are professional findings and have limitations. Even a rigorous professional assessment may fail to detect all ASS and/or PASS on a site. Sulfates may be present in areas that were not surveyed or sampled.

Appendix a

SITE PLANS

SITE LOCALITY MAP





Source: https://maps.six.nsw.gov.au/

PROJECT DETAILS		DRAWING DETAILS			
Project Title	Acid Sulfate Soils Management Plan	Figure No.	1	Rev No.	0
Project No.	EC8030-2	Scale	NTS	Size	A4
Client	Toronto Investments No.1 Pty Ltd	Drawn by	GB	Date	06.10.2020
Site Address	114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW	Approved by	MK	Date	06.10.2020

SITE FEATURES & SURROUNDING LAND

N

No.	Site Features
1	Grass covered vacant land
2	Concrete driveway

Source: http://maps.six.nsw.gov.au/

PROJECT DETAILS			DRAWING DETAILS			
Project Title	Acid Sulfate Soils Management Plan	Chameleon	Figure No.	2	Rev No.	0
Project No.	EC8030-2		Scale	NTS	Size	A4
Client	Toronto Investments No.1 Pty Ltd		Drawn by	GB	Date	06.10.2020
Site Address	114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW		Approved by	MK	Date	06.10.2020

SITE SAMPLING LOCATION

Source: http://maps.six.nsw.gov.au/

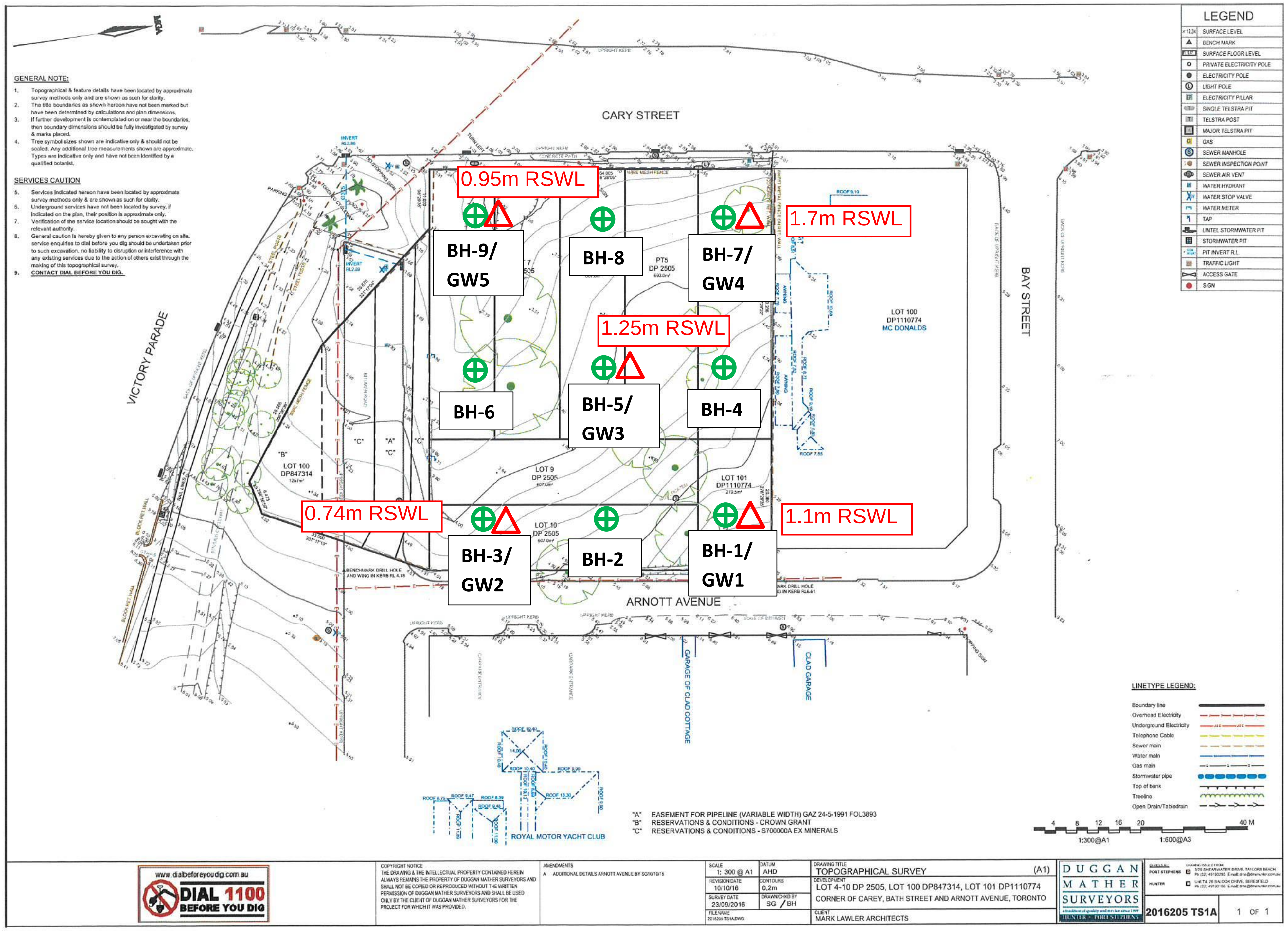
PROJECT DETAILS			DRAWING DETAILS			
Project Title	Acid Sulfate Soils Management Plan		Figure No.	3	Rev No.	0
Project No.	EC8030/2	Chameleon	Scale	NTS	Size	A4
Client	Toronto Investments No.1 Pty Ltd		Drawn by	GB	Date	06.10.2020
Site Address	114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW		Approved by	MK	Date	06.10.2020

The groundwater levels monitored in the wells after the installations are summarised below in Table 1.

Table 1 Standing Groundwater Levels

Borehole Number	Well Depths (m bgl)	Water Level (m bgl) as measured on 10th September 2020	Water Level (m bgl) as measured on 1st October 2020
BH1/GW1	13.0	4.4	4.7
BH3/GW2	13.5	3.4	3.4
BH5/GW3	9.5	2.6	2.7
BH7/GW4	13.0	2.1	2.5
BH9/ GW5	13.0	1.6	1.9

Groundwater RSWL at 10/09/2020



LEGEND

- Borehole locations (BH)
- Groundwater monitoring well locations (GW)

Image Source

Aargus ENVIRONMENTAL - ENGINEERING - DRILLING - LABORATORIES - ASBESTOS

Drawn	SP	**TORONTO INVESTMENTS NO.1 PTY LTD**	Figure 1
Checked	SG	**Geotechnical Investigation for**	Title **Site Plan**
Date	15 September 2020	**New Apartment Building**	
Scale @ A3	NTS	**118 Cary Street, Toronto, NSW, 2283**	Job No **GS8030-1A**

Chameleon

Groundwater RSWL at 1/10/2020

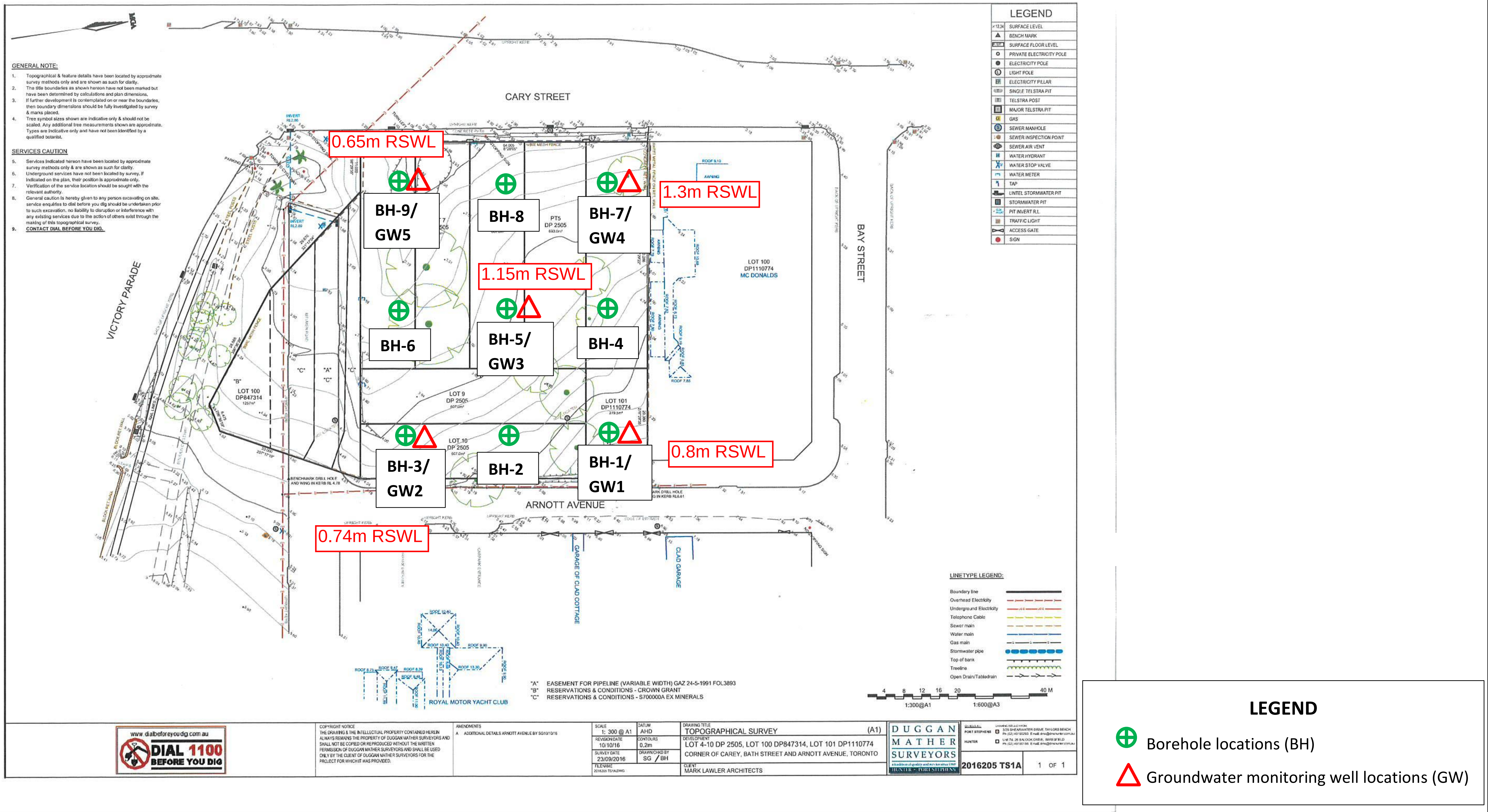


Image Source

Aargus ENVIRONMENTAL - ENGINEERING - DRILLING - LABORATORIES - ASBESTOS

Drawn	SP	**TORONTO INVESTMENTS NO.1 PTY LTD**	Chameleon	Figure 1
Checked	SG	**Geotechnical Investigation for**		Title **Site Plan**
Date	15 September 2020	**New Apartment Building**		
Scale @ A3	NTS	**118 Cary Street, Toronto, NSW, 2283**		Job No **GS8030-1A**

Appendix b

IMPORTANT INFORMATION ABOUT YOUR REPORT

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL SITE ASSESSMENT

These notes have been prepared by Chameleon Pty Ltd and its associated companies using guidelines prepared by ASFE (The Association) of Engineering Firms Practising in the Geo-sciences. They are offered to help you in the interpretation of your Environmental Site Assessment (ESA) reports.

REASONS FOR CONDUCTING AN ESA

ESA's are typically, though not exclusively, carried out in the following circumstances:

- as pre-acquisition assessments, on behalf of either purchaser or vender, when a property is to be sold;
- as pre-development assessments, when a property or area of land is to be redeveloped or have its use changed for example, from a factory to a residential subdivision;
- as pre-development assessments of greenfield sites, to establish "baseline" conditions and assess environmental, geological and hydrological constraints to the development of, for example, a landfill; and
- as audits of the environmental effects of an ongoing operation.

Each of these circumstances requires a specific approach to the assessment of soil and groundwater contamination. In all cases however, the objective is to identify and if possible quantify the risks that unrecognised **c**ontamination poses to the proposed activity. Such risks may be both financial, for example, cleanup costs or limitations on site use, and physical, for example, health risks to site users or the public.

THE LIMITATIONS OF AN ESA

Although the information provided by an ESA could reduce exposure to such risks, no ESA, however, diligently carried out can eliminate them. Even a rigorous professional assessment may fail to detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled.

AN ESA REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

Your environmental report should not be used:

- when the nature of the proposed development is changed, for example, if a residential development is proposed instead of a commercial one;
- when the size or configuration of the proposed development 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.

To help avoid costly problems, refer to your consultant to determine how any factors, which have changed subsequent to the date of the report, may affect its recommendations.

ESA "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site assessment 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 interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, 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 help minimise its impact. For this reason owners should retain the services of their consultants through the development stage, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Natural processes and the activity of man change subsurface conditions. As an ESA report is based on conditions, which existed at the time of subsurface exploration, decisions should not be based on an ESA report whose adequacy may have been affected by time. Speak with the consultant to learn if additional tests are advisable.

ESA SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Every study and ESA report is prepared in response to a specific brief 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. Other persons should not use a report for any purpose, or by the client for a different purpose. No individual other than the client should apply a report even apparently for its intended purpose without first conferring with the consultant. No person should apply a report for any purpose other than that originally contemplated without first conferring with the consultant.

AN ESA REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when design professionals develop their plans based on misinterpretations of an ESA. To help avoid these problems, the environmental consultant should be retained to work with appropriate design professionals to explain relevant findings and to review the adequacy of their plans and specifications relative to contamination issues.

LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final borehole or test pit logs are developed by environmental scientists, engineers or geologists based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final logs customarily included in our reports. These logs should not under any circumstances be redrawn for inclusion in site remediation 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 minimise 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 reduce the likelihood of boring log misinterpretation, the complete report must be available to persons or organisations involved in the project, such as contractors, for their use. Those who o not provide such access may proceed under the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing all the available information to persons and organisations such as contractors helps prevent costly construction problems and the adversarial attitudes that may aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because an ESA is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in transmittals. These are not exculpatory clauses designed to foist liabilities onto some other party. Rather, they are definitive clauses that identify where your consultant's responsibilities begin and end. Their use helps all parties involved recognise their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your ESA report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

Appendix c

BOREHOLE LOGS

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH3

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20 **R.L. SURFACE** 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			4	0–1.0			Silty Sandy CLAY, medium plasticity, dark brown.		Moist	Soft	FILL
			3, 2	1.0–2.5		CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown.	SPT 8, 12, 18 N=30	Moist	Stiff	NATURAL SOIL
	09/09/2020		1, 0, -1, -2, -3	2.5–8		CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown, mottled, color changing to white/ grey.	SPT 12, 16, 18 N=34 SPT 10, 12, 15 N=27 SPT 13, 22, 32 N=54	Moist	Stiff	

Cha**me**leon
Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH3

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20 **R.L. SURFACE** 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-4			CH	Silty CLAY, with fine to medium gravel, medium to high plasticity, red/ brown, mottled, color changing to white/ grey. *(continued)*	SPT 9, 14, 19 N=33	Moist	Stiff	
			-5, -6, -7, -8, -9	9, 10, 11, 12, 13		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, color changing to white/ grey, increasing amount of fine to medium gravel wih depth.	SPT 12, 18, 20 N=38; SPT 5, 12, Refusal	Moist	Soft	
			-10, -11	14, 15, 16			Borehole BH3 continued as cored hole				

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
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BOREHOLE NUMBER BH3

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20
R.L. SURFACE 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	Is(50) MPa (D- diametral, A- axial)	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
			-4									
				9								
			-5									
				10								
			-6									
				11								
			-7									
				12								
			-8									
				13								
			-9			Continued from non-cored borehole						
NMLC Coring				14		TC bit refusal at 13.7m. CONGLOMERATE, medium sized clasts, dark grey to pale grey, with traces of sand.	EW/HW					13.83-13.89m. FZ.
			-10			CONGLOMERATE, rounded to sub angular gravel sized clasts, pale grey to dark grey, traces of fine to medium grained sand in between the clasts.	MW/SW					14.15m. BP, 0-10°, RO, IR, UN.
												14.33-14.40m. FZ.
												14.50m. JT, 0-40°, RO, IR, UN.
									D 0.06 A 0.29			14.61-14.66m. FZ.
										89		14.76-14.80m. FZ.
				15								
			-11									
									D 0.56 A 0.68			15.31m. JT, 0-30°, RO, UN, IR.
									D 0.2 A 0.34			
				16								15.88-16.26m. FZ.

BOREHOLE NUMBER BH3

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

CLIENT Toronto Investments No.1 Pty Ltd **PROJECT NAME** Geotechnical Investigation
PROJECT NUMBER GS8030-1A **PROJECT LOCATION** 118 Cary Street, Toronto, NSW

DATE STARTED 9/9/20 **COMPLETED** 9/9/20 **R.L. SURFACE** 4.14 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
NMLC Coring			-12			CONGLOMERATE, rounded to sub angular gravel sized clasts, pale grey to dark grey, traces of fine to medium grained sand in between the clasts. *(continued)*	MW/SW		D 0.04 A 0.25	89		15.88-16.26m. FZ. 16.37-16.48m. FZ. 16.52m. BP, 2mm, RO, IR, UN. 16.63-16.70m. FZ.
			-13	17		BH3 terminated at 16.7m						
			-14	18								
			-15	19								
			-16	20								
			-17	21								
			-18	22								
			-19	23								
				24								

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH5

CLIENT Toronto Investments No.1 Pty Ltd | **PROJECT NAME** Geotechnical Investigation
PROJECT NUMBER GS8030-1A | **PROJECT LOCATION** 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 **R.L. SURFACE** 3.85 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT							Silty Sandy CLAY, medium to high plasticity, dark brown.		Wet	Soft	FILL
			3	1		CH	Silty CLAY, medium to high plasticity, pale brown, with gravel.		Moist	Soft	NATURAL SOIL
			2	2		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel.	SPT 8, 10, 10 N=20	Moist	Stiff	
			1	3				SPT 10, 14, 20 N=34			
			0	4							
			-1	5				SPT 7, 12, 14 N=26			
			-2	6				SPT 11, 17, 27 N=44			
			-3	7							
	10/09/2020		-4	8				SPT 12, 12, 15 N=27			

Chameleon Geosciences Pty Ltd
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Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH5

CLIENT Toronto Investments No.1 Pty Ltd **PROJECT NAME** Geotechnical Investigation
PROJECT NUMBER GS8030-1A **PROJECT LOCATION** 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 **R.L. SURFACE** 3.85 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-5	9		CH	Silty CLAY, medium to high plasticity, red/ brown, mottled, with fine to medium gravel, with Clay, high plasticity, grey/ white, with fine gravel. *(continued)*	SPT 7, 11, 15 N=26	Moist	Stiff	
			-6	10							
			-7	11				SPT 6, 15, 18 N=33			
			-8	12							
			-9	13				SPT 12, 18, 22 N=40			
							TC bit refusal at 12.95m. Borehole BH5 terminated at 12.95m				
			-10	14							
			-11	15							
			-12	16							

BOREHOLE NUMBER BH7

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

CLIENT Toronto Investments No.1 Pty Ltd | **PROJECT NAME** Geotechnical Investigation
PROJECT NUMBER GS8030-1A | **PROJECT LOCATION** 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 | **R.L. SURFACE** 3.80 | **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd | **SLOPE** 90° | **BEARING** N.A.
EQUIPMENT Truck mounted drill rig | **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm | **LOGGED BY** SP | **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT							Sandy Silty CLAY, medium to high plasticity, dark brown.		Moist	Soft	FILL
			3	1		CH	Sandy CLAY, medium to high plasticity, pale brown, with fine gravel.	SPT 8, 8, 9 N=17	Moist	Soft	NATURAL SOIL
			2	2							
			1	3		CH	CLAY, high plasticity, grey, mottled, with fine gravel, with Silty Clay, red/ brown, fine to medium gravel.	SPT 14, 19, 25 N=44	Moist	Stiff	
			0	4							
	10/09/2020		-1	5				SPT 14, 14, 18 N=32			
			-2	6							
			-3	7				SPT 12, 15, 16 N=31			
			-4	8							

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH7

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20 **R.L. SURFACE** 3.80 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd **SLOPE** 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig **HOLE LOCATION** Refer to Figure 1 - Site Plan
HOLE SIZE 100mm **LOGGED BY** SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture	Cons./Dens.	Additional Observations
ADT			-5, -6, -7, -8, -9, -10	9, 10, 11, 12, 13, 14		CH	CLAY, high plasticity, grey, mottled, with increasing amountof fine gravel, with Silty Clay, red/ brown, fine to medium gravel.	SPT 10, 15, 16 N=31; SPT 11, 18, 20 N=38; SPT 10, 16, 22 N=38; SPT 15, 18, 22 N=40	Wet to Saturated	Stiff to Soft	
			-11, -12	15, 16			Borehole BH7 continued as cored hole				

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH7

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.80 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
			-5	9								
			-6	10								
			-7	11								
			-8	12								
			-9	13								
			-10	14		Continued from non-cored borehole						
NMLC Coring			-11	15		TC bit refusal at 14.5m. CORE LOSS. 2500mm.						
			-12	16								

Chameleon Geosciences Pty Ltd
6 Carter Street, Lidcombe, NSW, 2141
Tel: 1300 137 038
Fax: 1300 136 638

BOREHOLE NUMBER BH7

CLIENT Toronto Investments No.1 Pty Ltd
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER GS8030-1A
PROJECT LOCATION 118 Cary Street, Toronto, NSW

DATE STARTED 10/9/20 **COMPLETED** 10/9/20
R.L. SURFACE 3.80 **DATUM** m AHD
DRILLING CONTRACTOR Fico Pty Ltd
SLOPE 90° **BEARING** N.A.
EQUIPMENT Truck mounted drill rig
HOLE LOCATION Refer to Figure 1 - Site Plan
HOLE SIZE 100mm
LOGGED BY SP **CHECKED BY** SG
NOTES Surface levels and depths of subsurface conditions are approximate.

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa (D- diametral, A- axial)	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
NMLC Coring			-13	17		CORE LOSS. 2500mm. *(continued)*						
			-14	18		BH7 terminated at 17m						
			-15	19								
			-16	20								
			-17	21								
			-18	22								
			-19	23								
			-20	24								

Appendix d

REGULATORY CRITERIA

APPENDIX 1. Field pH and the Peroxide Test

1. Field pH Test

The field pH (pH_F) of actual acid sulfate soils tends to be ≤ 4 while the field pH of potential acid sulfate soils tends to be neutral. Field pH provides a useful quick indication of the likely presence and severity of “actual” acid sulfate soils. The field pH is a qualitative method only that cannot be used as a substitute for laboratory analysis in the identification of acid sulfate soils for assessment purposes.

Field pH readings should be taken at regular intervals down the soil profile. It is recommended this test be done every 0.25 m down the profile but at least every 0.5 m interval or horizon whichever is the lesser.

- pH readings of pH ≤4, indicates that actual acid sulfate soil are present with the sulfides having been oxidised in the past, resulting in acid soil (and soil pore water) conditions.
- pH values >4 and <5.5 are acid and may be the result of some previous or limited oxidation of sulfides, but is not confirmatory of actual ASS. Substantial exchangeable/soluble aluminium and hydrogen ions usually exist at these pH values. Other factors such as excessive fertiliser use, organic acids or strong leaching can cause pH >4 - <5.5. Field pH alone cannot indicate potential ASS as they may be neutral to slightly alkaline when unoxidised.

In order to test for potential acid sulfate soils that contain unoxidised sulfides, peroxide is used to rapidly oxidise the iron sulfides (usually pyrite), resulting in the production of acid with a corresponding drop in pH.

Notes on pH equipment

Preferably a battery powered, field pH meter with a robust, spear point, double reference pH electrode should be used. The probe can be inserted directly into soft wet soils or soil mixed up into a paste with deionised water. Care must be exercised not to scratch the electrode on sandy or gravely soils. The probe should be standardised prior to use and regularly during use against standard solutions according to the manufacturers instructions.

Alternatively, an approximate 1:5 soil:deionised water suspension can be made up in small tubes, hand shaken and pH of the solution measured. pH test strips can be used to give an approximate value (pH +/- 0.25). Raupach soil pH test kits should be used with caution as they can give erroneous results. Both these latter methods are based on mixed indicator solutions that give a pH dependant colour and are subject to interferences .

2. Field Peroxide pH Test

To test for the presence of unoxidised sulfides and therefore potential acid sulfate soils, the oxidation of the soil with 30% (100 volume) hydrogen peroxide can be performed in the field. The most common method is:

- a small sample of soil is placed in a small glass container (eg short clear centrifuge tubes or clear tissue culture clusters) and a small volume of peroxide is dropped onto the soil.

Note: Allow the digested solution to cool after the reaction.
A pH probe will only measure to 60°C.

The reaction should be observed and rated. In some cases, the reaction may be instantaneous; in others, it may take 10 minutes or more. Heating over hot water or in the sun may be necessary to start the reaction on cool days, particularly if the peroxide is cold.

Potentially positive reactions includes one or more of the following:

- change in colour of the soil from grey tones to brown tones
- effervescence
- the release of sulfurous odours
- a substantial depression in pH below pH_F
- pH < 3

The strength of the reaction is a useful indicator. The peroxide test is most useful and reliable with clays and loams containing low levels of organic matter. It is least useful on coffee rock, sands or gravels, particularly dredged sands with low levels of sulfidic material (eg <0.05 % S). With soils containing high organic matter (such as surface soils, peats, mangrove/estuarine muds and marine clays), care must be exercised when interpreting the reaction as high levels of organic matter and other soil constituents particularly manganese oxides can also cause a reaction.

Note of caution with the use of peroxide

30 % hydrogen peroxide is a strong oxidising agent and should be handled carefully with appropriate eye and skin protection. This test should be only undertaken by trained operators.

The pH of analytical grade peroxide may be as low as 3 as manufacturers stabilise technical grade peroxide with acid, The peroxide pH should be checked on every new container and regularly before taking to the field and adjusted to 4.5 - 5.5 with a few drops of 0.1M NaOH if necessary. False field pH_{FOX} readings could result if this step is not undertaken.

3. pH after oxidation

The measurement of the change in the pH $_{FOX}$ following oxidation can give a useful indication of the presence of sulfidic material and can give an early indication of the distribution of sulfide down a core/ profile or across the site. The pH after oxidation test is not a substitute for analytical test results.

If the pH $_{FOX}$ value is at least one unit below field pH $_F$, it may indicate potential acid sulfate soils. The greater the difference between the two measurements, the more indicative the value is of a potential acid sulfate soils. The lower the final pH $_{FOX}$ value is, the better the indication of a positive result.

- If the pH $_{FOX}$ < 3 and there was a strong reaction to the peroxide, there is a high level of certainty of a potential acid sulfate soils. The more the pH $_{FOX}$ drops below 3, the more positive the presence of sulfides.
- A pH $_{FOX}$ 3-4 is less positive and laboratory analyses are needed to confirm if sulfides are present. Sands particularly may give confusing field test results and must be confirmed by laboratory analysis.
- For pH $_{FOX}$ 4-5 the test is neither positive nor negative. Sulfides may be present either in small quantities and be poorly reactive under quick test field conditions. In some cases, the sample may contain shell/carbonate that neutralises some or all acid produced by oxidation. In other cases, the pH $_{FOX}$ value may be due to the production of organic acids and there may be no sulfides present. In these cases, analysis for sulfur using the POCAS method would be the best to check for the presence of oxidisable sulfides.
- For pH $_{FOX}$ >5 and little or no drop in pH from the field value, little net acid generating ability is indicated. Again, the sulfur trail of the POCAS method should be used to check some samples to confirm the absence of oxidisable sulfides.

Care is needed with interpretation of the result on highly reactive soils. Some soil minerals other than pyrite react vigorously with peroxide, particularly manganese but may only show small pH changes. When selecting soil for testing it is advisable to avoid material high in organic matter as the oxidation of organic matter can lead to the generation of acid. However, pH of soils containing organic matter and no pyrite do not generally stay below 4 on extended oxidation. In general, positive tests on 'apparently well drained' surface soils should always be treated with caution and followed up with laboratory confirmation.

The field peroxide tests can be made more consistent if a fixed volume of soil (using a small scoop) is used, a consistent volume of peroxide is added and left to react for an hour, and the sample is made up to a fixed volume with deionised water before reading. However, such procedures take time in the field and are more suited to a 'field shed' situation. When effervescence (sometimes violent) has ceased, a few additional mL of peroxide should be added until the reaction appears complete. If the reaction is violent, it is recommended that deionised water be added to cool and dilute the reaction. The test may have to be repeated with a small amount of water added to the soil prior to peroxide addition. The
pH ^{FOX} of the resultant mixture is then measured.

4. Reporting the results

All pH $_F$ and pH$_{FOX}$ results along with the strength of reaction should be tabulated by site and depth and reported in the ASS report. An example of a recording sheet is attached.

Appendix e

LABORATORY CERTIFICATES

Chameleon Geosciences Pty Ltd

6 Carter Street
Lidcombe, NSW 2141

P O Box 398 Tel: 1300 137 038
DRUMMOYNE NSW 1470 Fax: 1300 136 038

Laboratory Test Request / Chain of Custody Record

Email reports: cynthia@aargus.net; gokul@aargus.net; mark.kelly@aargus.net;ningye@aargus.net
Email invoices: anika@aargus.net; cynthia@aargus.net; gokul@aargus.net; mark.kelly@aargus.net; ningye@aargus.net

TO: **MGT EUROFINS**
UNIT F3, BUILDING F
16 MARS ROAD
LANE COVE WEST NSW 2066

PH: **028215 6222** **FAX:** **02 9420 2977**
ATTN:

Sampling Date: 07.09.2020 **Job No:** EC8030-2
Sampled By: SP **Project:** ASS
Project Manager: MK **Location:** Toronto

Results required by: STANDARD

Location	Depth (m)	Date	Soil	Water (Filled Up)	Air	SPOCAS									Analysis Suite(s)	KEEP SAMPLE?
	Sampling details		**Sample type**													
BH3	3.0	07.09.2020	DSP			✓										YES
BH3	4.0	07.09.2020	DSP			✓										YES
BH3	6.0	07.09.2020	DSP			✓										YES
BH3	10.0	07.09.2020	DSP			✓										YES
BH5	3.0	07.09.2020	DSP			✓										YES
BH5	5.0	07.09.2020	DSP			✓										YES
BH5	7.0	07.09.2020	DSP			✓										YES
BH5	9.0	07.09.2020	DSP			✓										YES
BH5	10.0	07.09.2020	DSP			✓										YES
BH7	2.0	07.09.2020	DSP			✓										YES
BH7	3.0	07.09.2020	DSP			✓										YES
BH7	5.0	07.09.2020	DSP			✓										YES
BH7	7.0	07.09.2020	DSP			✓										YES
BH7	9.0	07.09.2020	DSP			✓										YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Sara	SB	16.09.2020	Grace		16/9

Legend:

WG	Water sample, glass bottle	USG	Undisturbed soil sample (glass j	DSP	Disturbed soil sample (small plastic bag)
WP	Water sample, plastic bottle	DSG	Disturbed soil sample (glass jar)	✓	Test required
GV	Glass vial	OTH	Other	ACAN	Air sample, canister

@ mole H^+/tonne

744558

eurofins Environment Testing

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
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NATA # 1261
Site # 1254 & 14271

Sydney
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Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
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New Zealand

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Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Sep 16, 2020 4:46 PM
Address:	6 Carter Street Lidcombe NSW 2141	**Report #:**	744558	**Due:**	Sep 23, 2020
		Phone:	02 9568 6159	**Priority:**	5 Day
		Fax:	02 9566 6179	**Contact Name:**	- ALL INVOICES/SRA - Mark Kelly
Project Name:	ASS				
Project ID:	EC8030-2				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						SPOCAS Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794						X	X
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH3 3.0	Sep 08, 2020		Soil	S20-Se28664	X	X
2	BH3 4.0	Sep 08, 2020		Soil	S20-Se28665	X	X
3	BH3 6.0	Sep 08, 2020		Soil	S20-Se28666	X	X
4	BH3 10.0	Sep 08, 2020		Soil	S20-Se28667	X	X
5	BH5 3.0	Sep 10, 2020		Soil	S20-Se28668	X	X
6	BH5 5.0	Sep 10, 2020		Soil	S20-Se28669	X	X
7	BH5 7.0	Sep 10, 2020		Soil	S20-Se28670	X	X
8	BH5 9.0	Sep 10, 2020		Soil	S20-Se28671	X	X
9	BH5 10.0	Sep 10, 2020		Soil	S20-Se28672	X	X

eurofins Environment Testing

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Australia

Melbourne
6 Monterey Road
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NATA # 1261
Site # 1254 & 14271

Sydney
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Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
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Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

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Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Sep 16, 2020 4:46 PM
Address:	6 Carter Street	**Report #:**	744558	**Due:**	Sep 23, 2020
	Lidcombe	**Phone:**	02 9568 6159	**Priority:**	5 Day
	NSW 2141	**Fax:**	02 9566 6179	**Contact Name:**	- ALL INVOICES/SRA - Mark Kelly
Project Name:	ASS				
Project ID:	EC8030-2				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						SPOCAS Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794						X	X
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory							
External Laboratory							
10	BH7 2.0	Sep 08, 2020		Soil	S20-Se28673	X	X
11	BH7 3.0	Sep 08, 2020		Soil	S20-Se28674	X	X
12	BH7 5.0	Sep 08, 2020		Soil	S20-Se28675	X	X
13	BH7 7.0	Sep 09, 2020		Soil	S20-Se28676	X	X
14	BH7 9.0	Sep 08, 2020		Soil	S20-Se28677	X	X
Test Counts						14	14

eurofins | Environment Testing

Certificate of Analysis

Aargus Pty Ltd
6 Carter Street
Lidcombe
NSW 2141

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

WORLD RECOGNISED ACCREDITATION

Attention: **- ALL INVOICES/SRA - Mark Kelly**

Report **744558-S**
Project name ASS
Project ID EC8030-2
Received Date Sep 16, 2020

Client Sample ID			**BH3 3.0**	**BH3 4.0**	**BH3 6.0**	**BH3 10.0**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S20-Se28664**	**S20-Se28665**	**S20-Se28666**	**S20-Se28667**
Date Sampled			**Sep 08, 2020**	**Sep 08, 2020**	**Sep 08, 2020**	**Sep 08, 2020**
Test/Reference	LOR	Unit				
SPOCAS Suite						
pH-KCL	0.1	pH Units	5.5	4.4	4.5	4.5
pH-OX	0.1	pH Units	5.4	4.8	4.9	4.8
Acid trail - Titratable Actual Acidity	2	mol H+/t	8.0	52	44	44
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	23	75	64	62
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	15	23	19	19
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.010	0.080	0.070	0.070
sulfidic - TPA equiv. S% pyrite	0.02	% pyrite S	0.04	0.12	0.10	0.10
sulfidic - TSA equiv. S% pyrite	0.02	% pyrite S	0.03	0.04	0.03	0.03
Sulfur - KCl Extractable	0.02	% S	< 0.02	0.04	0.03	0.03
Sulfur - Peroxide	0.02	% S	0.02	0.03	0.02	0.02
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	< 10	< 10	< 10	< 10
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
HCl Extractable Sulfur	0.02	% S	n/a	0.08	0.05	0.06
Net Acid soluble sulfur	0.02	% S	n/a	0.04	0.03	0.03
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	18	13	14
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	0.03	0.02	0.02
Calcium - KCl Extractable	0.02	% Ca	0.07	< 0.02	< 0.02	< 0.02
Calcium - Peroxide	0.02	% Ca	0.07	< 0.02	< 0.02	< 0.02
Acid Reacted Calcium	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Calcium	10	mol H+/t	< 10	< 10	< 10	< 10
sulfidic - Acid Reacted Ca equiv. S% pyrite	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Magnesium - KCl Extractable	0.02	% Mg	0.05	0.04	0.03	0.02
Magnesium - Peroxide	0.02	% Mg	0.06	0.04	0.03	< 0.02
Acid Reacted Magnesium	0.02	% Mg	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Magnesium	10	mol H+/t	< 10	< 10	< 10	< 10
sulfidic - Acid Reacted Mg equiv. S% pyrite	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Acid Neutralising Capacity (ANCE)	0.02	% CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - Acidity units (a-ANCE)	10	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite(s-ANCE)	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
SPOCAS - Net Acidity (Sulfur Units)	0.02	% S	< 0.02	0.11	0.09	0.09
SPOCAS - Net Acidity (Acidity Units)	10	mol H+/t	11	70	57	58
SPOCAS - Liming rate	1	kg CaCO3/t	1.0	5.0	4.0	4.0

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Client Sample ID			BH3 3.0	BH3 4.0	BH3 6.0	BH3 10.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S20-Se28664	S20-Se28665	S20-Se28666	S20-Se28667
Date Sampled			Sep 08, 2020	Sep 08, 2020	Sep 08, 2020	Sep 08, 2020
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	94	54	61	57
>2mm Fraction	0.005	g	3.2	< 0.005	0.41	15
Analysed Material	0.1	%	97	100	99	79
Extraneous Material	0.1	%	3.3	< 0.1	0.7	21
% Moisture	1	%	17	17	17	33

Client Sample ID			BH5 3.0	BH5 5.0	BH5 7.0	BH5 9.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S20-Se28668	S20-Se28669	S20-Se28670	S20-Se28671
Date Sampled			Sep 10, 2020	Sep 10, 2020	Sep 10, 2020	Sep 10, 2020
Test/Reference	LOR	Unit				
SPOCAS Suite						
pH-KCL	0.1	pH Units	4.5	4.5	4.5	4.5
pH-OX	0.1	pH Units	5.0	4.9	5.0	4.9
Acid trail - Titratable Actual Acidity	2	mol H+/t	42	36	37	37
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	68	57	55	53
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	26	21	18	16
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.070	0.060	0.060	0.060
sulfidic - TPA equiv. S% pyrite	0.02	% pyrite S	0.11	0.09	0.09	0.09
sulfidic - TSA equiv. S% pyrite	0.02	% pyrite S	0.04	0.03	0.03	0.03
Sulfur - KCl Extractable	0.02	% S	0.04	0.03	0.03	0.03
Sulfur - Peroxide	0.02	% S	0.03	0.02	0.03	0.03
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	< 10	< 10	< 10	< 10
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
HCl Extractable Sulfur	0.02	% S	0.09	0.07	n/a	0.06
Net Acid soluble sulfur	0.02	% S	0.04	0.03	n/a	0.03
Net Acid soluble sulfur - acidity units	10	mol H+/t	21	15	n/a	13
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	0.03	0.02	n/a	0.02
Calcium - KCl Extractable	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
Calcium - Peroxide	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
Acid Reacted Calcium	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Calcium	10	mol H+/t	< 10	< 10	< 10	< 10
sulfidic - Acid Reacted Ca equiv. S% pyrite	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Magnesium - KCl Extractable	0.02	% Mg	0.05	0.03	0.03	< 0.02
Magnesium - Peroxide	0.02	% Mg	0.04	0.02	0.02	< 0.02
Acid Reacted Magnesium	0.02	% Mg	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Magnesium	10	mol H+/t	< 10	< 10	< 10	< 10
sulfidic - Acid Reacted Mg equiv. S% pyrite	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Acid Neutralising Capacity (ANCE)	0.02	% CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - Acidity units (a-ANCE)	10	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite(s-ANCE)	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
SPOCAS - Net Acidity (Sulfur Units)	0.02	% S	0.10	0.06	0.06	0.08
SPOCAS - Net Acidity (Acidity Units)	10	mol H+/t	62	36	37	50
SPOCAS - Liming rate	1	kg CaCO3/t	5.0	3.0	3.0	4.0

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Client Sample ID			BH5 3.0	BH5 5.0	BH5 7.0	BH5 9.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S20-Se28668	S20-Se28669	S20-Se28670	S20-Se28671
Date Sampled			Sep 10, 2020	Sep 10, 2020	Sep 10, 2020	Sep 10, 2020
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	61	77	59	76
>2mm Fraction	0.005	g	2.2	0.43	4.7	3.0
Analysed Material	0.1	%	97	99	93	96
Extraneous Material	0.1	%	3.5	0.6	7.3	3.8
% Moisture	1	%	19	19	21	20

Client Sample ID			BH5 10.0	BH7 2.0	BH7 3.0	BH7 5.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S20-Se28672	S20-Se28673	S20-Se28674	S20-Se28675
Date Sampled			Sep 10, 2020	Sep 08, 2020	Sep 08, 2020	Sep 08, 2020
Test/Reference	LOR	Unit				
SPOCAS Suite						
pH-KCL	0.1	pH Units	4.5	4.5	4.4	4.3
pH-OX	0.1	pH Units	4.8	4.5	4.4	4.3
Acid trail - Titratable Actual Acidity	2	mol H+/t	44	34	43	83
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	61	48	59	110
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	17	15	< 2	26
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.070	0.050	0.070	0.13
sulfidic - TPA equiv. S% pyrite	0.02	% pyrite S	0.10	0.08	0.09	0.17
sulfidic - TSA equiv. S% pyrite	0.02	% pyrite S	0.03	0.02	< 0.02	0.04
Sulfur - KCl Extractable	0.02	% S	0.03	< 0.02	< 0.02	0.04
Sulfur - Peroxide	0.02	% S	0.04	< 0.02	< 0.02	0.04
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	< 10	< 10	< 10	< 10
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
HCl Extractable Sulfur	0.02	% S	0.07	n/a	0.03	0.07
Net Acid soluble sulfur	0.02	% S	0.03	n/a	< 0.02	0.04
Net Acid soluble sulfur - acidity units	10	mol H+/t	15	n/a	< 10	17
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	0.02	n/a	< 0.02	0.03
Calcium - KCl Extractable	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
Calcium - Peroxide	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
Acid Reacted Calcium	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Calcium	10	mol H+/t	< 10	< 10	< 10	< 10
sulfidic - Acid Reacted Ca equiv. S% pyrite	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Magnesium - KCl Extractable	0.02	% Mg	< 0.02	< 0.02	< 0.02	0.02
Magnesium - Peroxide	0.02	% Mg	< 0.02	< 0.02	< 0.02	0.02
Acid Reacted Magnesium	0.02	% Mg	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Magnesium	10	mol H+/t	< 10	< 10	< 10	< 10
sulfidic - Acid Reacted Mg equiv. S% pyrite	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Acid Neutralising Capacity (ANCE)	0.02	% CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - Acidity units (a-ANCE)	10	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite(s-ANCE)	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
SPOCAS - Net Acidity (Sulfur Units)	0.02	% S	0.10	0.06	0.08	0.16
SPOCAS - Net Acidity (Acidity Units)	10	mol H+/t	60	35	52	100
SPOCAS - Liming rate	1	kg CaCO3/t	5.0	3.0	4.0	8.0

Client Sample ID			BH5 10.0	BH7 2.0	BH7 3.0	BH7 5.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S20-Se28672	S20-Se28673	S20-Se28674	S20-Se28675
Date Sampled			Sep 10, 2020	Sep 08, 2020	Sep 08, 2020	Sep 08, 2020
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	52	68	80	77
>2mm Fraction	0.005	g	5.7	15	1.7	< 0.005
Analysed Material	0.1	%	90	81	98	100
Extraneous Material	0.1	%	9.8	19	2.1	< 0.1
% Moisture	1	%	20	13	13	24

Client Sample ID			BH7 7.0	BH7 9.0
Sample Matrix			Soil	Soil
Eurofins Sample No.			S20-Se28676	S20-Se28677
Date Sampled			Sep 09, 2020	Sep 08, 2020
Test/Reference	LOR	Unit		
SPOCAS Suite				
pH-KCL	0.1	pH Units	4.3	4.5
pH-OX	0.1	pH Units	4.4	4.5
Acid trail - Titratable Actual Acidity	2	mol H+/t	60	46
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	82	65
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	22	19
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.10	0.070
sulfidic - TPA equiv. S% pyrite	0.02	% pyrite S	0.13	0.10
sulfidic - TSA equiv. S% pyrite	0.02	% pyrite S	0.04	0.03
Sulfur - KCl Extractable	0.02	% S	0.02	0.02
Sulfur - Peroxide	0.02	% S	< 0.02	< 0.02
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	< 0.02	< 0.02
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	< 10	< 10
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0
HCl Extractable Sulfur	0.02	% S	0.05	0.04
Net Acid soluble sulfur	0.02	% S	0.03	0.02
Net Acid soluble sulfur - acidity units	10	mol H+/t	12	11
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	< 0.02	< 0.02
Calcium - KCl Extractable	0.02	% Ca	< 0.02	0.02
Calcium - Peroxide	0.02	% Ca	< 0.02	0.02
Acid Reacted Calcium	0.02	% Ca	< 0.02	< 0.02
acidity - Acid Reacted Calcium	10	mol H+/t	< 10	< 10
sulfidic - Acid Reacted Ca equiv. S% pyrite	0.02	% S	< 0.02	< 0.02
Magnesium - KCl Extractable	0.02	% Mg	0.02	< 0.02
Magnesium - Peroxide	0.02	% Mg	< 0.02	< 0.02
Acid Reacted Magnesium	0.02	% Mg	< 0.02	< 0.02
acidity - Acid Reacted Magnesium	10	mol H+/t	< 10	< 10
sulfidic - Acid Reacted Mg equiv. S% pyrite	0.02	% S	< 0.02	< 0.02
Acid Neutralising Capacity (ANCE)	0.02	% CaCO3	n/a	n/a
Acid Neutralising Capacity - Acidity units (a-ANCE)	10	mol H+/t	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite(s-ANCE)	0.02	% S	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5
SPOCAS - Net Acidity (Sulfur Units)	0.02	% S	0.11	0.09
SPOCAS - Net Acidity (Acidity Units)	10	mol H+/t	71	57
SPOCAS - Liming rate	1	kg CaCO3/t	5.0	4.0

Client Sample ID			BH7 7.0	BH7 9.0
Sample Matrix			Soil	Soil
Eurofins Sample No.			S20-Se28676	S20-Se28677
Date Sampled			Sep 09, 2020	Sep 08, 2020
Test/Reference	LOR	Unit		
Extraneous Material				
<2mm Fraction	0.005	g	86	66
>2mm Fraction	0.005	g	5.0	1.5
Analysed Material	0.1	%	94	98
Extraneous Material	0.1	%	5.5	2.2
% Moisture	1	%	27	22

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Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
SPOCAS Suite			
SPOCAS Suite	Brisbane	Sep 21, 2020	6 Week
- Method: LTM-GEN-7050			
Extraneous Material	Brisbane	Sep 21, 2020	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Sep 22, 2020	14 Days
- Method: LTM-GEN-7080 Moisture			

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NATA # 1261
Site # 1254 & 14271

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NATA # 1261 Site # 18217

Brisbane
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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
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Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

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Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Sep 16, 2020 4:46 PM
Address:	6 Carter Street Lidcombe NSW 2141	**Report #:**	744558	**Due:**	Sep 23, 2020
		Phone:	02 9568 6159	**Priority:**	5 Day
		Fax:	02 9566 6179	**Contact Name:**	- ALL INVOICES/SRA - Mark Kelly
Project Name:	ASS				
Project ID:	EC8030-2				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						SPOCAS Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794						X	X
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH3 3.0	Sep 08, 2020		Soil	S20-Se28664	X	X
2	BH3 4.0	Sep 08, 2020		Soil	S20-Se28665	X	X
3	BH3 6.0	Sep 08, 2020		Soil	S20-Se28666	X	X
4	BH3 10.0	Sep 08, 2020		Soil	S20-Se28667	X	X
5	BH5 3.0	Sep 10, 2020		Soil	S20-Se28668	X	X
6	BH5 5.0	Sep 10, 2020		Soil	S20-Se28669	X	X
7	BH5 7.0	Sep 10, 2020		Soil	S20-Se28670	X	X
8	BH5 9.0	Sep 10, 2020		Soil	S20-Se28671	X	X
9	BH5 10.0	Sep 10, 2020		Soil	S20-Se28672	X	X

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NATA # 1261 Site # 18217

Brisbane
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NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
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New Zealand

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IANZ # 1327

Christchurch
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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name:	Aargus Pty Ltd	**Order No.:**		**Received:**	Sep 16, 2020 4:46 PM
Address:	6 Carter Street	**Report #:**	744558	**Due:**	Sep 23, 2020
	Lidcombe	**Phone:**	02 9568 6159	**Priority:**	5 Day
	NSW 2141	**Fax:**	02 9566 6179	**Contact Name:**	- ALL INVOICES/SRA - Mark Kelly
Project Name:	ASS				
Project ID:	EC8030-2				

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						SPOCAS Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794						X	X
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory							
External Laboratory							
10	BH7 2.0	Sep 08, 2020		Soil	S20-Se28673	X	X
11	BH7 3.0	Sep 08, 2020		Soil	S20-Se28674	X	X
12	BH7 5.0	Sep 08, 2020		Soil	S20-Se28675	X	X
13	BH7 7.0	Sep 09, 2020		Soil	S20-Se28676	X	X
14	BH7 9.0	Sep 08, 2020		Soil	S20-Se28677	X	X
Test Counts						14	14

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
SPOCAS Suite									
pH-KCL			%	99			80-120	Pass	
Acid trail - Titratable Actual Acidity			%	98			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
SPOCAS Suite				Result 1	Result 2	RPD			
pH-KCL	S20-Se28664	CP	pH Units	5.5	5.4	1.0	30%	Pass	
pH-OX	S20-Se28664	CP	pH Units	5.4	5.4	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	S20-Se28664	CP	mol H+/t	8.0	8.0	2.0	30%	Pass	
Acid trail - Titratable Peroxide Acidity	S20-Se28664	CP	mol H+/t	23	24	3.0	30%	Pass	
Acid trail - Titratable Sulfidic Acidity	S20-Se28664	CP	mol H+/t	15	16	4.0	30%	Pass	
sulfidic - TAA equiv. S% pyrite	S20-Se28664	CP	% pyrite S	0.010	0.010	2.0	30%	Pass	
sulfidic - TPA equiv. S% pyrite	S20-Se28664	CP	% pyrite S	0.04	0.04	3.0	30%	Pass	
sulfidic - TSA equiv. S% pyrite	S20-Se28664	CP	% pyrite S	0.03	0.03	4.0	30%	Pass	
Sulfur - KCl Extractable	S20-Se28664	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - Peroxide	S20-Se28664	CP	% S	0.02	0.02	4.0	30%	Pass	
Sulfur - Peroxide Oxidisable Sulfur	S20-Se28664	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
acidity - Peroxide Oxidisable Sulfur	S20-Se28664	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
Calcium - KCl Extractable	S20-Se28664	CP	% Ca	0.07	0.07	1.0	30%	Pass	
Calcium - Peroxide	S20-Se28664	CP	% Ca	0.07	0.07	1.0	30%	Pass	
Acid Reacted Calcium	S20-Se28664	CP	% Ca	< 0.02	< 0.02	<1	30%	Pass	
acidity - Acid Reacted Calcium	S20-Se28664	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
sulfidic - Acid Reacted Ca equiv. S% pyrite	S20-Se28664	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Magnesium - KCl Extractable	S20-Se28664	CP	% Mg	0.05	0.05	1.0	30%	Pass	
Magnesium - Peroxide	S20-Se28664	CP	% Mg	0.06	0.06	2.0	30%	Pass	
Acid Reacted Magnesium	S20-Se28664	CP	% Mg	< 0.02	< 0.02	<1	30%	Pass	
acidity - Acid Reacted Magnesium	S20-Se28664	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
sulfidic - Acid Reacted Mg equiv. S% pyrite	S20-Se28664	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
ANC Fineness Factor	S20-Se28664	CP	factor	1.5	1.5	<1	30%	Pass	
SPOCAS - Liming rate	S20-Se28664	CP	kg CaCO3/t	1.0	1.0	1.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B20-Se35260	NCP	%	32	32	1.0	30%	Pass	
Duplicate									
SPOCAS Suite				Result 1	Result 2	RPD			
pH-KCL	S20-Se28674	CP	pH Units	4.4	4.4	1.0	30%	Pass	
pH-OX	S20-Se28674	CP	pH Units	4.4	4.4	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	S20-Se28674	CP	mol H+/t	43	43	<1	30%	Pass	
Acid trail - Titratable Peroxide Acidity	S20-Se28674	CP	mol H+/t	59	60	3.0	30%	Pass	
Acid trail - Titratable Sulfidic Acidity	S20-Se28674	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
sulfidic - TAA equiv. S% pyrite	S20-Se28674	CP	% pyrite S	0.070	0.070	<1	30%	Pass	
sulfidic - TPA equiv. S% pyrite	S20-Se28674	CP	% pyrite S	0.09	0.10	3.0	30%	Pass	
sulfidic - TSA equiv. S% pyrite	S20-Se28674	CP	% pyrite S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - KCl Extractable	S20-Se28674	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - Peroxide	S20-Se28674	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - Peroxide Oxidisable Sulfur	S20-Se28674	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
acidity - Peroxide Oxidisable Sulfur	S20-Se28674	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
HCl Extractable Sulfur	S20-Se28674	CP	% S	0.03	0.03	2.0	30%	Pass	

Environment Testing

Duplicate									
SPOCAS Suite				Result 1	Result 2	RPD			
Net Acid soluble sulfur	S20-Se28674	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Net Acid soluble sulfur - acidity units	S20-Se28674	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
Net Acid soluble sulfur - equivalent S% pyrite	S20-Se28674	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Calcium - KCl Extractable	S20-Se28674	CP	% Ca	< 0.02	< 0.02	<1	30%	Pass	
Calcium - Peroxide	S20-Se28674	CP	% Ca	< 0.02	< 0.02	<1	30%	Pass	
Acid Reacted Calcium	S20-Se28674	CP	% Ca	< 0.02	< 0.02	<1	30%	Pass	
acidity - Acid Reacted Calcium	S20-Se28674	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
sulfidic - Acid Reacted Ca equiv. S% pyrite	S20-Se28674	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Magnesium - KCl Extractable	S20-Se28674	CP	% Mg	< 0.02	< 0.02	<1	30%	Pass	
Magnesium - Peroxide	S20-Se28674	CP	% Mg	< 0.02	< 0.02	<1	30%	Pass	
Acid Reacted Magnesium	S20-Se28674	CP	% Mg	< 0.02	< 0.02	<1	30%	Pass	
acidity - Acid Reacted Magnesium	S20-Se28674	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
sulfidic - Acid Reacted Mg equiv. S% pyrite	S20-Se28674	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
ANC Fineness Factor	S20-Se28674	CP	factor	1.5	1.5	<1	30%	Pass	
SPOCAS - Liming rate	S20-Se28674	CP	kg CaCO3/t	4.0	4.0	1.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5

Authorised By

Asim Khan	Analytical Services Manager
Myles Clark	Senior Analyst-SPOCAS (QLD)

Glenn Jackson

General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

APPENDIX H

Salinity Report

Chameleon

Geosciences Pty Ltd

7th October 2020

Our Ref: EC8030/3

Toronto Investments No.1 Pty Ltd

4 Parramatta Road

Summer Hill NSW 2287

By Email: fayv@napf.com.au

Dear Fay,

Re: Groundwater Salinity Assessment

Site: 114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW

Chameleon Geosciences Pty Ltd (Chameleon) was appointed by Toronto Investments No.1 Pty Ltd to undertake an assessment of the groundwater salinity from the groundwater monitoring wells within the property located at 114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW (hereafter referred to as the "site"), refer fig.1 in Appendix.

The site is surrounded by Cary Street, then vacant land to the west, McDonald's Toronto, then Bay Street to the north, Arnott Avenue, then the Royal Motor Yacht Club & low density residential to the east, and vacant land, then Victory Parade to the south.

To assess the classification of water to be disposed of into the stormwater system, the NSW EPA refers to the "*ANZECC Fresh and Marine water Quality Guidelines 2018*". These guidelines provide trigger levels to characterise waters and determine their contamination status. Contaminating materials cannot be introduced into any clean areas. Therefore, before water from the construction site can be disposed of into the stormwater system and the eventual receiving waters, it must be tested and classified to the guidelines outlined above.

An examination of the groundwater quality in the proposed area using "*National Acid Sulfate Soils Guidance 2018*"can also be used to provide an indication of whether Reduced Inorganic Sulfur (RIS) oxidation has occurred in the vicinity. Groundwater quality parameters that can be used to indicate the presence of ASS materials include a soluble sulfate to soluble chloride ($SO4^{2-}$: Cl^{-}) of more than 0.25 and a pH of less than 4.

Reference to the Department of Infrastructure, Planning and Natural Resources, NSW Coastal Salinity Audit 2004, *Salinity in the Sydney South Coast, Hunter and North Coast Regions,* mapping indicates that the site is located in region identified as having a moderate salinity potential.

Chameleon staff visited the site on 16th September 2020 and from inspection of the above details, the following information was gathered with regards to the property.

At the time of the visit the site was vacant grass covered land. Groundwater samples were collected from five (5) monitoring wells in the site and tested for salinity.

The following observations were made from the lab results as per Council requirements:

- Sulphate and Chloride values satisfied the Australian and New Zealand Guidelines for Recreational Purposes (2018).

- pH – <6.5, indicating the water is slightly acidic and thereby not satisfying the freshwater criteria as per Australian And New Zealand Guidelines For Fresh And Marine Water Quality (2018).
- EC values satisfied the Australian and New Zealand Guidelines for Recreational Purposes (2018).
- Soluble sulphate to soluble chloride ($SO4^{2-}$: Cl^-) ratio– >0.25, indicating Reduced Inorganic Sulphur (RIS) oxidation has occurred in the vicinity of the groundwater monitoring wells thereby indicating presence of ASS materials on site.

It is expected that the any groundwater disposed off-site during excavation works would require treatment prior to disposal.

We would be pleased to provide further information on any aspects of this report.

For and on behalf of

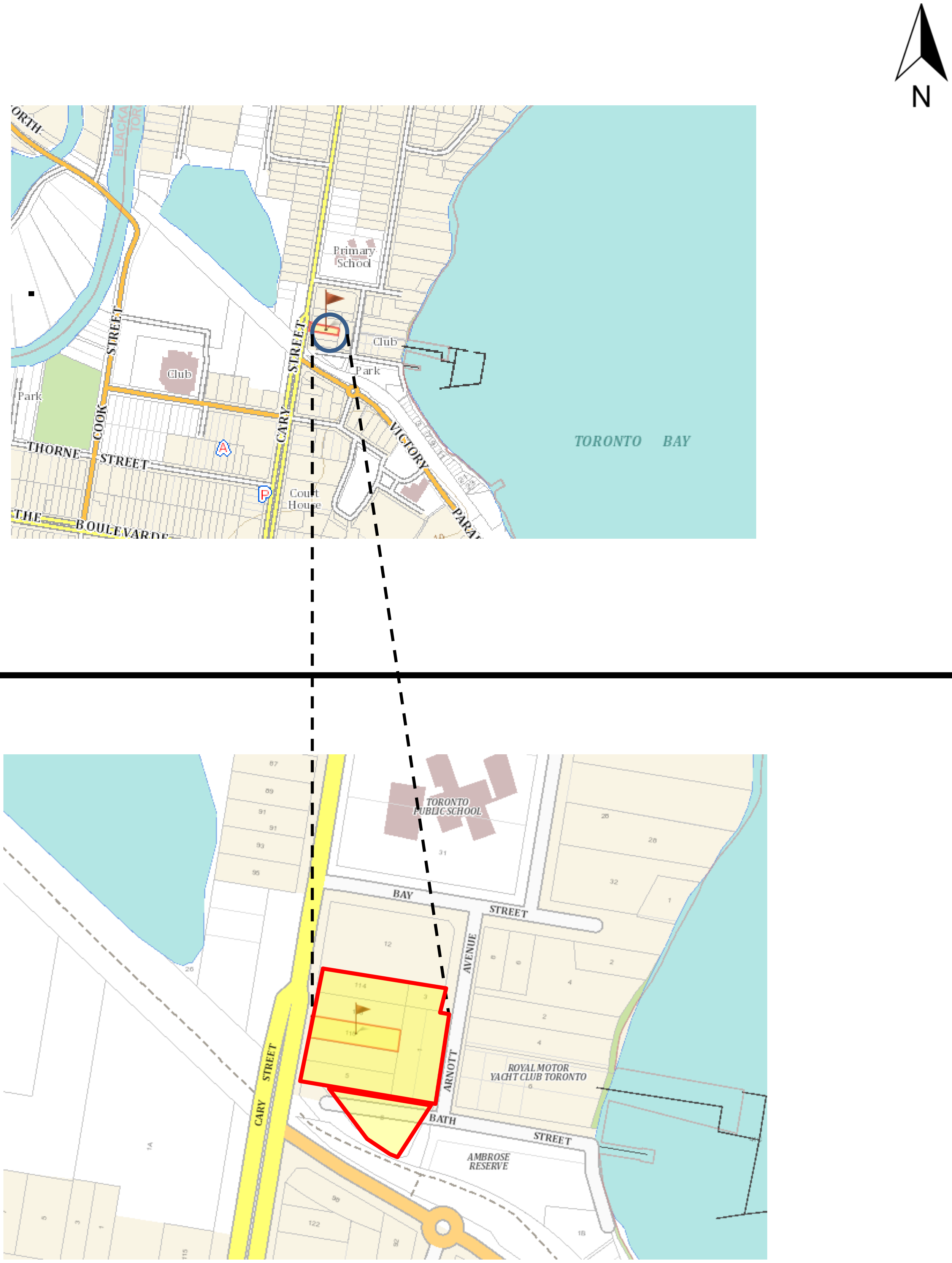
Chameleon Geosciences Pty Ltd

Gokul Balakrishnan
Environmental Engineer

Reviewed By

Mark Kelly
Environmental Manager

SITE LOCALITY MAP



Source: https://maps.six.nsw.gov.au/

PROJECT DETAILS		DRAWING DETAILS			
Project Title	Groundwater Salinity Assessment	Figure No.	1	Rev No.	0
Project No.	EC8030/3	Scale	NTS	Size	A4
Client	Toronto Investments No.1 Pty Ltd	Drawn by	GB	Date	06.10.2020
Site Address	114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW	Approved by	MK	Date	07.10.2020

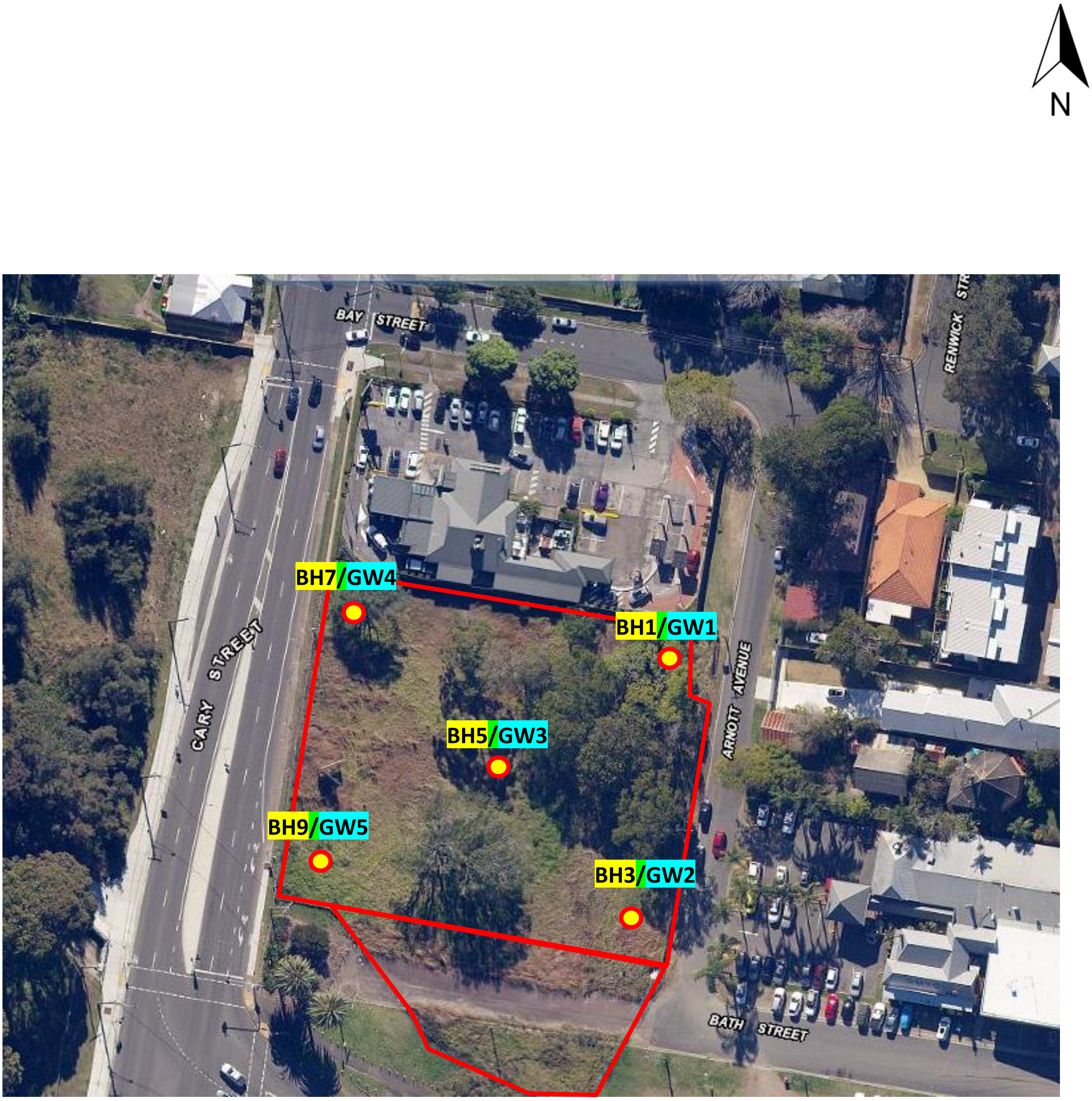
SITE FEATURES & SURROUNDING LAND

No.	Site Features
1	Grass covered vacant land
2	Concrete driveway

Source: http://maps.six.nsw.gov.au/

PROJECT DETAILS		Chameleon	DRAWING DETAILS			
Project Title	Groundwater Salinity Assessment		Figure No.	2	Rev No.	0
Project No.	EC8030/3		Scale	NTS	Size	A4
Client	Toronto Investments No.1 Pty Ltd		Drawn by	GB	Date	06.10.2020
Site Address	114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW		Approved by	MK	Date	07.10.2020

SITE SAMPLING LOCATION



Source: http://maps.six.nsw.gov.au/

PROJECT DETAILS			DRAWING DETAILS			
Project Title	Groundwater Salinity Assessment	Chameleon	Figure No.	3	Rev No.	0
Project No.	EC8030/3		Scale	NTS	Size	A4
Client	Toronto Investments No.1 Pty Ltd		Drawn by	GB	Date	06.10.2020
Site Address	114-120 Cary Street, 1-5 Bath Street & 3 Arnott Avenue, Toronto NSW		Approved by	MK	Date	06.10.2020

CHAMELEON GEOSCIENCES PTY LTD

Laboratory Test Request / Chain of Custody Record

6 Carter Rd
LIDCOMBE NSW 2141

P O Box 398 Tel: 1300 137 038
DRUMMOYNE NSW 1470 Fax: 1300 136 038

Email reports: **sai@aargus.net**
Email invoices: anika@aargus.net; cynthia@aargus.net

TO:	**MGT EUROFINS** **UNIT F3, BUILDING F** **16 MARS ROAD** **LANE COVE WEST NSW 2066**	**Sampling Date:** 16/09/2020	**Job No:** EC8030-2
PH:	**028215 6222** **FAX:** **294202977**	**Sampled By:** SP	**Project:** Salinity Testing
ATTN:	**Samples Receipt**	**Project Manager:** MK	**Location:** 118 Cary Street, Toronto, NSW

Results required by: Standard TAT

Sampling details			**Sample type**														
Location	Depth (m)	Date	Soil	Water (Filled Up)	Air	**Electrical Conductivity**	**pH**	**Sulphate**	**Chloride**							**Analysis Suite(s)**	**KEEP SAMPLE?**
BH1		16/09/20		WP		✓	✓	✓	✓								Yes
BH3		16/09/20		WP		✓	✓	✓	✓								Yes
BH5		16/09/20		WP		✓	✓	✓	✓								Yes
BH7		16/09/20		WP		✓	✓	✓	✓								Yes
BH9		16/09/20		WP		✓	✓	✓	✓								Yes

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Gokul	GB	17/09/2020	Anson Lee		17/9/20 3:15PM

16.3°C #744790

Legend:

WG	Water sample, glass bottle	USG	Undisturbed soil sample (glass jar)	DSP	Disturbed soil sample (small plastic bag)
WP	Water sample, plastic bottle	DSG	Disturbed soil sample (glass jar)	✓	Test required
✓	Test required				
GV	Glass vial	OTH	Other	ACAN	Air sample, canister

@ mole H^+/tonne

eurofins Environment Testing

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Aargus Pty Ltd
6 Carter Street
Lidcombe
NSW 2141

Attention: **Sai Najaraju (cc All Invoices)**

Report	**744790-W**
Project name	SALINITY TESTING
Project ID	EC8030-2
Received Date	Sep 17, 2020

Client Sample ID			**BH1**	**BH3**	**BH5**	**BH7**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**S20-Se30657**	**S20-Se30658**	**S20-Se30659**	**S20-Se30660**
Date Sampled			**Sep 16, 2020**	**Sep 16, 2020**	**Sep 16, 2020**	**Sep 16, 2020**
Test/Reference	LOR	Unit				
Chloride	1	mg/L	160	110	210	120
Conductivity (at 25°C)	10	uS/cm	490	540	970	320
pH (at 25 °C)	0.1	pH Units	6.4	6.4	5.9	5.7
Sulphate (as SO4)	2	mg/L	96	120	240	59

Client Sample ID			**BH9**
Sample Matrix			**Water**
Eurofins Sample No.			**S20-Se30661**
Date Sampled			**Sep 16, 2020**
Test/Reference	LOR	Unit	
Chloride	1	mg/L	130
Conductivity (at 25°C)	10	uS/cm	480
pH (at 25 °C)	0.1	pH Units	6.1
Sulphate (as SO4)	2	mg/L	67

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chloride	Sydney	Sep 18, 2020	28 Days
- Method: E045 /E047 Chloride			
Conductivity (at 25°C)	Sydney	Sep 18, 2020	28 Days
- Method: LTM-INO-4030 Conductivity			
pH (at 25 °C)	Sydney	Sep 18, 2020	1 Days
- Method: LTM-GEN-7090 pH in water by ISE			
Sulphate (as SO4)	Sydney	Sep 18, 2020	28 Days
- Method: E045 Anions by Ion Chromatography			

Company Name: Aargus Pty Ltd
Address: 6 Carter Street
Lidcombe
NSW 2141

Project Name: SALINITY TESTING
Project ID: EC8030-2

Order No.:
Report #: 744790
Phone: 02 9568 6159
Fax: 02 9566 6179

Received: Sep 17, 2020 3:15 PM
Due: Sep 24, 2020
Priority: 5 Day
Contact Name: Sai Najaraju (cc All Invoices)

Eurofins Analytical Services Manager : Asim Khan

Sample Detail						Chloride	Conductivity (at 25°C)	pH (at 25 °C)	Sulphate (as SO4)
Melbourne Laboratory - NATA Site # 1254 & 14271									
Sydney Laboratory - NATA Site # 18217						X	X	X	X
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
Newcastle Laboratory									
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	BH1	Sep 16, 2020		Water	S20-Se30657	X	X	X	X
2	BH3	Sep 16, 2020		Water	S20-Se30658	X	X	X	X
3	BH5	Sep 16, 2020		Water	S20-Se30659	X	X	X	X
4	BH7	Sep 16, 2020		Water	S20-Se30660	X	X	X	X
5	BH9	Sep 16, 2020		Water	S20-Se30661	X	X	X	X
Test Counts						5	5	5	5

eurofins

Environment Testing

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
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QC - Acceptance Criteria

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Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

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Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Chloride			mg/L	< 1			1	Pass	
Conductivity (at 25°C)			uS/cm	< 10			10	Pass	
Sulphate (as SO4)			mg/L	< 2			2	Pass	
LCS - % Recovery									
Chloride			%	95			70-130	Pass	
Conductivity (at 25°C)			%	81			70-130	Pass	
Sulphate (as SO4)			%	98			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Chloride	S20-Se26143	NCP	%	110			70-130	Pass	
Sulphate (as SO4)	S20-Se26143	NCP	%	111			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S20-Se26143	NCP	mg/L	190	200	7.0	30%	Pass	
Conductivity (at 25°C)	S20-Se29697	NCP	uS/cm	12000	11000	1.6	30%	Pass	
Sulphate (as SO4)	S20-Se26143	NCP	mg/L	69	77	11	30%	Pass	

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Asim Khan	Analytical Services Manager
Gabriele Cordero	Senior Analyst-Inorganic (NSW)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

APPENDIX I

Groundwater Modelling Report

21 February 2022

Groundwater Drawdown Model and Detailed Settlement Analysis – 114-120 Cary Street, 1,2,3,5 Bath Street and 3 Arnott Avenue Toronto

Toronto Investments No1 Pty Ltd

SYD2021-0134AB Rev4

SYD2021-0134AB		
Date	**Revision**	**Comments**
10 September 2021	Rev 0	First issue
13 September 2021	Rev 1	Second issue
2 December 2021	Rev 2	Third issue
18 January 2022	Rev 3	Fourth issue
21 February 2022	Rev 4	Fifth issue

Table of Contents

Appendices

1 INTRODUCTION

CMW Geosciences Pty Ltd (CMW) was engaged by Toronto Investments No1 Pty Ltd (Toronto) to undertake an assessment of groundwater dewatering and associated settlement for the development located at 118 Cary St Toronto, NSW. **Figure 1** shows the site location.

1.1 Site development

We understand that the building development will comprise a multi-storey building and will include a two-level tanked basement with secant-piled walls. Based on the architectural plans provided, the two basements will occupy vertical depth of ~5.6 m, and it is understood that excavation will be required to approximately 6 metres below ground level (mBGL). Because this will be below the watertable elevation, dewatering will be required.

Previous work undertaken at the site included:

1. Chameleon Geosciences Pty Ltd (2020). Geotechnical Investigation Report. Prepared for Toronto Investments No.1 Pty Ltd, dated 22 December 2020.
2. Chameleon Geosciences Pty Ltd (2021). Response to amended statement of facts and contentions. Letter report in response to the Land and Environment Court. Dated 18 June 2021.
3. JK Geotechnics (2016). Geotechnical Assessment Report. Ref. 29644S Brpt, dated 13 October 2016.
4. Coffey Geosciences (2005). Preliminary Geotechnical Assessment. Ref. N09456/01-AB, dated 22 March 2005.

Only references 1) and 2) above were available for review for this study.

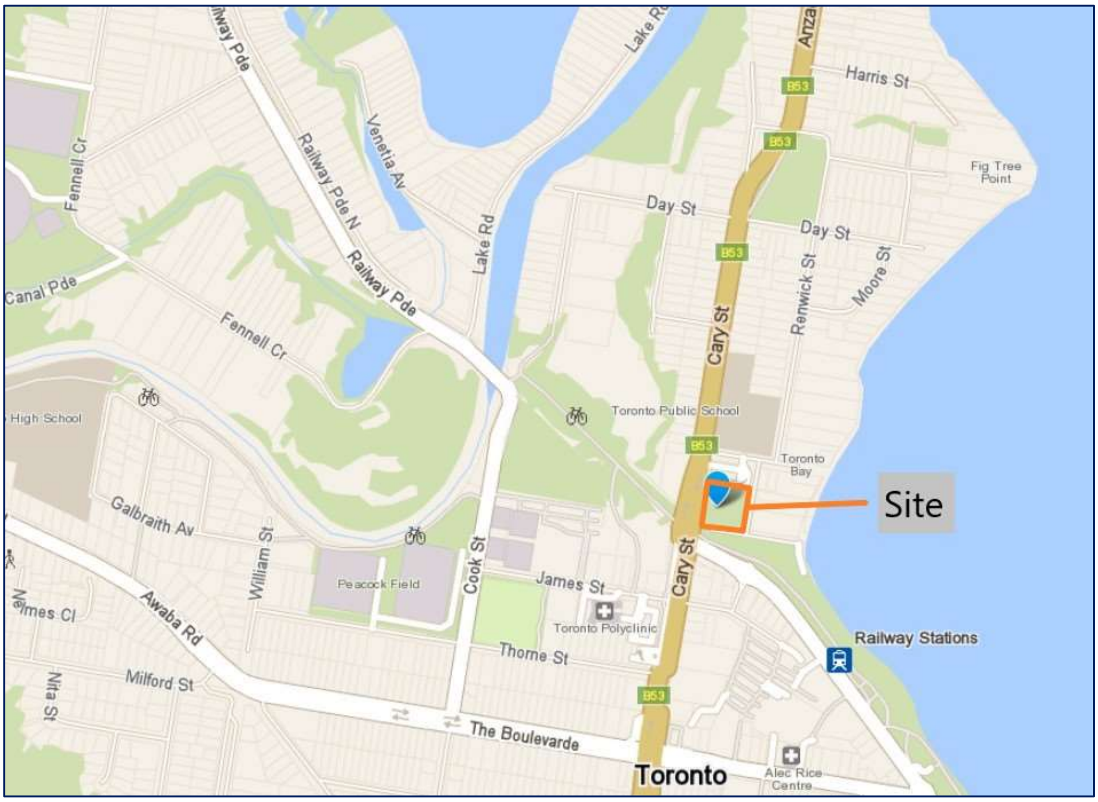

Figure 1 Site plan and investigation locations

1.2 Scope of Work

The following work scope was carried out:

- Review of the site situation and previous work,
- Numerical groundwater modelling to predict groundwater drawdown, and
- Geotechnical settlement analysis, informed by the groundwater model drawdown predictions, to demonstrate potential off-site impacts.

Field investigations were not included in the scope, which relied on previous investigations and generally available information.

2 EXISTING ENVIRONMENT

The site is located approximately 100 m west of Toronto Bay, and is bound to the west by Cary St and to the east by Arnott St. A vacant grassed area and Victory Parade are located to the south of the site (Chameleon, 2020).

The ground surface at the site is approximately 3 to 4 mAHD (metres Above Australian Height Datum).

2.1 Climate

Mean annual rainfall near the site is 1,090 mm/year with a range from 605 to 1,745 mm/year based on the record for nearby Bolton Point (BOM station 61133) which holds data from 1962 to 2021.

The rainfall pattern is distributed throughout the year, with higher average rainfall experienced from the months January to April.

2.2 Geology

The Gosford-Lake Macquarie 1:100,000 map sheet indicates the site is underlain by Newcastle Coal Measures, comprising conglomerate, tuff, siltstone, claystone and coal (Chameleon, 2020). Residual soils and fill overly the conglomeratic bedrock. The generalised ground conditions inferred from the site investigations (9 boreholes) are summarised in **Table 1**.

Table 1: Summary of lithology (after Chameleon, 2020)

Description	Depth mBGL	
	minimum	maximum
Silty sandy CLAY, medium plasticity, soft, moist.	0	1.0
Silty CLAY, with fine gravel, medium to high plasticity, moist, stiff to very stiff.	0.4	3.8
Silty CLAY, fine to medium gravel, medium to high plasticity, moist, very stiff to hard.	1.0	14.0
Gravelly silty CLAY, medium to high plasticity, wet, soft. (BH7 and BH8 only)	0.4	2.7
CLAY, with fine gravel, high plasticity, with silty clay, with fine to medium gravel, moist, very stiff to hard. (BH7, BH8 and BH9 only)	1.0	14.5
CONGLOMERATE, variable sized clasts with traces of sand.	13.4	17.0

2.3 Hydrogeology

The surficial groundwater system comprises an unconfined aquifer hosted within the weathered residual sequence.

Based on bore logs, the upper part of the aquifer comprises stratified sandy and gravelly clay, with conglomerate rock indicated at depth.

2.3.1 Groundwater levels

Based on the previous geotechnical investigation (Chameleon, 2020) groundwater was encountered in all boreholes drilled. Boreholes BH1, BH3, BH5, BH7 and BH9 were constructed as groundwater monitoring wells. Groundwater levels were monitored in these wells from January 2020 to August 2021 and summarised in Table 2. A review of the data indicated a general seasonal fluctuation in groundwater SWL up to 0.8 m (Chameleon, October 2021).

Mean groundwater levels at BH1 to BH9 ranged from 0.66 to 1.23 mAHD. Groundwater levels at the site will vary due to seasonal fluctuation in the groundwater table, and also due to local influences and response to rainfall events at the cleared site.

Monitoring wells BH101 to 103 were installed and measured at a later date than the BH1 to BH9, and a further two wells (Well 1 and Well 2) are located off-site at 97 Cary Street, and only limited time-series monitoring data are available for these wells. It is also noted that BH101 to 103 are constructed at shallower depths than BH1 to BH5 and the slightly higher groundwater RLs at these locations may indicate a downward vertical hydraulic gradient typical of active recharge processes at the site.

Table 2: Summary of groundwater levels (after Chameleon, 2020)

Well ID	Depth (mBGL)	Surface RL (mAHD)	SWL Range (mBGL)	Mean SWL (mBGL)	Mean Groundwater RL (mAHD)
BH1/GW1	13.0	5.5	4.1 to 4.9	4.62	0.88
BH3/GW2	13.5	4.14	3.3 to 3.6	3.43	0.71
BH5/GW3	9.5	3.85	2.6 to 3.0	2.78	1.07
BH7/GW4	13.0	3.80	2.1 to 2.9	2.57	1.23
BH9/GW5	13.0	2.55	1.6 to 2.3	1.89	0.66
BH101	6.0	3.6		1.19	2.41
BH102	6.5	4.1		1.79	2.31
BH103	6.0	3.2		0.66	2.54
Well 1*	4.0	2.46	-	2.0	0.46
Well 2*	4.0	2.60	-	2.1	0.5

* Wells located at 97 Cary Street.

2.3.2 Hydraulic conductivity

Slug tests (Chameleon, October 2021) provided K values for three boreholes BH101, 102 and 103 of 0.0029, 0.0015 and 0.0042 m/day respectively The geometric mean value of these results is 0.0026 m/day. Chameleon (September 2021) also provided K values for other wells of 0.3 m/day, considered more representative of the underlying formations.

2.4 Surface water

Lake Macquarie is located 100 m east of the site and Fennel Bay, part of Lake Macquarie, is located approximately 700 m to the north-west. Stony Creek discharges to Fennel Bay, and is located approximately 350 m to the west.

A westerly trending canal is located between Cary St and the creek, entering the creek just north of the Cook St bridge. Surveyed elevations of key surface water features are provided in Table 3 and used to inform boundary conditions for the model.

Table 3: Surveyed surface water elevations (mAHD)

Feature	High tide	Low tide	Mean
Lake Macquarie	0.11	0.07	0.09
Wetland	0.54	0.56	0.55
Canal	0.41	0.46	0.43
Stony Creek	0.13	0.09	0.11

3 GROUNDWATER MODELLING

Numerical modelling was conducted to simulate excavation dewatering.

A layered 3D numerical model was implemented, with model design undertaken using the Groundwater Vistas modelling environment. The numerical modelling code utilised for the simulations was USGS Modflow 2005, an industry standard finite-difference groundwater flow model.

3.1 Model setup

3.1.1 Discretisation

A four-layer model was setup, with 20 m row and column grid-spacing, refined to 10 m grid-spacing in the site area to improve resolution (Figure 2). The model base was assigned at -20 mAHD. Elevation top surfaces were assigned at:

- Layer 2: RL -3
- Layer 3: RL -5
- Layer 4: RL -10

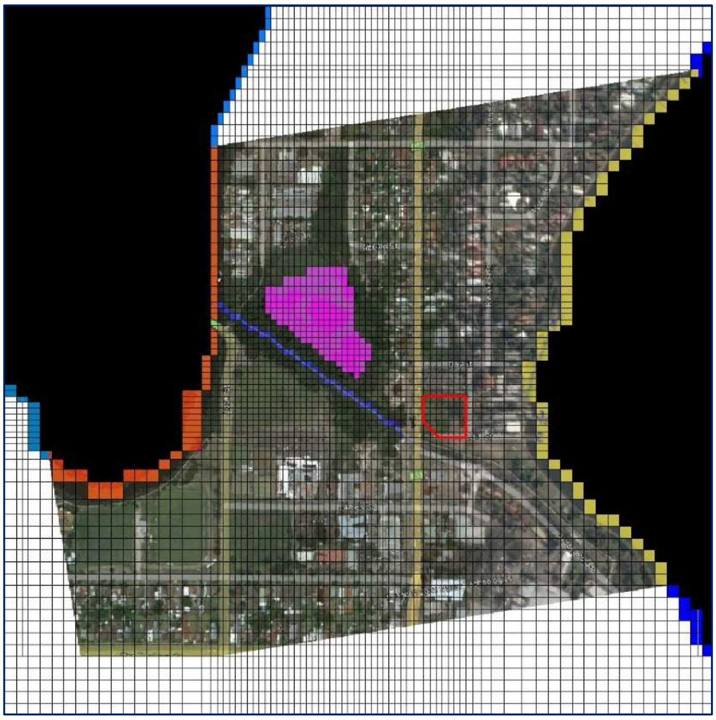

Figure 2 Model grid

3.1.2 Parameters

Based on the results of aquifer testing (refer Section 2.3) the horizontal hydraulic conductivity (K_h) adopted for the clay dominated upper formation was 0.0026 m/day (model layer 1). The horizontal hydraulic conductivity adopted for the underlying model layers was 0.3 m/day. Vertical hydraulic conductivity (K_v) was assigned an order of magnitude lower than K_h in all layers.

A specific yield (S_y) of 0.05 was assumed, representing relatively low effective porosity, typical of lithology with high fines content.

3.1.3 Boundary conditions

Constant-head boundaries were applied to the model edges to represent Lake Macquarie to the east, and Stony Creek and feeding Fennel Bay to the west (refer Figure 2) with head values assigned based on the mean surveyed levels (refer Section 2.4). No-flow cells were applied beyond these areas.

Modflow River cells were used to represent the wetland and the canal. This method provides a more realistic representation of such features compared with drain or constant-head cells. The wetland water level was assigned a value of 0.55 RL, and the canal water level was assigned a value of 0.43 mAHD.

Cut-off walls (secant piles)

The excavation area at the site was modelled to have an area approximately equivalent to the proposed basement. Secant pile cut-off walls are incorporated into the model using the Modflow HFB (horizontal flow boundary) package. The hydraulic parameters adopted have equivalent characteristics of 0.5 m thick walls with $1x10^{-5}$ m/day hydraulic conductivity and therefore are modelled as effectively impermeable. The toe level of the cut-off wall is simulated at -5 mAHD (9 mBGL)

Excavation drainage

Excavation drainage was simulated using the Modflow Drains package. The drain cell locations are located within the excavation perimeter, and assigned a drainage head (dewatering level) of -2 mAHD, representative of dewatering to 6 mBGL. The model drain cells have a conductance of 100 m^2/d.

3.2 Simulations and Results

The modelling included a baseline steady-state simulation, and transient simulation to estimate inflow and drawdown under drainage.

In addition, a steady-state simulation was made to represent the likely changes to groundwater head and flow direction post-construction.

3.2.1 Baseline condition

A baseline model was initially simulated with recharge across the model adjusted to establish an initial head condition at the site area that is within the range of the observed groundwater levels.

Figure 3 shows the baseline steady-state groundwater surface, using the adopted model parameters. The baseline assumes no dewatering, and provides a starting surface for the subsequent dewatering simulations.

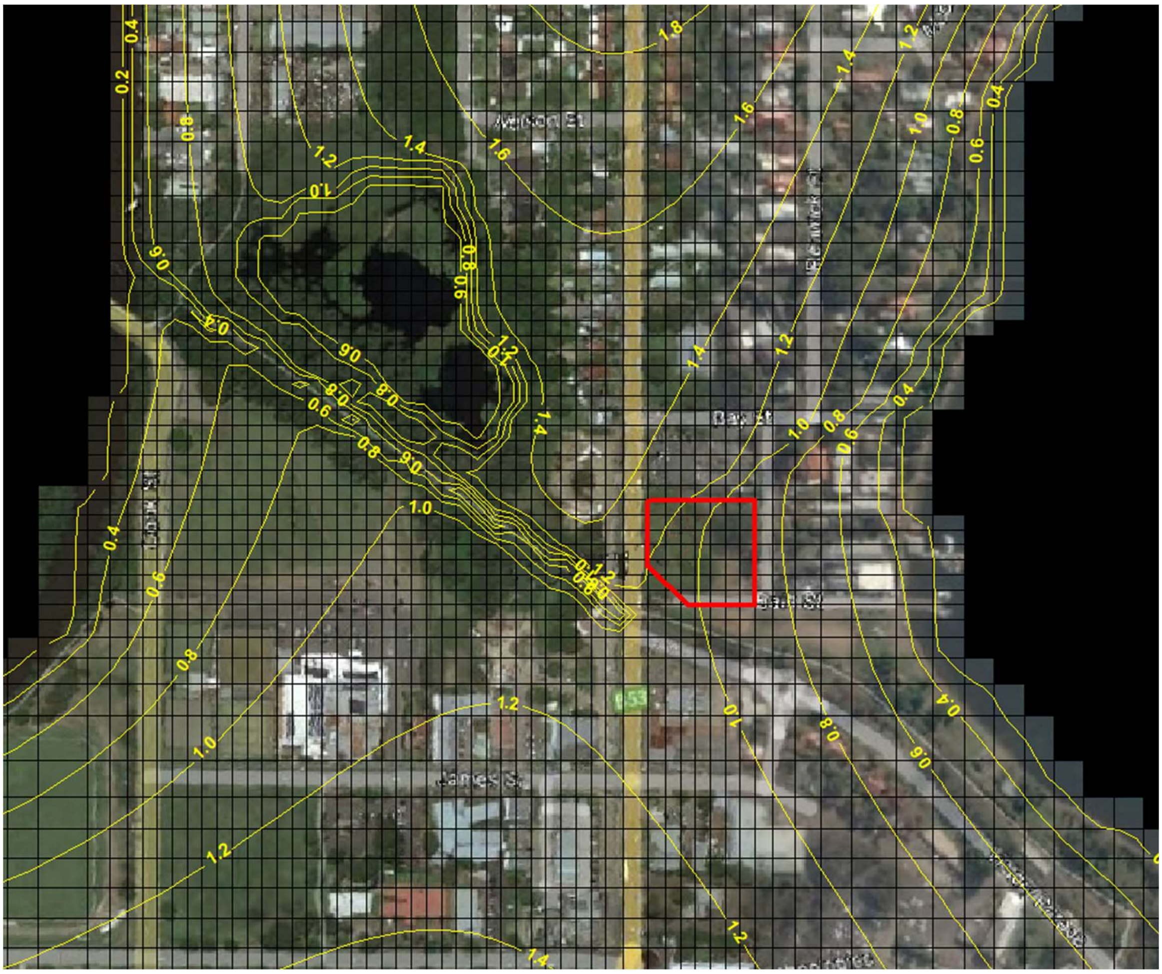

Figure 3 Groundwater baseline – no dewatering

The calibrated rainfall recharge rates in the model were:

- Northern model zone (north of the canal) 0.0001 m/day, equivalent to approximately 3.5% of rainfall.
- Southern model zone (south of the canal) 0.00025 m/day, equivalent to approximately 8% of rainfall.

3.2.2 Transient dewatering simulation

Figure 4 to **Figure 8** show transient drawdown for this scenario at 30, 60, 120, 180 and 360 days. Drawdown will be relative to the starting groundwater level at the time of commencement. Under this scenario, the model mass balance reports groundwater inflows as indicated in **Table 3**.

Table 4: Dewatering inflows

Time (days)	Inflow (m^3/day)	Inflow (L/sec)
7	20.4	0.24
30	20.3	0.23
60	20.1	0.23
120	19.8	0.23
180	19.6	0.23
360	19.3	0.22

The model indicates a maximum off-site extent of groundwater drawdown (0.2 m contour) of ~120 m to the north and south after 360 days of dewatering. The extent to the east/north-east toward the wetland is reduced due to the wetland boundary supporting the groundwater level locally. After 360 days dewatering, within approximately 30 m of the site boundary, a maximum drawdown of approximately 0.5 m is indicated.

Figure 4 Groundwater drawdown – 30 days

Figure 5 Groundwater drawdown – 60 days

Figure 6 Groundwater drawdown – 120 days

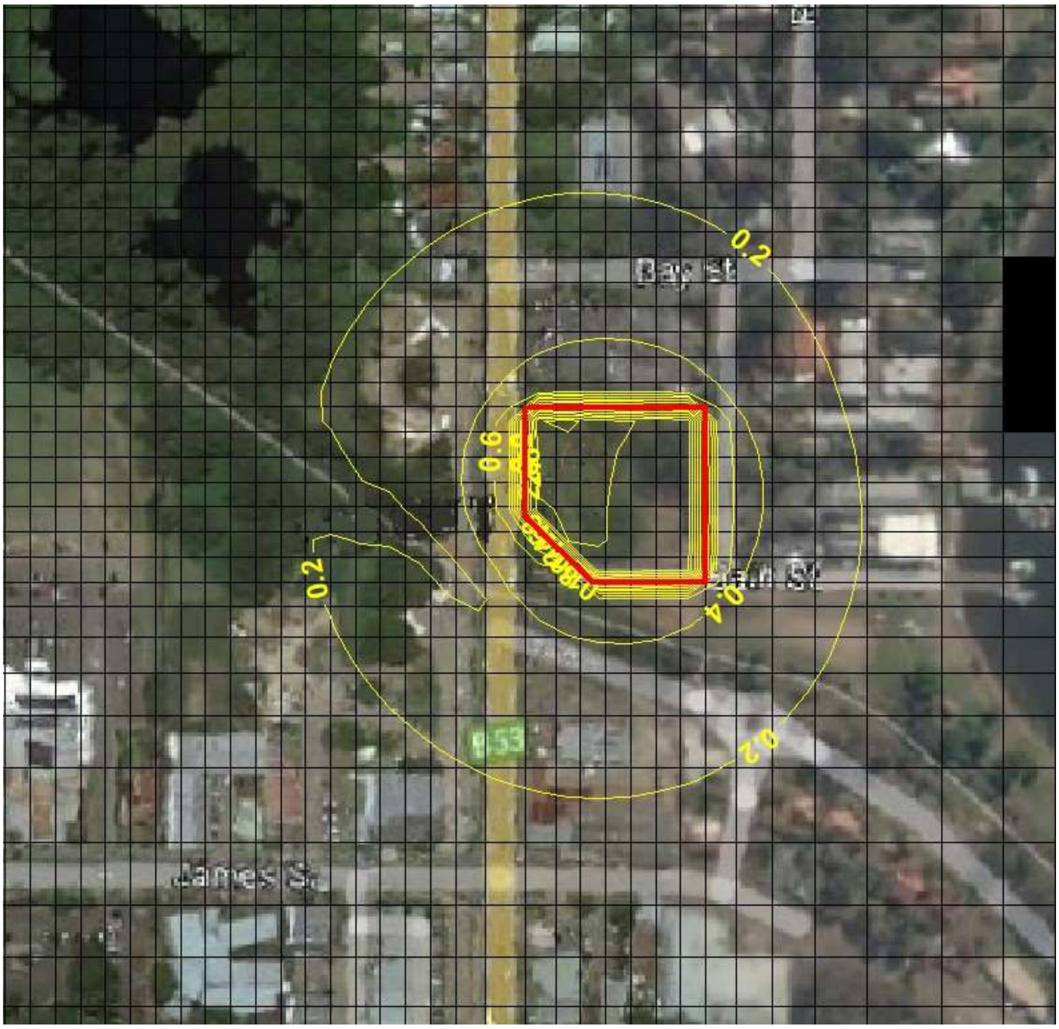

Figure 7 Groundwater drawdown – 180 days

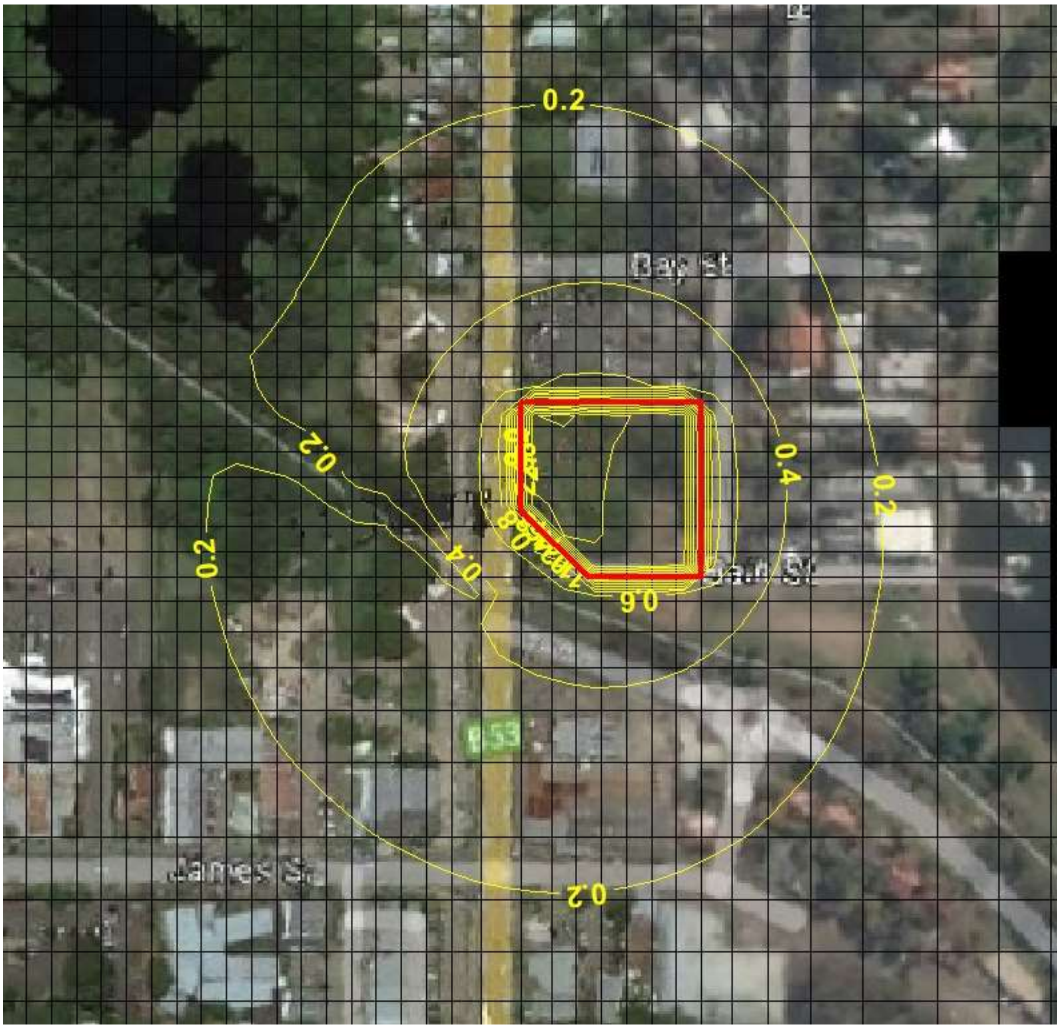

Figure 8 Groundwater drawdown – 360 days

Impact to wetland water balance

Based on model simulated groundwater inflow to the wetland with and without excavation dewatering, a summary of groundwater inflow and wetland impact is provided in Table 5, together with the estimated water level change.

Assuming a wetland area of 1.7 ha the water level change is indicated to be less than 9 mm by 180 days, and approximately 21 mm after 360 days dewatering.

It is noted that the wetland area varies according to water level, and has been reported up to 2.45 ha (GIS measurements undertaken by Dr Daniel McDonald on 25 January 2022). Assuming a wetland area of 2.45 ha the water level change is reduced by ~70% to less than 6 mm by 180 days, and less than 15 mm after 360 days dewatering (Table 5).

Table 5: Wetland Impacts

Time (days)	Cumulative wetland inflow* (m^3)	Difference (m^3/d)	Cumulative water level change at wetland (mm)

	without dewatering	**with dewatering**		wetland surface area of ~1.7 ha	wetland surface area of ~2.45 ha
30	257.8	241.1	16.6	0.98	0.68
60	515.6	478.3	37.3	2.2	1.5
90	773.3	712.8	60.6	3.6	2.5
120	1031.1	944.9	86.2	5.1	3.5
180	1546.8	1401.9	144.9	8.5	5.9
360	3093.7	2734.6	359.1	21.1	14.7
* inflow data from transient model reported mass balance data					

3.2.3 Post-construction groundwater simulation

To simulate the effects of the development, the cells in the model representing the basement were assigned a very low hydraulic conductivity value to simulate a zone with no effective permeability.

Figure 9 shows steady-state groundwater head and flow vector arrows for the baseline groundwater surface, which represents the pre-development groundwater system simulation (i.e. no dewatering), and **Figure 10** shows steady-state groundwater head and flow vector arrows for the post-construction groundwater surface.

The simulation indicates that:

- The model predicted changes in groundwater head and flow direction in the site vicinity are considered materially insignificant.
- No material change is indicated to groundwater discharge area locations or discharge rate.

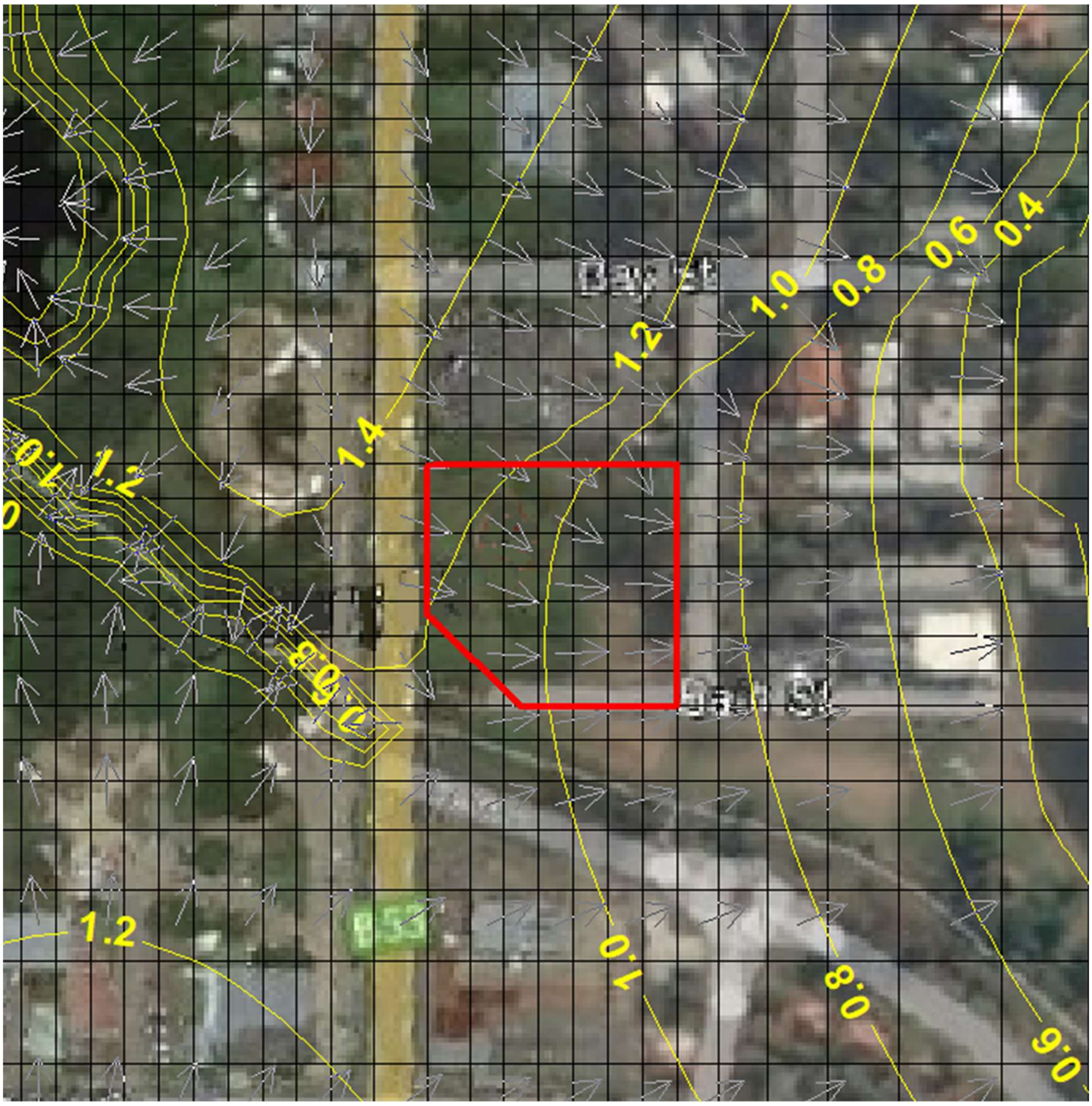

Figure 9 Groundwater head and flow vector arrows – pre-development

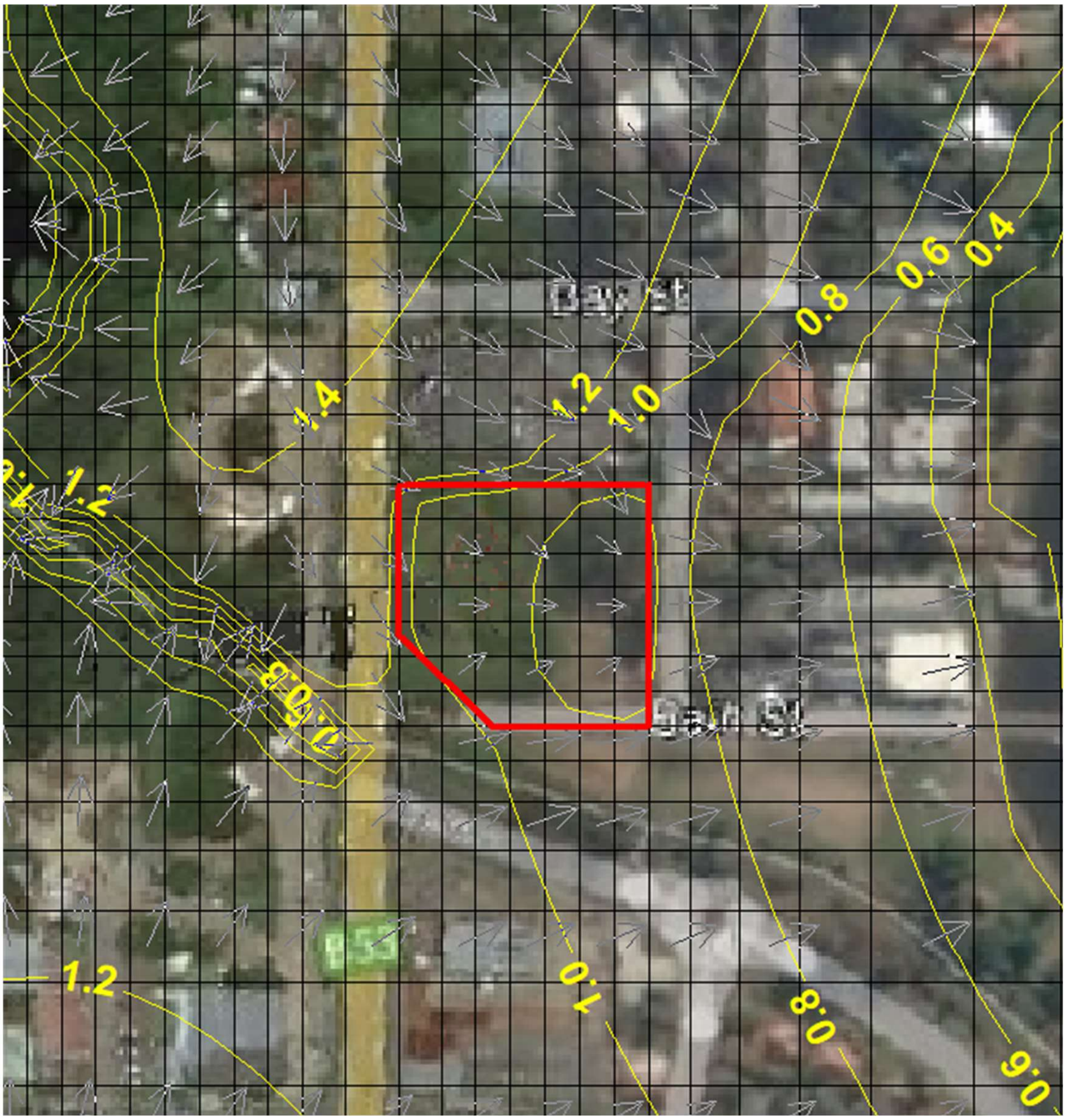

Figure 10 Groundwater head and flow vector arrows – post-development

3.2.4 Sensitivity analysis

The following simulations were undertaken to help understand model sensitivity to parameters (sensitivity analysis):

- Case 1 - Layer 1 vertical hydraulic conductivity increased to equal the horizontal hydraulic conductivity;
- Case 2 - Layer 1 horizontal hydraulic conductivity increased by a factor of two.
- Case 3 - Layer 1 horizontal hydraulic conductivity decreased by a factor of two.
- Case 4 - Layer 1 specific yield reduced from 5% to 2.5%.

The model predicted outputs are presented in Appendix B for 30, 120 and 360 days, together with tabulated excavation inflow and a comparison of wetland impacts (water level change at wetland) for the sensitivity simulations (also for 30, 120 and 360 days) compared with the transient simulation presented in Section 3.2.2.

For each of the sensitivity cases, only the parameter of interest is changed, for the purpose of evaluating how model predictions might be affected by different values. Hence, these models are effectively decalibrated, and should not be considered reliable for predictions. For example, increasing K by a factor of two doubles the transmissivity of the upper model layer, which would normally require a significant increase to model recharge and/or an adjustment to specific yield, in order to rematch the model to observed groundwater levels.

The results show that the model is sensitive to hydraulic conductivity, as summarised below:

- Case 1 - Increasing model vertical hydraulic conductivity (K_v=K_h) results in ~20% increase in groundwater dewatering rates. A slightly increased extent of drawdown is observed that slightly increases the impact to the wetland. The maximum cumulative additional impact is <1.2 mm.
- Case 2 - Increasing model K results in ~17% increase in groundwater dewatering rates. An increased extent of drawdown is observed that increases the impact to the wetland. The maximum cumulative additional impact is ~55 mm, noting that in a calibrated model this would be reduced by a higher rate of recharge.
- Case 3 - Reducing model K results in ~23% decrease in groundwater dewatering rates. A significantly decreased extent of drawdown is observed that reduces the impact to the wetland.
- Case 4 - Reducing model specific yield (S_y) results in ~1.5% decrease in groundwater dewatering rates. A slightly increased extent of drawdown is observed that slightly increases the impact to the wetland. The maximum cumulative additional impact is <4 mm.

4 DISCUSSION

The dewatering simulations provide inflow values and drawdown that are valid for the hydrogeological conditions as modelled. Model simulated inflow rates are indicated to be below 1 L/sec, and assume that the cut-off wall installation is satisfactory – refer to Section 3.2.

The model indicates a maximum off-site extent of groundwater drawdown (0.2 m contour) of ~120 m to the north and south after 360 days of dewatering. The extent to the east/north-east toward the wetland is reduced due to the wetland boundary supporting the groundwater level locally.

After 360 days dewatering, within approximately 30 m of the site boundary, a maximum drawdown of approximately 0.5 m is indicated.

The hydraulic impact to the wetland is low, with a cumulative water level change due to reduced groundwater inflow, indicated to be less than 9 mm by 180 days, and approximately 21 mm after 360 days dewatering.

4.1 Dewatering method

The model simulations assumed dewatering within the excavated areas using the Modflow Drain package. Dewatering using wells may require slightly higher flow rates and/or longer dewatering lead times to achieve target drawdown, depending on the number and location of wells and/or sumps.

In practice, wells/sumps should be located inside the sheet piled areas. Dewatering from outside the sheet-piling will be ineffective and lead to higher inflow rates and drawdown.

4.2 General comments

Estimated extents of drawdown and inflows will be sensitive to the bulk field value for hydraulic conductivity and specific yield. We note that the modelling is based on a parameter set that is informed by limited site-specific investigation (slug tests) and actual hydraulic parameters may vary from those adopted. Pumping tests, and boreholes to characterise the deeper lithology, have not been undertaken, and accordingly, the dewatering system design should incorporate flexibility to increase or otherwise manage dewatering rates, should such be necessary if higher inflows are incurred, for example due to hydraulic parameter variation from modelled.

The dewatering system should be installed and operated by an experienced contractor, and should incorporate sufficient redundancy to ensure that failure of any element of the depressurisation system does not compromise the safety of the excavation.

4.3 Margin of safety

The construction contractor should ensure the basement designer/engineer's advice and recommendations are taken in relation to the margin of safety, and at what point during construction the dewatering/depressurisation system can be safely decommissioned.

We advise that the groundwater modelling conducted neither evaluates nor implies a margin of safety, nor that risk of heave or slope failure is not present. The results should be interpreted by a suitably qualified engineer.

4.4 Uncertainty

All groundwater models are subject to uncertainty, which arises due to parameter uncertainty and conceptual uncertainty.

Conceptual uncertainty in the model arises because of the limitations necessary in simplifying complex hydrogeology for the purpose of constructing a practical model. Parameter uncertainty arises because the modelling adopts physical and hydraulic parameters which have not been fully tested in the field.

The approach undertaken for this project was deterministic, and actual parameters may vary from those adopted. Based on the geological and hydrogeological information available at the time of reporting, the model parameters adopted are considered reasonable, but do not necessarily represent a unique solution. Other interpretations are possible. Accordingly, the modelling results and predictions made in this report should be considered as indicative, and subject to interpretation.

5 GROUND SETTLEMENT ASSESSMENT

The groundwater drawdown due to the dewatering can result in the ground settlement of the surrounding area. The soil below the groundwater table is experiencing the effective stress which is less than the overburden stress. When the groundwater level is lowered, the effective stress on soil body increases proportionally to the pore pressure reduction. This leads to compression of the soil body and subsequent settlement on the ground surface.

The coefficient of volume compressibility (m_v) is defined as the volume change per unit volume per unit increase in effective stress. The coefficient of volume compressibility is measured in the laboratory consolidation test as follows.

$$m_v = \frac{1}{H_0}\left(\frac{\Delta H_i}{\Delta \acute{\sigma}}\right)$$

Where,

H_0 – initial thickness of the soil

ΔH_i – change in soil layer thickness

$\Delta \acute{\sigma}$ – change if effective stress

According to this relationship, the settlement of a soil layer due to the effective stress increase can be expressed as,

$$\Delta H_i = m_v H_0 \Delta \acute{\sigma}$$

For 'n' number of soil layers below the groundwater table, the total settlement of the ground is estimated by,

$$\Delta H = \sum_{i=1}^{n} m_{vi} H_i \Delta \acute{\sigma}$$

Where,

H_i – initial thickness of the i^{th} soil layer

m_{vi} - coefficient of volume compressibility of i^{th} soil layer

ΔH – total settlement

5.1 Geotechnical Parameters

The coefficient of volume compressibility is measured in laboratory from the oedometer test. The parameter is not a constant and depends on the stress level. As the coefficient of volume compressibility of materials are not known, CMW has taken conservative approach to approximate the coefficient of volume compressibility, assuming the reciprocal of 3/4 of the modulus of elasticity of the soil. Table 5 shows the average soil unit thicknesses and adopted modulus of elasticity values for the soil units by Chameleon Geosciences with approximate coefficients of compressibility adopted in this assessment. Ground model and modulus of elasticity as presented in Geotechnical investigation report by Chameleon Geosciences.

Table 5 – Geotechnical parameters of soil units

Unit	Top of unit (m)	Unit thickness (m)	Modulus of Elasticity (MPa)	Coefficient of compressibility (m2/MN)
Fill	0	0.5	6	0.22
Stiff to Very Stiff Residual Soil (Clay)	0.5	2.5	15	0.09
Very Stiff to Hard Residual Soil (Clay)	3.0	11.5	25	0.05
Conglomerate	14.0	-		

The groundwater level monitored over time in the same report indicates the groundwater levels are at around 3.0m below ground level. Hence the effective stress increase due to the dewatering is applied only to the very stiff to hard clay layer. The compressibility of the bedrock is assumed negligible.

5.2 Results and Discussion

The groundwater drawdowns predicted in Section 3.2 were used to calculate the ground settlement. For the predicted drawdowns, the expected ground settlements are presented in Table 6. The settlement contours for dewatering 180 days are presented in **Figure 11**. The settlement contours for other dewatering scenarios are attached in **Appendix A**.

Table 6 – Predicted Ground Settlements

Drawdown (m)	Change in Effective Stress (kPa)	Predicted Settlement (mm)
1.00	10.0	7
0.80	8.0	6
0.60	6.0	4
0.40	4.0	3
0.20	2.0	1

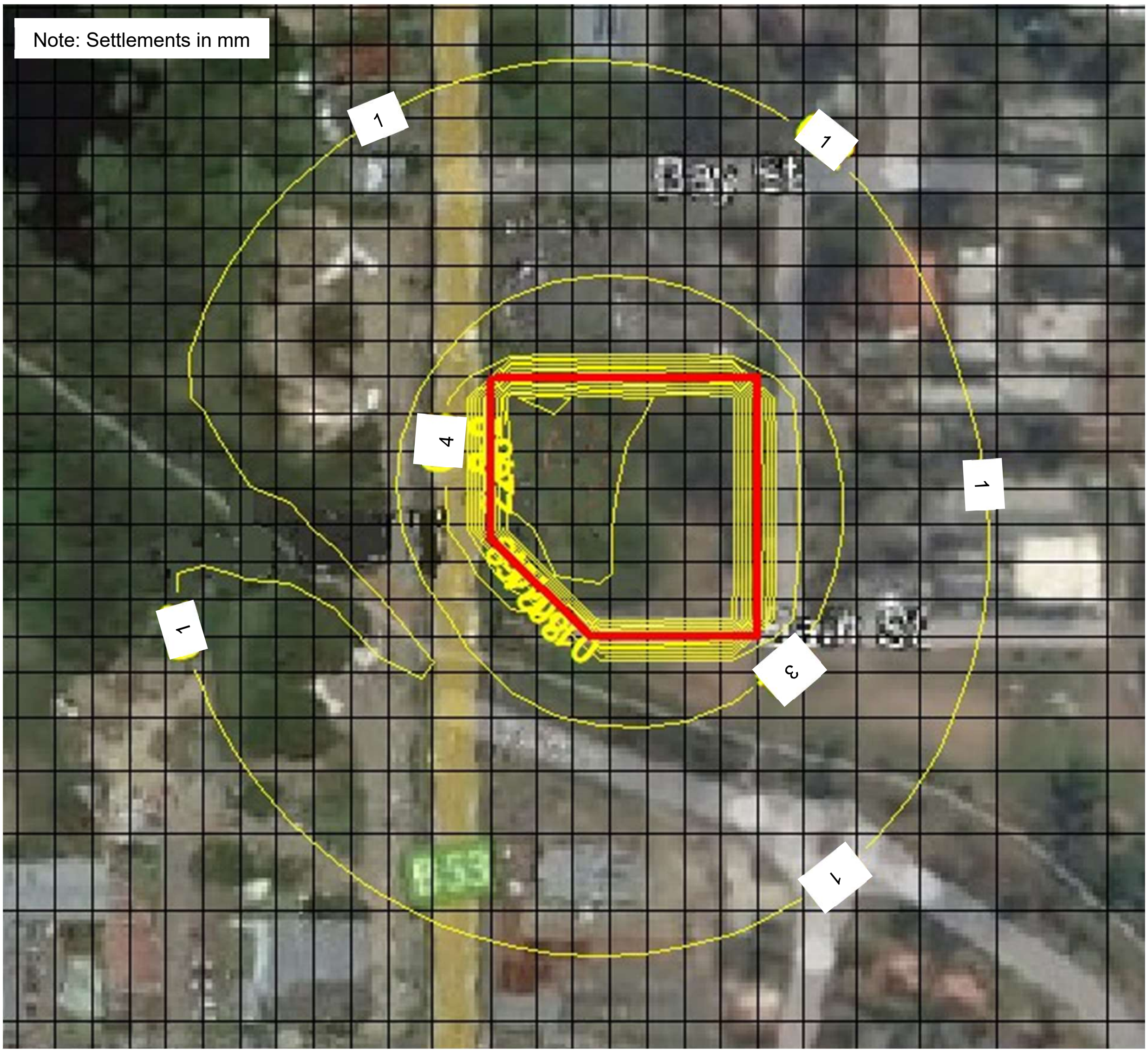

Figure 11 Ground surface settlement contours for dewatering for 180 days

6 CLOSURE

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of the ground conditions away from our investigation locations.

If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately.

This report has been prepared for use by Toronto Investments No1 Pty Ltd in relation to the Mixed Use Development at 114-120 Cary Street, 1,2,3,5 Bath Street and 3 Arnott Avenue, Toronto project in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than Toronto Investments No1 Pty Ltd and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

For and on behalf of CMW Geosciences

Prepared by: | Reviewed and authorised by:

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Senior Principal Hydrogeologist

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Senior Principal Geotechnical Engineer

Distribution: 1 electronic copy to Toronto Investments No1 Pty Ltd via email
Original held at CMW Geosciences

Appendix A - Ground Settlement Contours

Appendix B – Sensitivity Analysis

Sensitivity Analysis Simulations

The following additional simulations were undertaken for the purpose of sensitivity analysis:

- Case 1 - Layer 1 vertical hydraulic conductivity equal to horizontal hydraulic conductivity ($K_v = K_h$);
- Case 2 - Layer 1 horizontal hydraulic conductivity increased by a factor of two (K_h x 2).
- Case 3 - Layer 1 horizontal hydraulic conductivity decreased by a factor of two ($K_h \div 2$).
- Case 4 - Layer 1 specific yield (S_y) reduced to 2.5%.

The sensitivity simulations are uncalibrated model versions, provided for reference only, and not for design. They are intended to provide insight into numerical effects within the model due to a single parameter alteration. As discussed in Section 3.2.4 the results are provided for the purpose of evaluating how model predictions might be affected by different values, and these models are effectively decalibrated.

Case 1

Figures B1 to B3 show transient drawdown for Case 1 (Layer 1 $K_v = K_h$) at 30, 120 and 360 days. Under this scenario, the model mass balance reports groundwater dewatering inflow as indicated in **Table B1**, and wetland impacts as detailed in **Table B2.**

Table B1: Dewatering inflows – Case 1

Time (days)	Inflow (m^3/day)	Inflow (L/sec)
30	24.4	0.282
120	23.7	0.274
360	23.0	0.266

Table B2: Wetland Impacts – Case 1

Time (days)	Cumulative wetland inflow* (m^3)		Difference (m^3/d)	Cumulative water level change** at wetland (mm)	Comparison with transient case (Table 5) (mm)
	No dewatering	Case 1 dewatering			
30	257.81	244.9	12.9	0.76	-0.24
120	1031.1	952.1	79.1	4.7	-0.45
360	3093.7	2714.3	379.4	22.3	1.22

* inflow data from transient model reported mass balance data
** water level change calculation assumes a wetland surface area of ~1.7 ha, for 2.45 ha the impacts will be reduced by ~70%.

Figure B1 Case 1 - Groundwater drawdown – 30 days

Figure B2 Case 1 - Groundwater drawdown – 120 days

Figure B3 Case 1 - Groundwater drawdown – 360 days

Case 2

Figures B4 to B6 show transient drawdown for Case 2 (Layer 1 K_h x 2) at 30, 120 and 360 days. Under this scenario, the model mass balance reports groundwater dewatering inflow as indicated in **Table B3**, and wetland impacts as detailed in **Table B4.**

Table B3: Dewatering inflows – Case 2		
Time (days)	**Inflow (m^3/day)**	**Inflow (L/sec)**
30	23.9	0.277
120	23.1	0.267
360	22.3	0.258

Table B4: Wetland Impacts – Case 2					
Time (days)	**Cumulative wetland inflow* (m^3)**		**Difference (m^3/d)**	**Cumulative water level change** at wetland (mm)**	**Comparison with transient case (Table 5) (mm)**
	No dewatering	**Case 2 dewatering**			

30	257.81	192.8	-69.05	3.83	2.8
120	1031.1	706.4	-324.7	19.1	14.0
360	3093.7	1802.2	-1291.5	76.0	54.9

* inflow data from transient model reported mass balance data
** water level change calculation assumes a wetland surface area of ~1.7 ha, for 2.45 ha the impacts will be reduced by ~70%.

Figure B4 Case 2 - Groundwater drawdown – 30 days

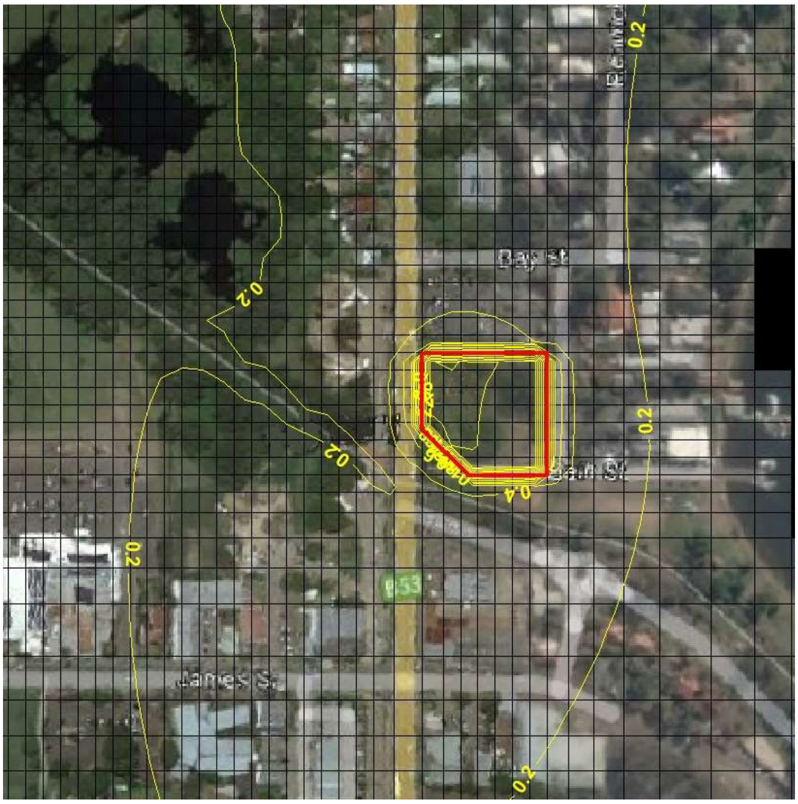

Figure B5 Case 2 - Groundwater drawdown – 120 days

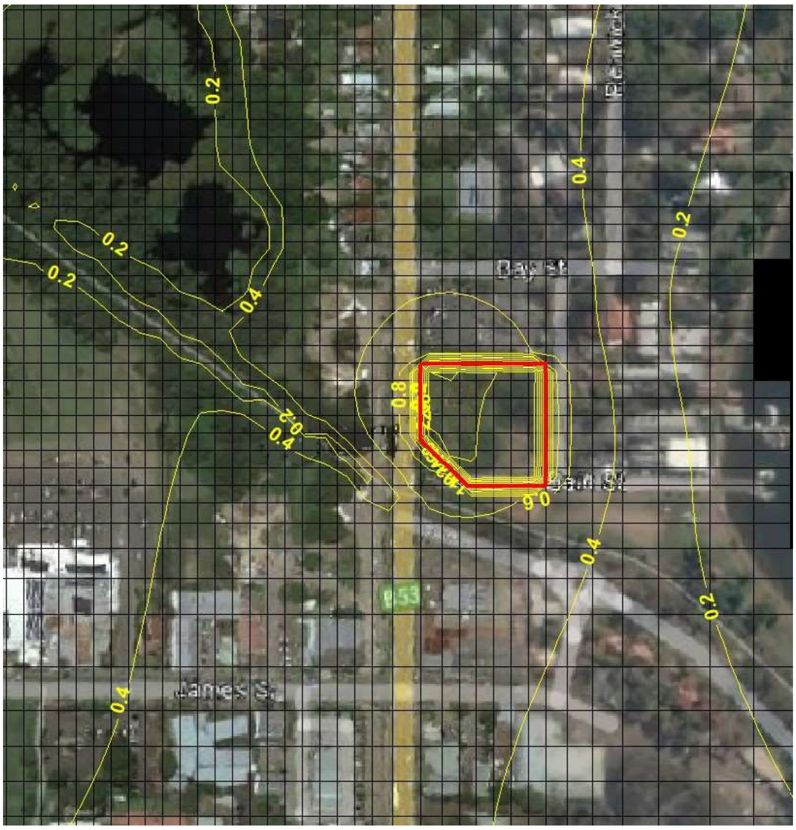

Figure B6 Case 2 - Groundwater drawdown – 360 days

Case 3

Figures B7 to B9 show transient drawdown for Case 3 (Layer 1 $K_h \div 2$) at 30, 120 and 360 days. Under this scenario, the model mass balance reports groundwater dewatering inflow as indicated in **Table B5**, and wetland impacts as detailed in **Table B6.**

Table B5: Dewatering inflows – Case 3		
Time (days)	**Inflow (m^3/day)**	**Inflow (L/sec)**
30	15.6	0.181
120	15.3	0.177
360	15.2	0.176

Table B6: Wetland Impacts – Case 3					
Time (days)	**Cumulative wetland inflow* (m^3)**		**Difference (m^3/d)**	**Cumulative water level change** at wetland (mm)**	**Comparison with transient case (Table 5) (mm)**
	No dewatering	**Case 3 dewatering**			
30	257.81	264.57	+6.77	-0.4	-1.4
120	1031.1	1084.1	+52.97	-3.12	-8.2
360	3093.7	3428.5	+334.8	-19.7	-40.1
* inflow data from transient model reported mass balance data ** water level change calculation assumes a wetland surface area of ~1.7 ha, for 2.45 ha the impacts will be reduced by ~70%.					

Figure B7 Case 3 - Groundwater drawdown – 30 days

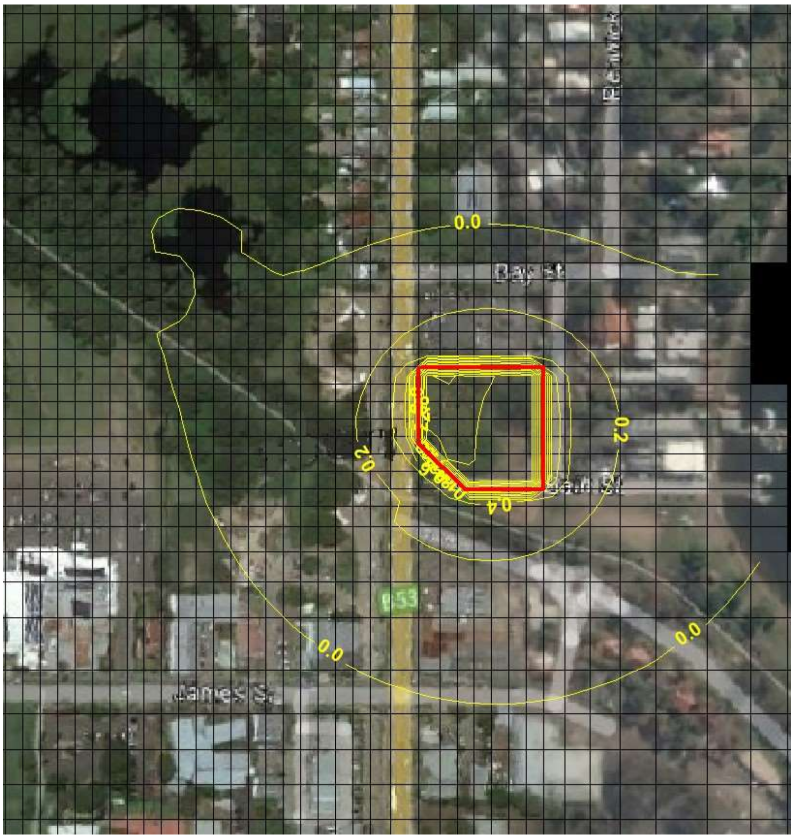

Figure B8 Case 3 - Groundwater drawdown – 120 days

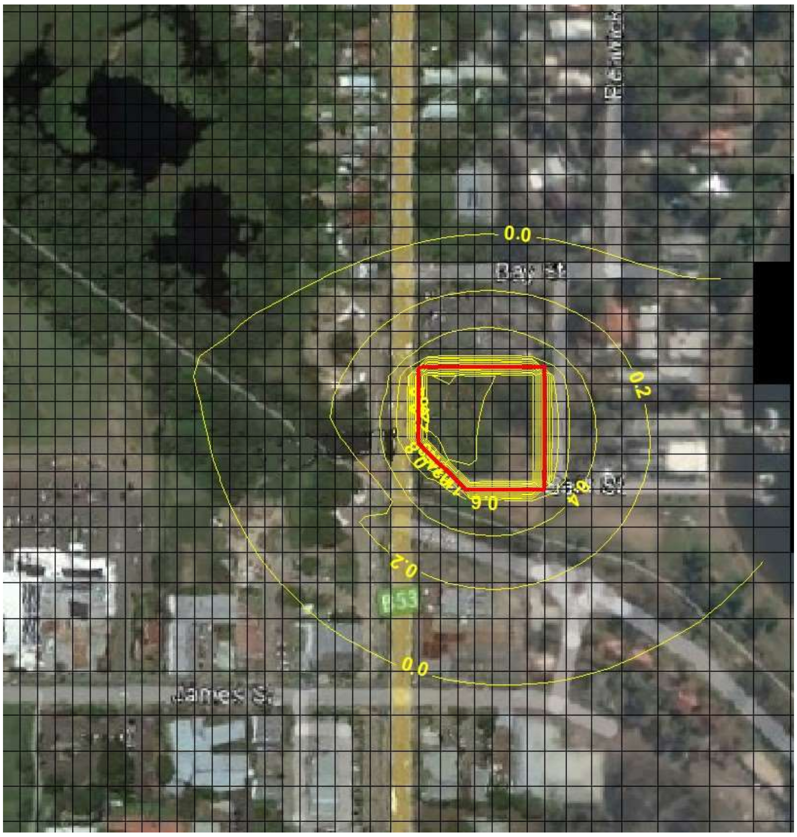

Figure B9 Case 3 - Groundwater drawdown – 360 days

Case 4

Figures B10 to B13 show transient drawdown for Case 4 (Layer 1 S_y = 2.5%) at 30, 120 and 360 days. Under this scenario, the model mass balance reports groundwater dewatering inflow as indicated in **Table B7**, and wetland impacts as detailed in **Table B8.**

Table B7: Dewatering inflows – Case 4		
Time (days)	**Inflow (m^3/day)**	**Inflow (L/sec)**
30	20.1	0.233
120	19.5	0.226
360	19.1	0.221

Table B8: Wetland Impacts – Case 4					
Time (days)	**Cumulative wetland inflow* (m^3)**		**Difference (m^3/d)**	**Cumulative water level change** at wetland (mm)**	**Comparison with transient case (Table 5) (mm)**
	No dewatering	**Case 4 dewatering**			

30	257.81	238.8	-19.0	1.12	+0.12
120	1031.1	925.9	-105.25	6.19	+1.09
360	3093.7	2669.8	-423.9	24.9	+3.84
* inflow data from transient model reported mass balance data ** water level change calculation assumes a wetland surface area of ~1.7 ha, for 2.45 ha the impacts will be reduced by ~70%.					

Figure B10 Case 4 - Groundwater drawdown – 30 days

Figure B11 Case 4 - Groundwater drawdown – 120 days

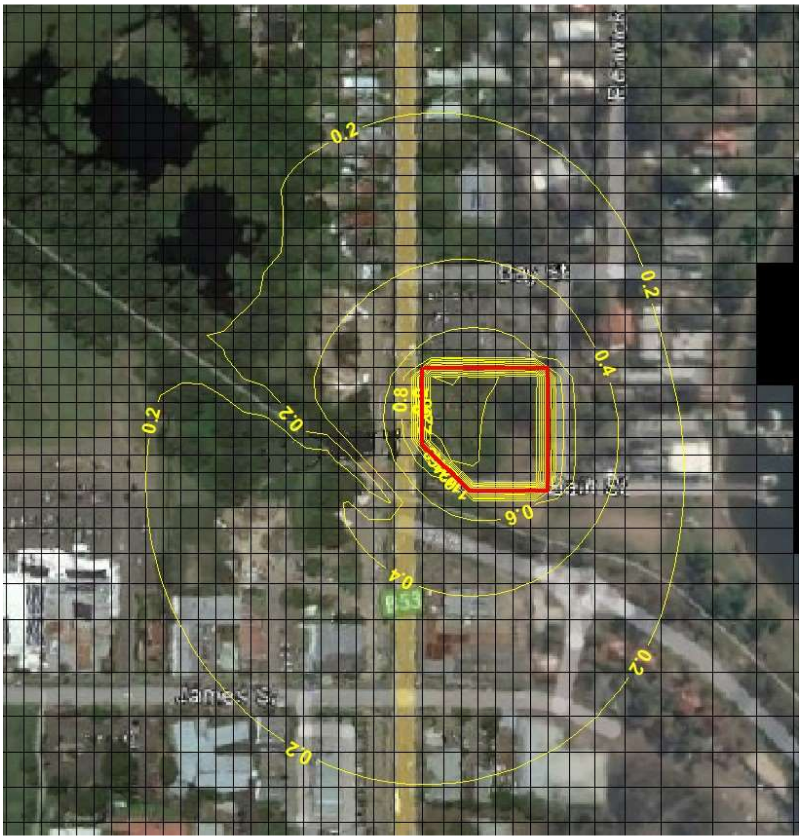

Figure B12 Case 4 - Groundwater drawdown – 360 days

APPENDIX J

Dewatering Management Plan

Chameleon Geosciences Pty Ltd

DEWATERING MANAGEMENT PLAN

118 Cary Street
(114-120 Cary St, 1, 2, 3, 5 Bath St and 3 Arnott Ave)
Toronto NSW 2283

Prepared for

TORONTO INVESTMENTS NO.1 PTY LTD

Report No. GS8030-5A

20th January 2022

Chameleon Geosciences Pty Ltd. ACN *086 993 937*
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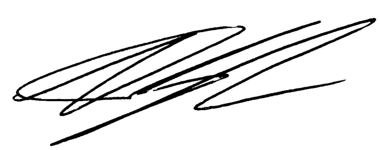
DOCUMENT HISTORY

Revision No.	Issue Date	Description	Issued By:
00	13/09/2021	Draft Report	Shyam Ghimire
01	20/01/2021	First Revision	Nick Kariotoglou



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- Appendix C - Laboratory Test Results
- Appendix D – "Groundwater Drawdown Model and Detailed Settlement Analysis – 114-118 Cary Street, 1,2,3,5 Bath Street and Arnott Avenue Toronto" by CMW Geosciences Pty Ltd (CMW) Ref. SYD2021-0134AB Rev4 21 February 2022
- Appendix E - Water NSW Groundwater Guidelines

REFERENCES

1. Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations. Bull. No.36, Waterways Experiment Station, Corps. Of Engineers, U.S. Army, pp. 50.
2. Geotechnical Investigation Report GS8030-1A Rev03 118 Cary Street, Toronto NSW 2283, 25th February 2022.
3. Chameleon Geosciences Pty Ltd (2021). Response to amended statement of facts and contentions. Letter report in response to the Land and Environment Court. Dated 18th June 2021.
4. "Groundwater Drawdown Model and Detailed Settlement Analysis – 114-118 Cary Street, 1,2,3,5 Bath Street and Arnott Avenue Toronto" by CMW Geosciences Pty Ltd (CMW) Ref. SYD2021-0134AB Rev4 21 February 2022.
5. National Water Quality Management Strategy Paper No.4 - ANZ Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (October 2000).
6. ANZG (2018) Guidelines for Fresh and Marine Water Quality. https://www.waterquality.gov.au/anz-guidelines.
7. Office of Water NSW - General terms of Approval for Dewatering.
8. Office of Water NSW Fact sheet - Construction dewatering Information for councils and applicants(https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU).

1. INTRODUCTION

Chameleon Geosciences Pty Ltd has been commissioned by TORONTO INVESTMENTS NO.1 PTY LTD Ltd to prepare a Dewatering Management Plan (DMP) for the site located at 118 Cary St' to '114-120 Cary Street, 1,2,3,5 Bath Street, and 3 Arnott Avenue Toronto NSW 2283. The proposed development comprises the construction of a mixed-use development with two basement levels for underground parking. Maximum excavation depths of approximately 7.5m below ground level will be required for the proposed bulk excavation including the lift shaft.

A comprehensive groundwater modelling and settlement analysis was carried out with the details outlined in reference 4, and Appendix D (Groundwater Drawdown Model and Detailed Settlement Analysis – 118 Cary St Toronto by CMW Geosciences Pty Ltd (CMW) Ref. SYD2021-0134AB Rev4 21 February 2022). Also, a water quality assessment was undertaken for the preparation of the Dewatering Management Plan (see Reference 2).
This Dewatering Management Plan was prepared to satisfy the requirements of the Office of Water NSW for this project site. The report therefore provides comments and advice on the following:

- Subsurface conditions including groundwater
- Dewatering options and guidelines for discharge from the site
- Estimated groundwater seepage rates
- Estimated drawdown profile
- Assessment of adverse effects on neighbouring structures

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

Before preparing this report, the following information was made available to Chameleon Geosciences Pty Ltd.:

- Topographical Survey Map, prepared by Duggan Mather Surveyors, surveyed on 23rd September 2016, and revised again on 10th October 2016.

- Architectural drawings for Development Application, prepared by Mark Lawler Architects, including plans, elevations, and sections, Drawing No. 1588 DD-1-01 to 1588 DD-7-12.
- Geotechnical Assessment Report by JK Geotechnics, dated 13th October 2016, Reference No. 29644S Brpt.
- Groundwater Drawdown Model and Detailed Settlement Analysis – 118 Cary St Toronto by CMW Geosciences Pty Ltd (CMW) Ref. SYD2021-0134AB Rev4 21 February 2022.
- Councils Statement of Facts and Contentions (case #2020/00091325 dated 10th July 2020).
- Water NSW General Terms of Approval for Dewatering (Reference 7).

Other information relied upon by Chameleon includes:

- Geotechnical Investigation Report GS8030-1A Rev03 118 Cary Street, Toronto NSW 2283, 25th February 2022.
- Chameleon Geosciences Pty Ltd (2021). Response to amended statement of facts and contentions. Letter report in response to the Land and Environment Court. Dated 18 June 2021.
- Amended Statement of Facts and Contentions
- Structural Engineering Assessment letter from Northrop Consulting Engineers Pty Ltd (Northrop) NL171556 / 17 June 2021 / Revision A
- Water NSW Fact Sheet - Exemption Guidelines for Dewatering (Reference 8)

3. SITE DESCRIPTION

The site is almost trapezoidal comprising Lot 4-10 DP 2505 and Lot 101 DP 1110774 corner of Cary Street, Bath Street, and Arnott Avenue. It is bound to the west by Cary Street and the east by Arnott Avenue. To the south of the site is a vacant grassed area and then Victory Parade. To the north of the site is a McDonald's development comprising a single-storey building. The proposed site is located about 100m to the west of Toronto Bay, which is part of Lake Macquarie, within gently to moderately undulating terrain. The ground surface within the site slopes down to the southwest and northwest with slopes generally of about 1°

to 2°, but locally steeper at about 3° in the north-eastern corner. At the time of site investigation, the site was vacant and covered with grass and medium-sized trees.

4. SUBSURFACE CONDITIONS

4.1 Geology

Gosford-Lake Macquarie 1:100,000 map sheet indicates the site is underlain by Newcastle Coal Measures, comprising conglomerate, tuff, siltstone, claystone, and coal (Chameleon, 2020). Residual soils and fill overly the conglomeratic bedrock.

4.2 Site Specific Hydrogeology

Chameleon undertook a geotechnical investigation for the project site aimed to obtain groundwater data and additional sub-surface soil and rock information, as following:

- Chameleon Report GS8030-1A Groundwater Seepage Analysis Report.
- Groundwater Drawdown Model and Detailed Settlement Analysis – 118 Cary St Toronto by CMW Geosciences Pty Ltd (CMW) Ref. SYD2021-0134AB Rev4 21 February 2022.

Groundwater was encountered during the auger-boring in all the boreholes. It is noted that the groundwater observation may have been made before water levels had stabilised. It should be noted that groundwater levels may be subject to seasonal and daily fluctuations influenced by factors such as rainfall and the future development of the surrounding properties. After heavy rain, groundwater may be present in the fill due to the surface infiltration.

After the borehole drilling, groundwater monitoring wells were installed at BH1, BH3, BH5, BH7, and BH9. The groundwater levels monitored in the wells after the installations are summarised below in Table 1.

A further three groundwater monitoring wells were installed later (i.e., BH101, BH102, and BH103), with the details summarised below in Table 1. During the drilling, two large rainfall events occurred, and due to the slow recovery rates and relatively impermeable soils, no apparent effect on flow direction, levels, or flow rate was observed.

Table 1: Standing Groundwater Levels

Borehole/ Monitoring Well	Well Depth (m)	Approximate Surface R.L (m AHD)	WATER LEVEL (m bgl)	DATE
BH1/GW1	13.0	5.5	4.7	10/01/2020
			4.9	10/07/2020
			4.4	10/09/2020
			4.4	16/09/2020
			4.7	01/10/2020
			4.1	07/10/2020
			4.9	09/10/2020
			4.7	01/12/2020
			4.6	17/06/2021
			4.8	24/08/2021
BH3/GW2	13.5	4.14	3.4	10/01/2020
			3.6	10/07/2020
			3.4	10/09/2020
			3.4	16/09/2020
			3.4	01/10/2020
			3.6	07/10/2020
			3.5	9/10/2020
			3.3	1/12/2020
			3.3	17/06/2021
			3.4	24/08/2021
BH5/GW3	9.5	3.85	2.7	10/01/2020
			2.9	10/07/2020
			2.6	10/09/2020

			2.7	16/09/2020
			2.7	01/10/2020
			2.9	07/10/2020
			3.0	09/10/2020
			2.6	1/12/2020
			3.0	17/06/2021
			2.7	24/08/2021
BH7/GW4	13.0	3.80	2.5	10/01/2020
			2.9	10/07/2020
			2.1	10/09/2020
			2.1	16/09/2020
			2.5	01/10/2020
			2.9	07/10/2020
			2.9	09/10/2020
			2.3	1/12/2020
			2.9	17/06/2021
			Not found	24/08/2021
BH9/GW5	13.0	2.55	1.9	10/01/2020
			2.0	10/07/2020
			1.6	10/09/2020
			1.6	16/09/2020
			1.9	01/10/2020
			2.0	07/10/2020
			2.3	09/10/2020
			1.90	01/12/2020
			2.1	17/06/2021

			1.6	24/08/2021
Well 1 (97 **Cary St)**	Approx. 4m	2.46	2.0	01/12/2020
			2.0	17/06/2021
			2.0	24/08/2021
Well 2 (97 **Cary St)**	Approx 4m	2.60	2.1	01/12/2020
			2.1	17/06/2021
			2.1	24/08/2021
BH101/GW6	6.0	3.60	1.19	07/12/2021
BH102/GW7	6.5	4.10	1.79	07/12/2021
BH103/GW8	6.0	3.20	0.66	07/12/2021

After the borehole drilling, groundwater monitoring wells were installed at BH1, BH3, BH5, BH7, and BH9 (referred to as GW1 to GW5). Later, three additional monitoring wells (i.e., GW6 to GW8) were installed at BH101, BH102, and BH103. The groundwater levels monitored in the wells after the installations are summarised below in Table 1. Based on the field observations from the monitoring wells, Site specific hydrogeological details are summarised in Table 2 below.

Table 1. Site Specific Hydrogeology

Item	**Details**
Groundwater Flow Direction	Groundwater direction is expected to be to the south to the south-east, as shown by the drop in elevation levels of the groundwater-surface measured in the wells.
Groundwater Odour	No odour was noted during sampling

5. LABORATORY TESTING

5.1 Pre-Dewatering Groundwater Quality

Groundwater samples were taken from two of the three piezometers installed by Chameleon at the southern and northern ends of the site. The samples were then sent to a NATA accredited laboratory for analysis. The results of the water quality testing are summarised in Table 3. Detailed laboratory report sheets are attached in Appendix C.

Table 2. Background Groundwater Laboratory Analysis

Analyte/Parameter Tested	BH1	BH2
Groundwater pH	6.86	7.37
Electrical Conductivity (EC)		
Electrical Conductivity (µS/cm)	217	729
Total Dissolved Solids		
TDS	181	681
Total Suspended Solids		
Suspended Solids (mg/L)	158	107
Turbidity		
Turbidity (NTU)	154	107
Chloride by Discrete Analyser		
Chloride	32	55
Hardness as CaCO3		
Total Hardness	56	125
Total Metals		
Arsenic (mg/L)	0.004	0.003
Cadmium (mg/L)	0.0001	0.0002
Chromium (mg/L)	< 0.001	< 0.001
Copper (mg/L)	0.012	0.007
Lead (mg/L)	0.002	0.004
Nickel (mg/L)	0.005	0.002
Zinc (mg/L)	0.044	0.094
Dissolved Mercury		
Mercury (mg/L)	< 0.0001	< 0.0001
Total Petroleum Hydrocarbons (TPH)		

TPH (µg/L)	All results below detection limits	All results below detection limits
Total Recoverable Hydrocarbons (TRH)		
TRH (µg/L)	All results below detection limits	All results below detection limits
BTEXN		
BTEXN (µg/L)	All results below detection limits	All results below detection limits

From the above analytical results, we note that while levels from the test results for metals, hydrocarbons, and pH are all within the acceptable range for discharge, the levels for turbidity, suspended solids, and total dissolved solids are above acceptable limits.

Groundwater will require pre-treatment such as sedimentation tanks or the use of a flocculent to reduce SS, TDS, and turbidity to acceptable levels before discharging into local stormwater/sewer infrastructure. This would be a standard exercise of reducing particles in water before the discharge. Ongoing monitoring of groundwater levels and groundwater quality will be required during dewatering activities as part of the water removal process. Other parameters such as oil & grease, phenols, sulphides, and PAHs will be sampled as part of the full dewatering process.

6. GROUNDWATER MODELLING ASSESSMENT

6.1 Model Development

The construction of the basement requires excavating to the depth of approximately 7.5m below the ground level (BGL), equivalent to the maximum excavation depth including the lift shaft. The site is underlain by very stiff to hard high plasticity CLAY, overlying variably conglomerate bedrock. At the bulk excavation level, the ground formation is mainly consisted of very stiff to hard moist silty CLAY.

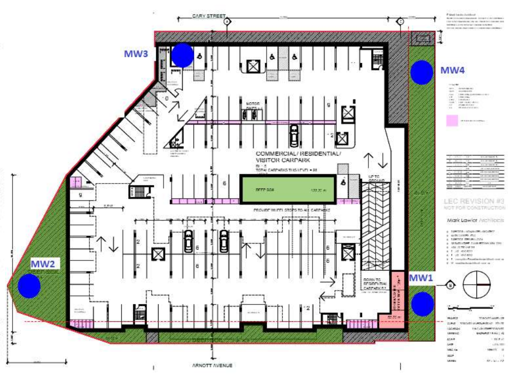
For this project, comprehensive groundwater modellings were carried out to conduct seepage analysis, estimate flow rates, and expected inflow volumes during and after the construction. The details of calculations and modellings are summarised in references 2, 4.

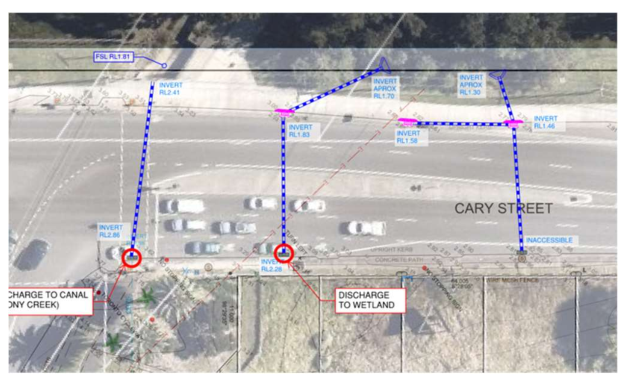
6.2 Results of Analysis

The numerical analysis simulations represented in Appendix D results in an initial conservative flow value of 0.24 L/sec and will be reduced to 0.22 L/sec after six months for the proposed excavation, which is approximately 0.007 ML(Mega Litres)/Year from the proposed excavation area. The calculation of this annualised flow rate is based on transient drawdown and long-term permeability values.

6.3 Pumping Method

Based on the analysis carried out, a sump and pump system may be used to de-water the site during and after the excavation. The project site plan showing potential discharge points (stormwater pits), and a diagram of the hypothetical sump and pump groundwater collection system are illustrated below.





Monitoring Well locations

Discharge Points

NB: discharge will be to the stormwater system unless otherwise notified

7. DEWATERING MANAGEMENT PLAN

7.1 Risks Associated with Dewatering

Generally, during the dewatering of a site for basement excavation, the following potential environmental and engineering risks need to be considered:

- Acidic leachate entering the environment from exposed acid sulphate soils exposed to oxygen when the water table is drawn down.
- Adverse impact on receiving environment from discharging poor quality or contaminated water.
- Adverse impact to existing groundwater users.
- Settlement of neighbouring foundations and services due to the drawdown of the water table.

7.2 Drawdown Impact

In specific cases, dewatering may induce ground subsidence on neighbouring properties, associated with the increased vertical effective stress of the underlying landform. It is considered that there is a low risk that dewatering would generate significant drawdown and settlement in the ground profile.

An experienced geotechnical engineer should verify any potential settlement calculations. The detail of this information is summarised in GMW Geosciences dated 21 February 2022: Groundwater Drawdown Model and Detailed Settlement Analysis – 114-120 Cary Street, 1,2,3,5 Bath Street and 3 Arnott Avenue Toronto.

As the site is within known occurrences of Acid Sulphate Soils and Potential Acid Sulphate Soils, the water treatment will also allow for any pH adjustments that may be required from waters entering the holding tanks for pre-treatment.

Options for disposal of groundwater included discharge to the stormwater system, or in some cases to the sewer system or off-site disposal at appropriate waste facilities. Treatment is most likely to be required with flocculants (and possible chemical treatment if any future parameters fail) prior to disposal to protect the environment and marine life (especially if discharging to the stormwater system).

7.3 Groundwater Monitoring Plan

Water quality and groundwater level monitoring will need to be carried out during the construction to ensure the discharge quality meets the established criteria. Chameleon notes that the excavation will be carried out to the property boundaries. As a result, the monitoring wells within the site will become redundant.

Three monitoring wells will be required to monitor groundwater levels during and after the construction. These may be installed outside the area of excavation in the footpath on the street at the southeast, northeast and northwest corners of the site, with testings at the monitoring frequencies outlined in Table 4. Monitoring wells in the public footpath would be subject to Council approval. Potential monitoring locations are presented in Figure 1 – Site Plan (Appendix B).

Establishment of background groundwater elevation and water quality prior to the dewatering will allow a better comparison with the release criteria and an assessment of potential treatment options.

Table 3. Monitoring Regime for Groundwater Quality

Parameter	Monitoring Frequency
Groundwater Level pH (field) Electrical Conductivity (field)	• Four times each month before dewatering • Daily for the first two weeks, then weekly during dewatering
Turbidity and Suspended Solids Oil and Grease Dissolved Metals	• Four times fortnightly before dewatering • Weekly for the first four weeks, then fortnightly for the remainder of dewatering

7.4 Record & Reporting

The Principal Contractor shall maintain a record of all water quality and groundwater level monitoring, along with details of corrective and preventative actions implemented in relation to the dewatering activity. The following reports shall be prepared:

- A weekly (interim) report issued upon receipt of laboratory analysis results that identifies potential compliance issues or water quality impacts that require immediate action, and other recommended preventive/corrective actions:

- A monthly dewatering report summarising the water quality data and management strategies implemented during the entire work. The report shall include a summary of discharge and receiving waters quality results, a statistical appraisal of the data, control charts showing quality results, a compliance assessment, indications of potential environmental harm, and comments and/or corrective actions implemented during the works. The following information must be maintained and submitted to NSW DPI Water on completion of dewatering as part of the "Completion Report":
- volume of groundwater pumped, the volume discharged offsite (and/or reinjected if applicable), the discharge/reinjection rate and the duration of pumping;
- groundwater level monitoring data;
- all water quality monitoring data, including results of pre-release water quality testing, within six months of completion of dewatering; and
- location and construction of groundwater extraction work that are abandoned after dewatering has ceased.

7.5 Groundwater Monitoring and Release Criteria

The groundwater extracted during the dewatering should be monitored for the parameters given in Table 4 and should meet the release criteria in Table 5 before being discharged off the site. Criteria for an acceptable water quality will depend on the final discharge point. It is assumed that the discharge will be into the local stormwater system. Except as may be expressly provided by a Licence, the Applicant must ensure that any controlled discharge from the dewatering process must comply with Council's stormwater disposal guidelines, *CSIRO (2006) Urban Stormwater: Best Practice Environmental Guidelines,* and ANZAAC (2000) Guidelines for Fresh and Marine waters as the potential receptors with dewatering release criteria are presented in Table 5.

The Applicant must: (a) ensure that the water collected from dewatering is pumped into the initial holding tank for initial testing to meet disposal criteria, thereafter, moving into a settlement tank for final treatment and settlement; (b) not use any flocculants on site for water pollution control treatment without the written approval of the EPA. Note: Flocculants may be used for the treatment of collected stormwater. While the specific flocculant was not specified, some types of flocculants have the potential to cause ecotoxicological impacts on receiving waters, and (c) when water guidelines are met, dispose of as water as per regulatory criteria and licenses. A water balance should be kept of all waters extracted from the site. The Water Balance must: (a) include details of all water extracted, dewatered water going to stormwater, transferred, used and/or discharged; and (b) describe measures to increase water quality by way of chemical dosing, pH adjustment or flocculant use by the development.

7.6 Water Quality Treatment and Monitoring Plan

Treatment of the groundwater may be required before it is released. Sufficient holding tanks/treatment trains should be present at the site to allow for this monitoring and treatment throughout the entire dewatering phase.

Table 4. Performance Requirements for Discharge

Parameters	Units	Performance indicator	Comments
pH	-	>6.5 and <9	-
Suspended Solids (Total)	mg/L	< 40 [1]	Total dissolved solids (mg/l) <1200
Ammonia (Total)	µg/L	910	Reported as N
Dissolved oxygen	%	90-110	-
Oil and Grease	mg/L	No	No sheens/oil/grease
Nitrate	mg/L		
Salinity	mS/cm	50	-
Turbidity	NTU	1 to 50	
Arsenic (As) III	µg/L	24	NHMRC (2018) drinking water guidelines
Arsenic (As) IV	µg/L	13	
Cadmium (Cd)	µg/L	0.2	-
Chromium (Cr) IV	µg/L	1	From table3.3.2 in ANZECC (2000)
Copper (Cu)	µg/L	1.4	-
Lead (Pb)	µg/L	3.4	-
Mercury (Hg) inorganic	µg/L	0.06	-
Nickel (Ni)	µg/L	11	-
Zinc (Zn)	µg/L	8	-
TPH hydrocarbons (TPH)	-	>LOR	No sheens/oil/grease

[1] Value from ANZ Guidelines for Fresh and Marine Water Quality (2000).

7.6.1 Treatment Methods and Groundwater Quality Monitoring

The treatment system is yet to be confirmed and this Dewatering Management Plan (DMP) will need to be updated once the appropriate system has been designed. It is understood that this DMP will be submitted to the dewatering contractors to enable a treatment system to be designed. The treatment system must include the required discharge release criteria. The treatment system may include:

- pH adjustment – an automatic continuous pH monitoring and dosing tank could be used on site
- Removal of suspended solids, heavy metals, hydrocarbons and/or nuisance odours by filtration or flocculation
- Increase dissolved oxygen by aeration with agitators or aerators
- Chemical treatment

Extracted groundwater should be monitored, as it enters the treatment system and the exit point of the treatment system (prior to release). Monitoring of the water quality in the holding tanks will be carried out daily during dewatering until the treatment of the groundwater is required.

7.6.2 Groundwater Quantity Monitoring

During dewatering, the quantity of groundwater extracted from the sumps shall be monitored and recorded on a weekly basis as a total volume.

7.6.3 Reporting of Monitoring Results

Factual reporting should be submitted monthly. The reporting will include descriptions of:

- Water retention methods (holding tank/treatment systems)
- Water quality assessment
- Treatment methods
- Status of groundwater levels in the monitoring wells
- Issues arising (e.g. odours) and corrective methods adopted.

8. Contingencies

In view of the lack of buildings in close proximity to the proposed excavation, there is no credible risk of drawdown causing damage to such assets. However, there are infrastructure assets, including pavements and buried services. Whilst the risk of damage to such assets is considered to be very low, it is considered prudent to establish a contingency in the event that drawdown exceeding the recommended/calculated depth (as per the CMW Geosciences report) is identified in the monitoring points outside the shoring wall. We recommend this involve:

- review of actual drawdown depths and discharge volumes from the dewatering;
- assessment of the condition of external pavements and infrastructure assets, including a survey to check for possible settlement if deteriorating conditions are observed or suspected; and
- obtain further advice from a geotechnical engineer on possible measures to reduce drawdown, which could include installing cut-off structures in key locations (we note that the likelihood of this being required is considered to be extremely low to barely credible, but it is mentioned for completeness of the management plan).

If unexpected monitoring results indicate that the quality of the discharge water has changed, treatment prior to discharge will need to be implemented.

Implementation/adjustment of physical and/or treatment processes and/or installation of larger retention structures should be completed as an initial procedure to mitigate unacceptable water quality readings.

Where implemented contingencies prove ineffective at mitigating risks to the receiving waterway, ceasing dewatering may be the only options until such time that other management techniques can be applied. To avoid potential damage to the constructed basement in such a situation, consideration should be given to obtaining a permit to discharge to sewer with local authorities.

For and on behalf of
Chameleon Geoscience Pty Ltd

Shyam Ghimire
Principal
B.Sc., M.Sc, MAIG

Reviewed By

Nick Kariotoglou
Managing Director

Attachments.

- Appendix A - Important Information about your report
- Appendix B - Site Plan
- Appendix C - Laboratory Test Results
- Appendix D - Groundwater modelling was carried Groundwater Drawdown Model and Detailed Settlement Analysis – 118 Cary St Toronto by CMW Geosciences Pty Ltd (CMW) Ref. SYD2021-0134AB Rev3 18 January 2022
- Appendix E - Water NSW Groundwater Guidelines

9. 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 Chameleon and 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, Chameleon Geosciences Pty Ltd be contacted immediately for further advice and any necessary review of recommendations. Chameleon does not accept any liability for site conditions not observed or accessible during the investigation or inspection.

This report and associated documentation and the information herein have been prepared solely for the use of **TORONTO INVESTMENTS NO.1 PTY LTD**, and any reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuing liability resulting from the use of the report by third parties cannot be transferred to Chameleon Geosciences Pty Ltd, directors, or employees.

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.

This report is subject to copyright and shall not be reproduced either totally or in part without the express permission of the Company. Where information from this report is to be included in contract documents or engineering specifications for the project, the entire report should be included in order to minimise the likelihood of misinterpretation.

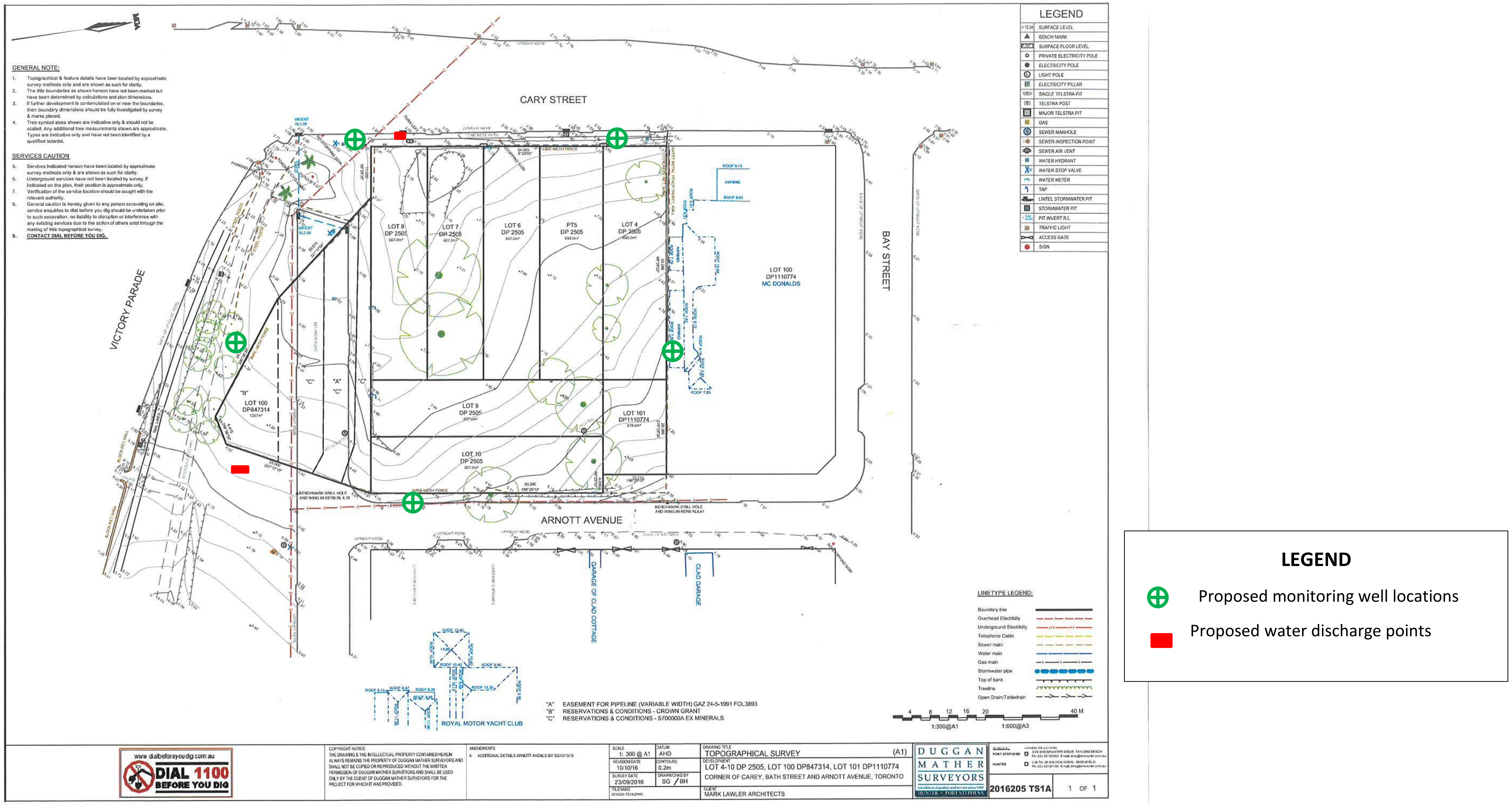


Image Source

Aargus ENVIRONMENTAL - ENGINEERING - DRILLING - LABORATORIES - ASBESTOS

Drawn		**TORONTO INVESTMENTS NO. 1 PTY LTD**
Checked	SG	**Dewatering Management Plan for**
Date	14 September 2021	**New Apartment Building**
Scale @ A3	NTS	**118 Cary Street, Toronto, NSW, 2283**

Chameleon

Figure	**1**
Title	**Site Plan**
Job No	**GS8030-5A**

CERTIFICATE OF ANALYSIS

Work Order	: **ES2130967**	Page	: 1 of 5
Client	: **AARGUS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: NICK	Contact	: Customer Services ES
Address	: PO BOX 398 DRUMMOYNE NSW, AUSTRALIA 2047	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: ES8030/4 Geotechnical Investigation	Date Samples Received	: 25-Aug-2021 16:30
Order number	: ----	Date Analysis Commenced	: 26-Aug-2021
C-O-C number	: ----	Issue Date	: 13-Sep-2021 08:13
Sampler	: NK		
Site	: 118 Cary St, Toronto, NSW 2283		
Quote number	: EN/222		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the Chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GWDW1	GWDW2	----	----	----
			Sampling date / time	25-Aug-2021 00:00	25-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2130967-001	ES2130967-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.86**	**7.37**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**217**	**729**	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**181**	**681**	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**158**	**107**	----	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**154**	**107**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**32**	**55**	----	----	----
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	**56**	**125**	----	----	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	**0.004**	**0.003**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0001**	**0.0002**	----	----	----
Chromium	7440-47-3	0.001	mg/L	**0.001**	**0.001**	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.012**	**0.007**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.005**	**0.002**	----	----	----
Lead	7439-92-1	0.001	mg/L	**0.002**	**0.004**	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.044**	**0.094**	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	<100	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GWDW1	GWDW2	----	----	----
			Sampling date / time	25-Aug-2021 00:00	25-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2130967-001	ES2130967-002	--------	--------	--------
				Result	Result	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----
Toluene	108-88-3	2	µg/L	<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----
^ Total Xylenes	----	2	µg/L	<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	99.1	114	----	----	----
Toluene-D8	2037-26-5	2	%	91.4	95.2	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	93.5	101	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

QUALITY CONTROL REPORT

Work Order	: **ES2130967**	Page	: 1 of 6
Client	: **AARGUS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: NICK	Contact	: Customer Services ES
Address	: PO BOX 398 DRUMMOYNE NSW, AUSTRALIA 2047	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: ES8030/4 Geotechnical Investigation	Date Samples Received	: 25-Aug-2021
Order number	: ----	Date Analysis Commenced	: 26-Aug-2021
C-O-C number	: ----	Issue Date	: 13-Sep-2021
Sampler	: NK		
Site	: 118 Cary St, Toronto, NSW 2283		
Quote number	: EN/222		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 3868118)									
ES2130983-005	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.18	6.94	3.4	0% - 20%
ES2130955-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.73	7.97	3.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 3868117)									
ES2130955-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	3160	3130	1.0	0% - 20%
ES2130902-006	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	54400	54200	0.4	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3872580)									
ES2130727-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	363	383	5.4	0% - 20%
ES2131040-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	481	512	6.1	0% - 20%
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 3872581)									
ES2130727-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	5	0.0	No Limit
ES2131040-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	50	44	13.9	0% - 50%
EA045: Turbidity (QC Lot: 3870961)									
ES2130923-002	Anonymous	EA045: Turbidity	----	0.1	NTU	<0.1	<0.1	0.0	No Limit
ES2131056-001	Anonymous	EA045: Turbidity	----	0.1	NTU	<0.1	<0.1	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 3871142)									
ES2130901-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	71	73	2.6	0% - 20%
ES2130996-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	770	779	1.2	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 3872654)									
ES2129952-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020T: Total Metals by ICP-MS (QC Lot: 3872654) - continued									
ES2129952-001	Anonymous	EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.092	0.092	0.0	0% - 50%
ES2131079-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.098	0.103	4.7	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.109	0.117	7.1	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.006	123	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.092	0.097	5.7	0% - 50%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3872696)									
ES2130492-011	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2131156-008	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3871583)									
ES2129659-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2130964-004	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3871583)									
ES2129659-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2130964-004	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 3871583)									
ES2129659-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2130964-004	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 3868118)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.8	101
				----	7 pH Unit	99.8	99.2	101
EA010P: Conductivity by PC Titrator (QCLot: 3868117)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	101	91.1	107
				<1	2100 µS/cm	97.2	93.2	108
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3872580)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	103	87.0	109
				<10	293 mg/L	105	75.2	126
				<10	2835 mg/L	108	83.0	124
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 3872581)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	99.7	83.0	129
				<5	1000 mg/L	101	82.0	110
				<5	463 mg/L	95.8	83.0	118
EA045: Turbidity (QCLot: 3870961)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	100	91.0	105
ED045G: Chloride by Discrete Analyser (QCLot: 3871142)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	105	80.9	127
				<1	1000 mg/L	100	80.9	127
EG020T: Total Metals by ICP-MS (QCLot: 3872654)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	89.6	82.0	114
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	89.7	84.0	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	89.9	86.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	91.8	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	89.2	85.0	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	90.1	84.0	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.1	79.0	117
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3872696)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.7	77.0	111
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3867225)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	69.0	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	97.2	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	94.7	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3871583)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3871583) - continued								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	86.3	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3867225)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	74.9	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	101	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	87.5	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3871583)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	88.6	75.0	127
EP080: BTEXN (QCLot: 3871583)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	82.0	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	76.1	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	79.5	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	78.0	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	79.7	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	73.0	70.0	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
ED045G: Chloride by Discrete Analyser (QCLot: 3871142)							
ES2130901-001	Anonymous	ED045G: Chloride	16887-00-6	50 mg/L	123	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 3872654)							
ES2129952-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	96.4	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	104	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	104	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	102	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	98.9	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	102	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	95.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3872696)							
ES2129663-002	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	82.2	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3871583)							
ES2129659-001	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	73.5	70.0	130

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
				Concentration	MS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3871583)							
ES2129659-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	71.5	70.0	130
EP080: BTEXN (QCLot: 3871583)							
ES2129659-001	Anonymous	EP080: Benzene	71-43-2	25 µg/L	76.9	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	78.4	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	82.8	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	82.6	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	83.6	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	85.6	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2130967**	Page	: 1 of 7
Client	: **AARGUS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: NICK	Telephone	: +61-2-8784 8555
Project	: ES8030/4 Geotechnical Investigation	Date Samples Received	: 25-Aug-2021
Site	: 118 Cary St, Toronto, NSW 2283	Issue Date	: 13-Sep-2021
Sampler	: NK	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
GWDW1,	GWDW2	----	----	----	26-Aug-2021	25-Aug-2021	**1**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
TRH - Semivolatile Fraction	0	20	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
TRH - Semivolatile Fraction	0	20	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P)								
GWDW1,	GWDW2	**25-Aug-2021**	**----**	----	----	**26-Aug-2021**	25-Aug-2021	×
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P)								
GWDW1,	GWDW2	**25-Aug-2021**	**----**	----	----	**26-Aug-2021**	22-Sep-2021	✓
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Clear Plastic Bottle - Natural (EA015H)								
GWDW1,	GWDW2	**25-Aug-2021**	**----**	----	----	**30-Aug-2021**	01-Sep-2021	✓
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025H)								
GWDW1,	GWDW2	**25-Aug-2021**	**----**	----	----	**30-Aug-2021**	01-Sep-2021	✓
EA045: Turbidity								
Clear Plastic Bottle - Natural (EA045)								
GWDW1,	GWDW2	**25-Aug-2021**	**----**	----	----	**27-Aug-2021**	27-Aug-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
GWDW1,	GWDW2	**25-Aug-2021**	----	----	----	**27-Aug-2021**	22-Sep-2021	✓
ED093F: SAR and Hardness Calculations								
Clear Plastic Bottle - Natural (ED093F)								
GWDW1,	GWDW2	**25-Aug-2021**	----	----	----	**30-Aug-2021**	01-Sep-2021	✓
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)								
GWDW1,	GWDW2	**25-Aug-2021**	**30-Aug-2021**	21-Feb-2022	✓	**30-Aug-2021**	21-Feb-2022	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)								
GWDW1,	GWDW2	**25-Aug-2021**	----	----	----	**30-Aug-2021**	22-Sep-2021	✓
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071)								
GWDW1,	GWDW2	**25-Aug-2021**	**30-Aug-2021**	01-Sep-2021	✓	**30-Aug-2021**	09-Oct-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
GWDW1,	GWDW2	**25-Aug-2021**	**30-Aug-2021**	08-Sep-2021	✓	**30-Aug-2021**	08-Sep-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Amber Glass Bottle - Unpreserved (EP071)								
GWDW1,	GWDW2	**25-Aug-2021**	**30-Aug-2021**	01-Sep-2021	✓	**30-Aug-2021**	09-Oct-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
GWDW1,	GWDW2	**25-Aug-2021**	**30-Aug-2021**	08-Sep-2021	✓	**30-Aug-2021**	08-Sep-2021	✓
EP080: BTEXN								
Amber VOC Vial - Sulfuric Acid (EP080)								
GWDW1,	GWDW2	**25-Aug-2021**	**30-Aug-2021**	08-Sep-2021	✓	**30-Aug-2021**	08-Sep-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✘ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	20	**0.00**	**10.00**	✘	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	2	11	**18.18**	**8.33**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by PC Titrator	EA010-P	1	11	**9.09**	**1.67**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	20	**0.00**	**5.00**	✘	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocyanate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **ES2130967**		
Client	: **AARGUS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: NICK	Contact	: Customer Services ES
Address	: PO BOX 398 DRUMMOYNE NSW, AUSTRALIA 2047	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: nick@aargus.net	E-mail	: ALSEnviro.Sydney@ALSGlobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: ES8030/4 Geotechnical Investigation	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017AARGUS0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: 118 Cary St, Toronto, NSW 2283		
Sampler	: NK		

Dates

Date Samples Received	: 25-Aug-2021 16:30	Issue Date	: 25-Aug-2021
Client Requested Due Date	: 01-Sep-2021	Scheduled Reporting Date	: **01-Sep-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 18.5'C
Receipt Detail	:	No. of samples received / analysed	: 2 / 2

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Appropriately preserved bottle was not received, therefore Sulphide analysis could not be conducted.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA005P pH (PCT)	WATER - EA010P Electrical Conductivity (PCT)	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EA025H Suspended Solids - Standard Level	WATER - EA045 Turbidity	WATER - ED045G Chloride by Discrete Analyser	WATER - ED093F + EA006 + EA065 Dissolved Major Cations + SAR + Hardness
ES2130967-001	25-Aug-2021 00:00	GWDW1	✓	✓	✓	✓	✓	✓	✓
ES2130967-002	25-Aug-2021 00:00	GWDW2	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - W-05T TRH/BTEXN/8 Metals (Total)
ES2130967-001	25-Aug-2021 00:00	GWDW1	✓
ES2130967-002	25-Aug-2021 00:00	GWDW2	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE		
- A4 - AU Tax Invoice (INV)	Email	anika@aargus.net
ALL REPORTS (CYNTHIA)		
- *AU Certificate of Analysis - NATA (COA)	Email	cynthia@aargus.net
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	cynthia@aargus.net
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	cynthia@aargus.net
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	cynthia@aargus.net
- A4 - AU Tax Invoice (INV)	Email	cynthia@aargus.net
- Chain of Custody (CoC) (COC)	Email	cynthia@aargus.net
- EDI Format - ESDAT (ESDAT)	Email	cynthia@aargus.net
- EDI Format - XTab (XTAB)	Email	cynthia@aargus.net
NICK		
- *AU Certificate of Analysis - NATA (COA)	Email	nick@aargus.net
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	nick@aargus.net
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	nick@aargus.net
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	nick@aargus.net
- Chain of Custody (CoC) (COC)	Email	nick@aargus.net
- EDI Format - ESDAT (ESDAT)	Email	nick@aargus.net
- EDI Format - XTab (XTAB)	Email	nick@aargus.net

ES803074 HT

AARGUS PTY LTD

6 Carter Rd
LIDCOMBE NSW 2141

P O Box 398 Tel: 1300 137 038
DRUMMOYNE NSW 1470 Fax: 1300 136 038

Email reports: nick@aargus.net
Email invoices: anika@aargus.net; cynthia@aargus.net

Laboratory Test Request / Chain of Custody Record

1 of 1

TO: ALS (Australian Laboratory Services) | Environmental
277 - 289 Woodpark Road
SMITHFIELD, NSW 2164

PH: 02 8784 8555 **FAX:** 02 8784 8500
ATTN: Samples Receipt

Sampling Date: 24/08/2021 **Job No:** ES8030 /4
Sampled By: NK **Project:** Geotechnical Investigation
Project Manager: NK **Location:** 118 Cary St, Toronto, NSW 2283

Results required by: Standard TAT
Quotation Number (if applicable): SY/258/14 V2

	Sampling details			Sample type															
	Location	Depth (m)	Date	Soil	Water (Filled Up)	Air	pH	Turbidity	EC	Total Suspended Solids	Total Dissolved Solids	Heavy Metals	TRH	BTEX	Hardness	Cloride	Sulphide	Analysis Suite(s)	KEEP SAMPLE?
1	GWDW1		25-August-2021		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		Yes
2	GWDW2		25-August-2021		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		Yes
												8 Metals							

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
Nick Kariotoglou	NK	25/08/21	[illegible]	[illegible]	25/8/21 1630 18.5

Legend:
WG Water sample, glass bottle
WP Water sample, plastic bottle
GV Glass vial
USG Undisturbed soil s
DSG Disturbed soil san
OTH Other
DSP Disturbed soil sample (small plastic bag)
✓ Test required
ACAN Air sample, canister

@ mole H^+/tonne

Environmental Division
Sydney
Work Order Reference
ES2130967

Telephone : + 61-2-8784 8555

21 February 2022

Groundwater Drawdown Model and Detailed Settlement Analysis – 114-120 Cary Street, 1,2,3,5 Bath Street and 3 Arnott Avenue Toronto

Toronto Investments No1 Pty Ltd
SYD2021-0134AB Rev4

REFER TO PREVIOUS APPENDIX I
FOR FULL REPORT

Fact sheet

Construction dewatering

Information for councils and applicants

This fact sheet provides local government authorities and applicants with information about construction dewatering and which approvals may be required to authorise dewatering. It also helps those seeking development consent to determine whether a development application is an integrated development application because of the need to obtain approvals relating to dewatering.

What is construction dewatering?

Construction work that requires excavation (such as basements, tunnels and trenches) can often encounter groundwater, particularly where the groundwater table is high or the excavation is particularly deep. Where construction activities will interfere with groundwater aquifers, the groundwater will either build up on the construction site (and potentially adjoining land) or will need to be extracted from the water table. In either case, the groundwater will need to be removed (by bore, pump or other means) - this is referred to as **dewatering**.

The removal of the groundwater from its water source and the taking/using of water (even if the take and use is for disposal) may require approval under the *Water Management Act 2000* (WMA).

Where a development application is lodged for development which requires approvals under the WMA, the development will be an integrated development and local government authorities will typically manage the WMA approval process in conjunction with WaterNSW.

All construction activities that will impact on groundwater aquifers should be referred to WaterNSW as part of the integrated development process to streamline the assessment processes. From 1 January 2020, this should be done via the NSW Planning Portal at planningportal.nsw.gov.au.

If the need for WMA approvals only becomes apparent following development consent, applicants should be referred directly to WaterNSW.

What approvals/licences are likely to be required to dewater a construction site?

The following are likely required under the WMA:

1. **Water supply work approval** to construct and use the work(s) required to remove, transport, store, and dispose of the water from a groundwater source, e.g. pumps, bores drainage works.
2. **Water access licence (WAL)** which will authorise a licence holder to take water from a specific groundwater source. WALs usually have an allocation of water attached to them which determines the amount of water that can be taken. Usually, this is in the form of units. The Minister for Water determines annually the amount of water (in megalitres (ML)) which a unit represents for a year. Usually, 1 unit represents 1 ML.

   Typically, a WAL has a NIL allocation when it is first issued. A WAL and/or units for a WAL, or the annual allocations referable to a particular unit, can be purchased in the market for the relevant water source. Importantly, a WAL is not an approval which is part of the integrated development process. It must be addressed separately. If no exemption applies to your application, then a WAL will need to be obtained prior to dewatering work commencing.
3. **Water use approval** to use or dispose of the water taken from the groundwater source. A water use approval is not required if the use of water is included in the development consent.

Fact sheet

Construction dewatering
Information for councils and applicants

Both work approvals and water use approvals under the WMA trigger the integrated development process. When a development application (DA) requires either of these approvals, the DA must be referred to WaterNSW. This referral is done by using NSW Planning Portal at planningportal.nsw.gov.au/online-concurrence-and-referral.

Some particular dewatering activities may be exempt from the above requirements. There are certain requirements that the applicant must meet and comply with in order to take advantage of the exemptions. Refer to the exemption for aquifer up to 3ML or exemption for excavation more than 3ML fact sheets for more information.

Approvals under the WMA to construct and use work(s) to remove groundwater require a dewatering management plan and recording of groundwater take under the exemption. Recording must be weekly and record of water taken submitted to WaterNSW within 28 days of the end of the water year

What happens once an application is submitted to WaterNSW?

WaterNSW refers all construction dewatering applications to the Department of Planning, Industry and Environment (DPIE).

Once received, DPIE undertakes a hydrogeological assessment of the application and provides a hydrogeological report to WaterNSW.

WaterNSW considers the hydrogeological report as part of the assessment process to assist in determining whether the WMA approvals should be granted.

Information required for DPIE to undertake a hydrogeological assessment

- Geotechnical investigation report describing the results of intrusive investigations at the site
- Survey plan of the site
- Architectural plan illustrating accurate design dimensions of the proposed basement and sections (oriented approximately at right angles) illustrating the design depth of the proposed basement(s).
- Environmental site assessment report identifying the contamination status of the property and the general quality characteristics of the groundwater beneath the site.
- Acid sulfate soils assessment and management report identifying the nature, extent and management of acid sulfate soils (where present)

If additional information is required, WaterNSW will contact the applicant directly.

General terms of approvals

Once WaterNSW has received the hydrogeological report for the application and considered all relevant matters, it will determine whether the WMA approvals can be granted.

If the approvals are granted for integrated development, WaterNSW will provide the local council with general terms of approval (GTAs). View the General terms and conditions fact sheet for more information.

If the local council proposes to grant development consent for the DA, then it must include the WaterNSW GTAs as conditions of the development consent.

The applicant must still separately apply to WaterNSW for

What if more time is needed to complete dewatering?

WaterNSW typically grants WMA approvals for dewatering activities for a period of two years. If there are issues completing dewatering within two years, the applicant may submit an application to extend the approval.

If an extension is warranted, WaterNSW will generally extend the approval for a further 12 months. The applicant will be required to submit an interim report to confirm the construction activity is underway. The interim report requires the same information as the completion report. Please refer to the Completion report fact sheet for more information.

Approvals must usually be extended before the expiry date of the original approval. Approvals which have expired without extension may be referred to NRAR for investigation.

More information

Contact our Customer Service team on 1300 662 077 or email Customer.Helpdesk@waternsw.com.au

Fact sheet

Exemptions

Construction dewatering

This fact sheet provides information to local authorities and applicants seeking development consent that may involve dewatering activities. It outlines exemptions from the need to obtain certain approvals/licences under the *Water Management Act 2000* (WMA). This fact sheet should be read in conjunction with the Dewatering information for councils and applicants fact sheet.

If intending to rely on one of the exemptions below, it is necessary to understand requirements that may involve recording water extraction and the time limits that apply to the exemption. **It is important to obtain any further advice before commencing the development application process.**

Note that as part of dewatering works you may need other approvals included under the *Local Government Act 1993* or *Roads Act 1993* to dispose of the water into council drains, use any part of the public footpath or carriageway or undertake any work within the public road.

There are two exemptions that apply from 6 December 2019.

Exemption 1: For extraction of less than 3 ML of water per year

When water extraction is taken as part of approved development (or exempt development), up to 3 ML of water may be taken in any one year (commencing on 1 July each year) without the need for:

- a water access licence (WAL)
- a water use approval.

A water supply work approval will be required for any works that are to be constructed or used to drain or pump the water.

To rely on this exemption, certain requirements must be met to record the water extraction and ensure that less than 3 ML of water is taken.

These requirements are set out in clause 21(6) of the *Water Management (General) Regulation 2018* and include requirements to:

- record the water take within 24 hours in the approved form and manner (see the Completion report fact sheet)
- keep the water take records for a period of five years
- provide the water take records to the Minister (or WaterNSW) by no later than 28 July for the year ending 1 July during which the water was taken.

Exemptions
Construction dewatering

Exemption 2: For construction activities that take water from the Botany Sands Groundwater Source only

When water extraction is taken as part of construction activities for a building, road or other infrastructure from the Botany Sands Groundwater Source, it may not require:

- a water access licence (WAL) or
- a water use approval

if a water supply work approval (e.g. for a pump) has already been obtained.

The water supply work approval is required to specify the maximum amount of water that can be taken during a year.

This exemption is only applicable until the earlier of:

- a controlled allocation of the water in the water source is opened by the Department of Industry, Planning and Environment (DPIE)
- 1 July 2021.

This exemption cannot be relied upon if construction activity is likely to continue beyond 1 July 2021 (unless the law changes).

In order to take water after 1 July 2021, the required water allocation must be purchased in the water market from that water source (or a transferable water source allocation).

To rely on the exemption, the conditions of the water supply work approval must be met and may require metering of the water take.

A water supply work approval will still need to be obtained for any works that are to be constructed or used to drain or pump the water.

Currently, the exemption only applies to the Botany Sands Groundwater Source, but other sources may be added and it is best to check with WaterNSW for the latest information.

More information

If you have any questions, please contact one of our friendly Customer Service team on 1300 662 077 or email Customer.Helpdesk@waternsw.com.au

Disclaimer:

This fact sheet is provided for general information purposes only and may not cover the precise circumstances of your development. It is only relevant to the particular matters identified in this fact sheet. There may be other processes and relevant fact sheets that are also relevant to your development. Links to all fact sheets related to construction dewatering may be found at waternsw.com.au/dewatering. This fact sheet is not legal advice and should not be relied upon as such. Interested persons should obtain their own advice. This fact sheet does not represent the views of any council or the Department of Planning, Industry and Environment or Natural Resources Access Regulator. This fact sheet represents an interim position and may be updated at any time. Please check the WaterNSW website for the current version. WaterNSW is not liable for consequences of actions taken in reliance of information provided or omitted from this document.

Contact Richard Meares
Phone 02 9865 2324
Email richard.meares@waternsw.com.au

Our ref IDAS1126880
Our file A-10021
Your ref DA-2019/1290

General Manager
Wollongong City Council
Locked Bag 8821
Wollongong NSW 2500

Attn: Rebecca Welsh

24 September 2020

Dear Sir/Madam

Re: Integrated Development Referral – General Terms of Approval
Dev Ref: DA-2019/1290
Description: 80mm submersible pump
Location: 16,18,20 Belmore Street Wollongong

I refer to your recent letter regarding an integrated Development Application (DA) proposed for the above location. Attached, please find the WaterNSW General Terms of Approval (GTA) for part of the proposed development requiring a Water Supply Work approval under the *Water Management Act 2000* (WM Act), as detailed in the subject DA.

Please note Council's statutory obligations under section 91A (3) of the *Environmental Planning and Assessment Act 1979* (EPA Act) which requires a consent, granted by a consent authority, to be consistent with the general terms of any approval proposed to be granted by the approval body. If the proposed development is approved by Council, WaterNSW requests these GTA be included (in their entirety) in Council's development consent. Please also note WaterNSW requests notification:

- if any plans or documents are amended and these amendments significantly change the proposed development or result in additional works or activities (i) in the bed of any river, lake or estuary; (ii) on the banks of any river lake or estuary, (iii) on land within 40 metres of the highest bank of a river lake or estuary; or (iv) any excavation which interferes with an aquifer.

Level 14,169 Macquarie Street,Parramatta,NSW 2150 | PO Box 398,Sydney,NSW 2124
customer.helpdesk@waternsw.com.au | www.waternsw.com.au

WaterNSW will ascertain from the notification if the amended plans require review of or variation/s to the GTA. This requirement applies even if the amendment is part of Council's proposed consent conditions and do not appear in thiginal documentation.

- if Council receives an application under s96 of the EPA Act to modify the development consent and the modifications change the proposed work or activities described in the original DA.
- of any legal challenge to the consent.

As the proposed work or activity cannot commence before the applicant applies for and obtains an approval, WaterNSW recommends the following condition be included in the development consent:

The attached GTA issued by WaterNSW do not constitute an approval under the *Water Management Act 2000*. The development consent holder must apply to WaterNSW for a Water Supply Work approval **after consent** has been issued by Council **and before** the commencement of any work or activity.

A completed application form must be submitted to WaterNSW together with any required plans, documents, application fee, security deposit or bank guarantee (if required) and proof of Council's development consent. Finalisation of an approval can take up to eight (8) weeks from the date the application and all required supporting documentation is received.

Application forms are available from the WaterNSW website at:
www.waternsw.com.au > Customer Services > Applications & Fees.

WaterNSW requests that Council provide a copy of this letter to the development consent holder.

WaterNSW also requests a copy of the determination for this development application be provided by Council as required under section 91A (6) of the EPA Act.

Lastly, the following recommendations apply:

• An extraction limit will be determined by the Department of Planning, Industry and Environment following a further hydrogeological assessment and included on the conditions applied to the authorisation for the dewatering activity.

• Detailed information required to permit the hydrogeological assessment to be carried out is to be provided by the applicant otherwise the issue of the authorisation will be subject to delay.

• The authorisation will be issued for the purpose of temporary construction dewatering only and it does not constitute any form of approval for ongoing pumping of groundwater from basement levels after the building is issued an occupation certificate.

Yours sincerely

Richard Meares

for

Wayne Conners
Senior Water Regulation Officer
Water Regulatory Operations
WaterNSW

WaterNSW

General Terms of Approval

for proposed development requiring approval under s89, 90 or 91 of the Water Management Act 2000

Reference Number:	IDAS1126880
Issue date of GTA:	24 September 2020
Type of Approval:	Water Supply Work
Description:	80mm submersible pump
Location of work/activity:	16,18,20 Belmore Street Wollongong
DA Number:	DA-2019/1290
LGA:	Wollongong City Council
Water Sharing Plan Area:	Greater Metropolitan Region Groundwater Sources

The GTA issued by WaterNSW do not constitute an approval under the *Water Management Act 2000*. The development consent holder must apply to WaterNSW for the relevant approval **after development consent** has been issued by Council **and before** the commencement of any work or activity.

Condition Number	Details
	Dewatering
GT0062-00001	Groundwater shall not be pumped or extracted for any purpose other than temporary construction dewatering at the site identified in the development application.
GT0063-00001	An authorisation under the relevant water legislation, such as a Water Access Licence (WAL), shall be obtained for the take of groundwater as part of the activity. For avoidance of doubt, these terms do not represent any authorisation for the take of groundwater, nor do they constitute the grant, or the indication of an intention to grant, any required WAL.
GT0064-00001	An authorisation under the relevant water legislation, such as an Approval, is also required for the works involved in extracting the groundwater. For avoidance of doubt, these terms do not represent any authorisation for the construction or installation of such works.
GT0065-00001	The relevant works must not be carried out, installed or operated until a specialist hydrogeological assessment has been completed by the Department of Planning Industry and Environment, which concludes that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems, as a consequence of the construction or use of the proposed water management work.
GT0066-00001	The design and construction of the building must prevent any take of groundwater after the authorisation has lapsed by making any below-ground levels that may be impacted by any water table fully watertight for the anticipated life of the building. Waterproofing of below-ground levels must be sufficiently extensive to incorporate adequate provision for unforeseen high water table elevations to prevent potential future inundation.
GT0067-00001	Sufficient permanent drainage shall be provided beneath and around the outside of the watertight structure to ensure that natural groundwater flow is not impeded and: a. any groundwater mounding at the edge of the structure shall be at a level not greater than 10 % above the level to which the water table might naturally rise in the location immediately prior to the construction of the structure; and b. any elevated water table is more than 1.0 m below the natural ground surface existent at the location immediately prior to the construction of the structure; and c. where the habitable part of the structure (not being footings or foundations) is founded in bedrock or impermeable natural soil then the requirement to maintain groundwater flows beneath the structure is not applicable.

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DA Number:	DA-2019/1290
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Water Sharing Plan Area:	Greater Metropolitan Region Groundwater Sources

GT0068-00001	Construction methods and material used in and for construction shall be designed to account for the likely range of salinity and pollutants which may be dissolved in groundwater, and shall not themselves cause pollution of the groundwater.
GT0069-00001	The Applicant is bound by the above terms and any other terms and conditions of the subsequent authorisation(s) required for the extraction of groundwater and the associated works under the relevant water legislation.
GT0070-00001	Measurement and monitoring arrangements to the satisfaction of WaterNSW are to be implemented. Weekly records of the volumes of all groundwater pumped and the quality of any water discharged are to be kept and a completion report provided after dewatering has ceased. Records of groundwater levels are to be kept and a summary showing daily or weekly levels in all monitoring bores provided in the completion report.
GT0071-00001	Following cessation of the dewatering operations and prior to the surrender of any associated authorisation, the applicant shall submit to WaterNSW the completion report which shall include: a. detail of the volume of water taken, the precise periods and location of water taken, the details of water level monitoring in all of the relevant bores; and b. The location and construction of groundwater extraction works that are decommissioned c. a water table map depicting the aquifer's settled groundwater condition and a comparison to the baseline conditions; and d. a detailed interpreted hydrogeological report identifying all actual resource and third party impacts, including an assessment of altered groundwater flows and an assessment of any subsidence or excessive settlement induced in nearby buildings and property and infrastructure.
GT0082-00001	The Department of Planning, Industry and Environment¿Water has determined that an authorisation to account for the temporary and transient impacts on groundwater systems associated with the proposed development for up to twelve months is required (to be issued by WaterNSW).
GT0084-00001	All required monitoring and reporting arrangements are to be designed to demonstrate the activity meets due diligence with respect to the Water Management Act 2000, the relevant water sharing plan(s) and the NSW Aquifer Interference Policy during construction and occupation phases of the building.
GT0085-00001	At the time of application for a Construction Certificate, the developer must be able to demonstrate to the consent authority that an authorisation for the pumping of groundwater for temporary construction dewatering has been obtained for the relevant groundwater source from which water is being taken.
GT0086-00001	At the time of application for an Occupation Certificate, the developer must be able to demonstrate to the consent authority that any unexpected groundwater pumping (resulting from poor construction methods, materials or inadequate waterproofing) has been authorised by a water access licence purchased for the relevant groundwater source from which water is being taken and must be able to demonstrate no impact on neighbouring sites or the integrity of the aquifer.
GT0088-00001	All monitoring data collected for the development and all monitoring and

General Terms of Approval
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DA Number:	DA-2019/1290
LGA:	Wollongong City Council
Water Sharing Plan Area:	Greater Metropolitan Region Groundwater Sources

	management reports are to be provided in electronic format (tabulated and raw corrected data) to the Department of Planning, Industry and Environment¿Water.
GT0098-00001	A specialist Site Hydrogeology Report prepared and certified by a qualified, experienced and practising hydrogeologist must be provided to enable the Department of Planning Industry and Environment to carry out the assessment that includes, but is not limited to, the following: a. pre-development (existing) conditions in the form of a baseline monitoring record and comprehensive groundwater system description: i. site and neighbouring area stratigraphy, formation description, site groundwater levels, groundwater flow paths, site aquifer and aquitard (if relevant) hydraulic characterisation ii. groundwater quality and specific consideration of groundwater potentially affected by contamination from surrounding land uses or acid sulfate soils where they are found to exist iii. neighbouring users, groundwater dependent ecosystems, water bodies and other relevant features within a one kilometre radius of the subject site iv. the above site information must not date more than six months prior to the date of lodgement of the development application to account for climate trends and maintain the currency of groundwater data b. excavation phase (during dewatering), in the form of a comprehensive impact prediction description as well as a monitoring and management strategy: i. predicted impacts (extent, magnitude and duration) that are developed through numerical groundwater modelling ii. corresponding trigger levels (levels, quality, flow, volume and ground surface settlement) to manage any potential impacts iii. construction techniques and approaches that will be used to prevent any ongoing groundwater pumping at the same time as not causing any obstruction to natural groundwater behaviour iv. details of monitoring (groundwater levels, quality as required, rate of inflows, metered pumping) v. where a risk of ground settlement is identified due to the proposed dewatering, the proponent is to provide a program of monitoring, trigger and responses to Council (Note while it is the Proponent¿s responsibility to identify the risk, the Department recommends that Council enforce this requirement for all applications in all high risk areas which includes sand formations or other unconsolidated ground). c. post-excavation phase (during aboveground construction) in the form of a comprehensive post-dewatering impact review: i. collation of monitoring records, ii. analysis of actual impacts compared to predicted impacts, noting that some impacts may be delayed, iii. magnitude and extent of potential long-term effects from the completed structure iv. arrangements for reporting (measurements, technical analysis and future predictions) to the relevant authority d. occupational phase (after building completion) in the form of an annual groundwater monitoring plan: i. monthly monitoring to demonstrate the magnitude of groundwater pumping after construction, either through satisfactory photographic and documented evidence of no visible seepage into the building or, if inflows cannot be prevented, measured flow rates into all pump-out sumps ii. recording arrangements to document ongoing compliance, event-based notification of unexpected groundwater take to the relevant authority and annual reporting arrangements

SCHEDULE 1

The plans and associated documentation listed in this schedule are referred to in general terms of approval (GTA) issued by WaterNSW for integrated development associated with DA-2019/1290 as provided by Council:

- Morrow- Residential Development
- 16-18 Belmore Street
- Wollongong NSW
- Prepared for Blaq Projects

APPENDIX K

Government Information,
Mine Subsidence & GTA

NSW GOVERNMENT | Subsidence Advisory NSW

117 Bull Street, Newcastle West NSW 2302
Tel 02 4908 4300 | www.subsidenceadvisory.nsw.gov.au
24 Hour Emergency Service: Free Call 1800 248 083
ABN 87 445 348 918

MARK LAWLER ARCHITECTS
ATTN: Stephen Coon

Via email: stephen@marklawlerarchitects.com.au

Dear Stephen

RE PROPOSED MIXED USE DEVELOPMENT - INCLUDING 2 LEVELS OF BASEMENT CARPARKING, COMMERCIAL GROUND FLOOR AND 5 LEVELS OF RESIDENTIAL APARTMENTS AT 114-120 CARY STREET & 1-3 ARNOTTS VENUE TORONTO; LOTS 4-10 SEC 6 DP 2505, LOT 100 DP 847314 AND LOT 101 DP 1110774; TBA18-00189

NOTICE OF DETERMINATION

I refer to the application detailed above. Subsidence Advisory NSW has determined to grant approval under section 22 of the *Coal Mine Subsidence Compensation Act 2017*.

Approval has been granted, subject to the conditions set out in the attached determination under Schedule 2. The stamped approved plans have also been attached.

Should you have any questions about the determination I can be contacted by phone on 02 4908 4300 or via email at shane.mcdonald1@finance.nsw.gov.au

Yours faithfully,

Shane McDonald
Senior Risk Engineer

Date: 4 May 2018

DETERMINATION

Issued in accordance with section 22 of the *Coal Mine Subsidence Compensation Act 2017*

As delegate for Subsidence Advisory NSW under delegation executed 4 May 2018, approval is for the development described in Schedule 1, subject to the conditions attached in Schedule 2.

Determination Date: **4 May 2018**

Approval to Lapse on: **4 May 2023**

The conditions of approval are imposed for the following reasons:

a) To confirm and clarify the terms of Subsidence Advisory NSW approval.

b) To minimise the risk of damage to surface development from mine subsidence.

Shane McDonald
Senior Risk Engineer

Date: 4 May 2018

SCHEDULE 1

Application No. **TBA18-00189**

Applicant: **MARK LAWLER ARCHITECTS**

Site Address: **114-120 CARY STREET & 1-3 ARNOTTS VENUE TORONTO**

Lot and DP: **LOTS 4-10 SEC 6 DP 2505, LOT 100 DP 847314 AND LOT 101 DP 1110774**

Proposal: **MIXED USE DEVELOPMENT - INCLUDING 2 LEVELS OF BASEMENT CARPARKING, COMMERCIAL GROUND FLOOR AND 5 LEVELS OF RESIDENTIAL APARTMENTS**

Mine Subsidence District: **WEST LAKE**

SCHEDULE 2

CONDITIONS OF APPROVAL

GENERAL	
Plans, standards and guidelines	
1.	The development being undertaken strictly in accordance with the details set out on the application form, any information submitted with the application and the plans submitted, as amended or as modified by the conditions of this approval. **Note:** Any proposal to modify the terms or conditions of this approval, whilst still maintaining substantially the same development to that approved, will require the submission of a formal application for consideration by Subsidence Advisory NSW. If amendments to the design result in the development not remaining substantially the same as that approved by this approval, a new Application will have to be submitted to Subsidence Advisory NSW.
2.	This approval expires 5 years after the date the approval was granted if construction work has not physically commenced.
PRIOR TO COMMENCEMENT OF CONSTRUCTION	
3.	**Prescribed Design Parameters** The proposed structure(s) is to be designed to be "*safe, serviceable and any damage from mine subsidence shall be limited to 'slight' in accordance with AS2870 (Damage Classification) and readily repairable*" using the subsidence parameters outlined below: a) Maximum vertical subsidence: 150 mm b) Maximum horizontal strains: (+/-): 1 mm/m c) Maximum Tilt: 1 mm/m d) Maximum radius of curvature: 10km
4.	Submit an "Engineering Impact Statement" prior to commencement of detailed design for acceptance by SANSW, which shall identify the: a. Mine Subsidence Parameters used for the design. b. Main building elements and materials. c. Risk of damage due to mine subsidence d. Design measures proposed to control the risks.
5.	Submit a final design incorporating for acceptance by *Subsidence Advisory NSW* prior to commencement of construction. It shall include certification by a qualified structural engineer to the effect that the improvements will remain "*safe, serviceable and any damage from mine subsidence shall be limited to 'slight' damage in accordance with AS2870 (Damage Classification), and readily repairable*" taking into consideration the mine subsidence parameters outlined above.

POST CONSTRUCTION	
5.	Upon completion of construction, works-as-executed certification by a qualified engineer is to be forwarded to the *Subsidence Advisory NSW* confirming that construction was in accordance with the plans approved by *Subsidence Advisory NSW*.

Dispute Resolution

If you are dissatisfied with the determination of this application an appeal may be formally submitted with the Chief Executive Officer for an independent internal review. The application must be made in writing and must provide reasons why the determination should be changed.

From: "Georgie Williams" <gwilliams@lakemac.nsw.gov.au>
Sent: 16/11/2018 1:50 PM
To: "council council" <council@lakemac.nsw.gov.au>
Subject: Fwd: DA/419/2018 at 114 Cary Street, Toronto
Attachments: image001.png, ATT00001.htm, image002.png, ATT00002.htm, image003.png, ATT00003.htm, image004.png, ATT00004.htm, image005.png, ATT00005.htm, DA419_2018_114 Cary St Toronto-LakeMqCouncil.pdf, ATT00006.htm

Sent from my iPad

Begin forwarded message:

From: Hemantha DeSilva <Hemantha.DeSilva@waternsw.com.au>
Date: 16 November 2018 at 10:26:54 am AEDT
To: Georgie Williams <gwilliams@lakemac.nsw.gov.au>
Subject: Re: DA/419/2018 at 114 Cary Street, Toronto

Hello Georgie,

Attached is the Water NSW's general terms of approval for a water supply work under the Water Management Act 2000.

Regards

Hemantha

Hemantha De Silva
Senior Water Regulation Officer (Projects) Water Regulation Coastal
Customer Approvals & Assessments | Customer & Community
WaterNSW
PO Box 2157, Dangar NSW 2309
Suit 2, Level 6 No. 384 Hunter Street, Newcastle NSW 2300
Phone: 02 98652880 Mob: 0438638987 Email: Hemantha.Desilva@waternsw.com.au
Web page: https://www.waternsw.com.au

From: Georgie Williams <gwilliams@lakemac.nsw.gov.au>
Sent: Tuesday, November 6, 2018 11:29 AM
To: Hemantha DeSilva
Subject: RE: DA/419/2018 at 114 Cary Street, Toronto

Thanks. It has been addressed to

PO Box 2157, Dangar 2309

Is this not correct?

Lake Macquarie

City Council

Georgie Williams

Senior Development Planner

Monday, Tuesday, Wednesday
P: 02 4921 0119

M: 0439 685 573

E: gwilliams@lakemac.nsw.gov.au

126-138 Main Road Speers Point NSW 2284

Box 1906 HRMC NSW 2310

lakemac.com.au

From: Hemantha DeSilva [mailto:Hemantha.DeSilva@waternsw.com.au]
Sent: Tuesday, 6 November 2018 11:23 AM
To: Georgie Williams
Subject: Re: DA/419/2018 at 114 Cary Street, Toronto

Thank you Georgie. Please note that We have a new postal address.

Regards

Hemantha

Hemantha

Hemantha De Silva

Senior Water Regulation Officer

Customer Assessments & Approvals

Customer & Community

WaterNSW

PO Box 2157, Dangar 2309

Suit 2, Level 6, 384 Hunter Street, Newcastle NSW 2300

Mobile 0438638987

Email Hemantha.Desilva@waternsw.com.au

On Tue, Nov 6, 2018 at 11:18 AM +1100, "Georgie Williams" <gwilliams@lakemac.nsw.gov.au > wrote:

Hi Hemantha,

In regard to the above-mentioned application, just letting you know we have now received a cheque (made out to the correct authority) from the applicant and the formal referral is in the mail today.

We look forward to receiving your comments at your earliest convenience.

Regards

Georgie Williams

Senior Development Planner

Monday, Tuesday, Wednesday

P: 02 4921 0119

M: 0439 685 573

E: gwilliams@lakemac.nsw.gov.au

126-138 Main Road Speers Point NSW 2284

Box 1906 HRMC NSW 2310

lakemac.com.au

-----Original Message-----

From: Amber L Murray

Sent: Tuesday, 6 November 2018 11:16 AM

To: Georgie Williams

Subject: FW: Scanned Document

Amber Murray

Senior Administration Officer - DAC - Planning Stream

P: 02 4921 0489

E: amurray@lakemac.nsw.gov.au

126-138 Main Road Speers Point NSW 2284

Box 1906 HRMC NSW 2310

lakemac.com.au

-----Original Message-----

From: PRN_ADM_DAC-ADMIN [mailto:faxdac@lakemac.nsw.gov.au]

Sent: Tuesday, 6 November 2018 11:14 AM

To: Amber L Murray

Subject: Scanned Document

Number of Images: 1

Attachment File Type: PDF

Device Name: PRN_ADM_DAC-ADMIN

Device Location: Admin - 1st Floor - DAC

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Any views expressed in this communication are those of the individual sender, except where the sender specifically states them to be the views of Council.

Information provided to Council in correspondence, submissions or requests (verbal, electronic or written), including personal information such as your name and address, may be made publicly available, including via Council website, in accordance with the Government Information (Public Access) Act (GIPA Act) 2009.

Contact: Hemantha De Silva
Phone: 02 9865 2880
Email: Hemantha.Desilva@waternsw.com.au
Your ref: DA/419/2018

Via email: council@lakemac.nsw.gov.au

Attn: Georgie Williams

Senior Development Planner
Development Assessment and Compliance
Lake Macquarie City Council
126-136 Main Road, Speers Point NSW 2310

16 November 2018

Dear Ms Williams,

Subject: DA/419/2018 Toronto Investments No. 1 Pty Limited. 114, 116, 118, 120 Cary Street Toronto NSW 2283

I refer to your letter dated 6 November 2018 on the above subject. The proposed development requires a water supply work approval under section 90 of the *Water Management Act 2000*.

The proponent is required to apply and obtain the approval before commencement of any works related to take of water. Subject to exemptions, the proponent will need to hold an access licence to account for the ongoing take of water.

General Terms of Approval for a water supply work is attached. Once granted approval will be subject to the terms and conditions of the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016.
https://www.legislation.nsw.gov.au/#/view/regulation/2016/375

Please direct all related correspondence to: Water Regulation - Coastal, Water NSW, **PO Box 2157, Dangar NSW 2309.**

Yours Faithfully

Hemantha De Silva
Senior Water Regulation Officer

General Terms of Approval for a

Water Supply Work under the *Water Management Act 2000* (WM Act).

1. A water licence is required under the WM Act where any act causes:

   (a) the removal of water from a water source;

   (b) the movement of water from one part of an aquifer to another part of an aquifer; or

   (c) the movement of water from one water source to another water source.

   A water licence is required whether water is taken for consumptive use or whether it is taken incidentally.
2. Sufficient permanent drainage shall be provided beneath and around the outside of the watertight structure to ensure that natural groundwater flow is not impeded.
3. Construction methods and material used in and for construction shall be designed to account for the likely range of salinity and pollutants which may be dissolved in groundwater, and shall not themselves cause pollution of the groundwater.
4. Documentation comprising water level measurements, maps, bore logs, calculations, results, discussion and justification for various matters related to the water supply work must be collected and provide on request by Water NSW.
5. The Applicant shall assess the likely impacts of the dewatering activities on other groundwater users.
6. A reasonable estimate of the total volume of groundwater to be extracted shall be calculated together with details and calculation methods for the parameters and supporting information to confirm their development or measurement.
7. The method of disposal of pumped water shall be nominated and a copy of the written permission from the relevant regulatory authority shall be provided with the application.
8. Contaminated groundwater shall not be reinjected into any aquifer.
9. Engineering measures designed to transfer groundwater around and beneath the basement shall be incorporated into the basement construction to prevent the completed infrastructure from restricting pre-existing groundwater flows.
10. Piping, piling or other structures used in the management of pumped groundwater shall not create a flooding hazard or induce mounding of groundwater. Control of pumped groundwater is to be maintained at all times during dewatering to prevent unregulated off-site discharge.
11. Pumped groundwater shall not be allowed to discharge off-site (e.g. adjoining roads, stormwater system, sewerage system, etc.). The pH of discharge water shall be managed to be between 6.5 and 8.5. The requirements of any other approval for the discharge of pumped groundwater shall be complied with.

APPENDIX L

Proposed Shoring Plan

Structural Report – Proposed Basement Design

for

118 Cary Street, Toronto

Executive Summary

The following report provides further detailed structural advice regarding the proposed basement structure design and construction for the proposed apartment development at 118 Cary Street Toronto. This report summarises the proposed basement wall design and addresses the relevant structural engineering queries raised in Lake Macquarie City Council's schedule of contentions.

The development is proposed to be constructed with a reinforced concrete frame. The basement is proposed to be constructed with a concrete secant pile basement wall, with reinforced concrete bored pile foundations, and reinforced concrete slabs, columns and walls.

In response to the specific structural queries raised we make the following comments:

Part B1-4 *Engineering*

(a) *Insufficient geotechnical data has been submitted to adequately assess the actual subsurface conditions.*

- Two geotechnical investigations have been completed on this site. In our professional opinion the level of geotechnical investigation and reporting carried out by Chameleon Geosciences (now Aargus Australia) is sufficient to carry out detailed design of the basement excavation support and building foundations.

(b) *The method of excavation support has not been justified.*

- A 600mm diameter concrete secant pile wall is proposed to be constructed to form the basement shoring wall. A secant pile wall is a retention wall constructed with two passes of continuous flight auger concrete pile installation to form an overlapped system with no gaps. The first stage consists of installation of *soft* piles, which are unreinforced piles consisting of 10MPa concrete. The second stage involves installation of the reinforced concrete *hard* piles which are cut into the adjacent *soft* piles creating a watertight overlap.
- The primary advantages of this method are:
  - Generally watertight due to formed overlap of piles, and;
  - Highly accurate with use of guide walls and specialist piling equipment.
- The body of this report details the structural analysis and design results for the shoring wall. The predicted horizontal settlements of the shoring walls from our analysis have been provided in the report and are shown to generally be within tolerable limits.

(c) *The method, extent and requirements for site groundwater dewatering during construction have not been assessed.*

- Based on results from geotechnical investigation, the ground water level is expected to be at approximately RL 1.0m (2.0m to 3.5m below existing ground level). The basement excavation level is proposed to be at approximately RL-2.0m which is below the ground water level.
- For excavation of the basement, it is proposed to temporarily and locally dewater within the excavation to a level of RL-3.0m. The extent of drawdown effects to adjacent lots will be addressed by the geotechnical assessment.
- It is expected that once the temporary dewatering system is shut down, the groundwater level will return to pre-existing levels which will result in hydrostatic pressures being imposed on the

structure. The base slabs are proposed to be constructed over a waterproof membrane and are designed to withstand the hydrostatic uplift pressures associated with a groundwater level of RL1.0m

(e) The long-term requirements and extent of groundwater dewatering, including the impacts of such dewatering have not been assessed

- The proposed dewatering is a temporary measure only during construction of the basement. Once completed the dewatering system would be shut down and natural pre-existing groundwater levels would return.

NORTHROP
Level 1, 215 Pacific Highway
Charlestown NSW 2290
02 4943 1777
newcastle@northrop.com.au
ABN 81 094 433 100

17 June 2021

NL171556

Toronto Investments No. 1 Pty Ltd
C/- McCabe Curwood Pty Ltd
Level 38, MLC Center
19 Martin Place
Sydney NSW 2000

Attention: Paul Vergotis

Dear Paul

Re: 118 Cary Street, Toronto – Structural Report

To provide additional supporting information to address the list of contentions raised by Lake Macquarie City Council for the development application of the above-mentioned site, Northrop Engineers have been engaged by Toronto Investments Pty Ltd to provide detailed structural advice regarding the basement design and construction for the above project. This letter aims to summarise the proposed basement wall design to address the relevant structural engineering queries raised in Lake Macquarie City Council's schedule of contentions. Refer to the executive summary for specific responses.

Project Description

The proposed development consists of a two-storey basement car park, with two five-storey residential buildings constructed off a common podium level. The site is bounded by Cary Street to the West, Arnott Avenue to the East, Bath Street to the South and a single storey commercial premises to the North.

Documentation

The proposed design of the basement, including shoring wall has been based on the following documentation provided to Northrop; as summarised below in Table 1

Item	By	No. & Revision
Geotechnical Report	Aargus Australia	GS8030-1A (dated 02/03/2021)
Geotechnical Report	JK Geotechnics	29644SBrpt (dated 13/10/2016)
Architectural Drawings	Mark Lawler Architects	1588DD-1-01 to 1-07 (dated 15/03/2021)

Structural Summary

The proposed development above ground will consist of post-tensioned concrete floor plates with reinforced concrete columns and core walls. The main building transfer will occur on Level 1. The structure is proposed to be founded in the conglomerate bedrock, using reinforced concrete foundation piles.

The proposed shoring wall system is a 600mm diameter concrete secant pile wall. A secant pile wall is a retention wall constructed with two passes of continuous flight auger concrete pile installation to form an overlapped system with no gaps. The first stage consists of installation of *soft* piles, which are unreinforced piles consisting of 10MPa concrete. The second stage involves installation of the reinforced concrete *hard* piles which are cut into the adjacent *soft* piles creating a watertight overlap. The key advantages are that it can build walls to a high degree of accuracy and therefore low likelihood of any voids between panels which aid the general watertightness of the system. Refer to figures below for typical details of the secant pile wall.

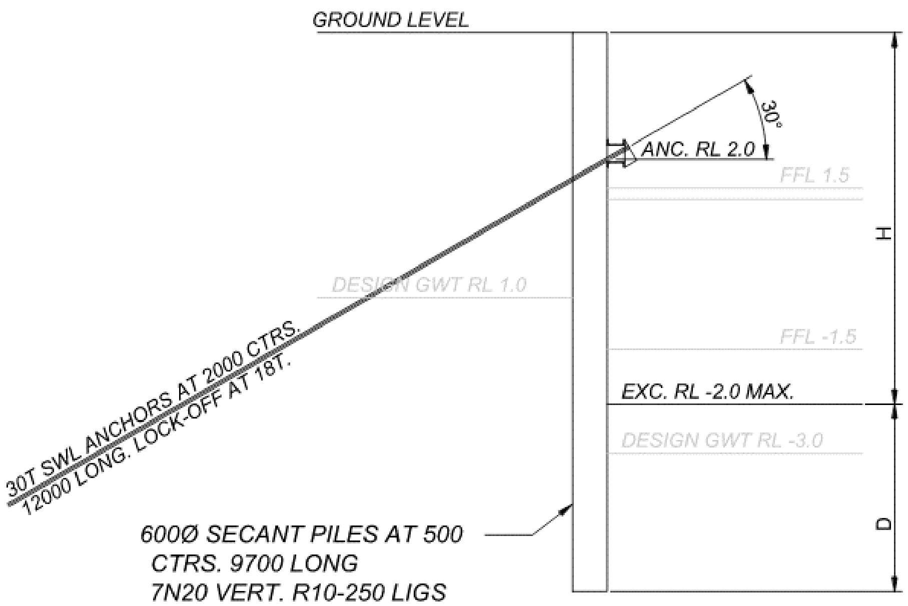


Figure 1: Basement Wall Cross-Section

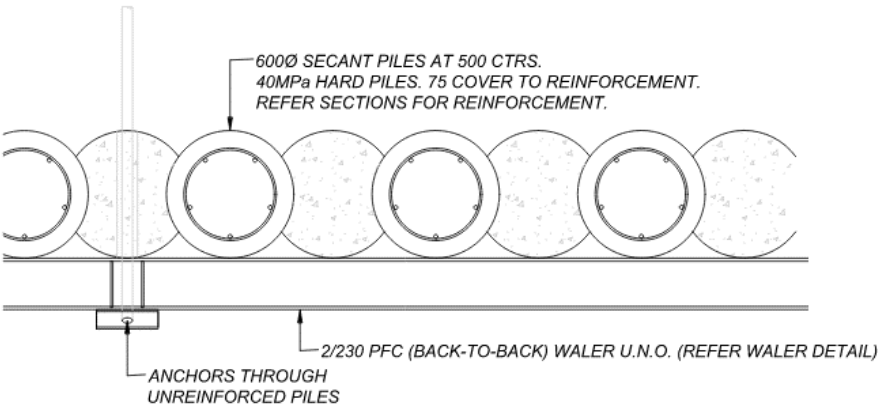


Figure 2: Structural detail of Secant Pile wall

Following the installation of the basement retention wall, it is proposed to construct the basement with a bottom-up approach. Following partial excavation of the basement, a row of temporary ground anchors are installed. After full excavation to bulk level, the watertight basement slab is constructed and subsequently the slabs above are constructed working out of the basement. The slabs provide permanent lateral support to the walls.

Geotechnical Summary

The site is generally underlain by the following subsurface layers:

Material	Depth from surface to top of layer (m)
Fill	0
Stiff Silty Clay	0.6
Very Stiff Silty Clay	2.4
Conglomerate Bedrock	14.0

Groundwater is expected to be encountered at RL1.0m.

The geotechnical design parameters have been interpreted from the information provided in the geotechnical reports prepared for this site and referenced above. The geotechnical design parameters for the shoring walls are summarised in tables below.

Soil Unit	Unit Weight (kN/m^3)	Effective Cohesion c' (kPa)	Angle of Friction ϕ' (º)	Elastic Modulus (MPa)	Active Earth Pressure Coefficient	At-rest Earth Pressure Coefficient	Passive Earth Pressure Coefficient
Fill	17	0	26	6	0.4	0.6	-
Stiff Clay	19	5	24	15	0.3	0.35	2.8
Very Stiff Clay	21	8	25	25	0.25	0.3	3.0
Conglomerate bedrock	24	50	35	500	0	0	5.0

Proposed Basement Design

Design Loads

The design loads for the building have been adopted using the provisions of AS1170.0, AS1170.1, AS1170.2 and AS1170.4.

The design of the basement shoring wall has been carried out to resist the lateral soil pressures and hydrostatic pressures from the ground water level, combined with a general surcharge live load of 10kPa.

Basement Wall Design Methodology

The secant pile shoring wall has been designed and analysed using 'WALLAP' retaining wall analysis software. This is an industry standard tool, considered suitable for this application. The WALLAP analysis considers one elevation at a time, where wall deflections are considered to interact with the opposing side, the results are superimposed. The WALLAP analysis has been staged to incorporate the bottom-up construction methodology.

- The design excavation level has been set nominally 500mm below the basement finished floor level to account for excavation and construction of the base slab.
- The wall is designed to a factor of safety against overturning of 1.50

Basement Wall Design Analysis

Refer to Appendix A for the detailed WALLAP output results for the initial design. This was taken along the Arnott Avenue elevation where the excavation (and thus retention height) is at a maximum and therefore conservatively applied to the other elevations.

The structural performance of the secant pile wall is governed by the structural adequacy of the reinforced concrete hard piles. Based on the results our initial design indicates the wall will consist of reinforced piles at 600mm diameter and 7-N20 vertical reinforcing bars.

We note that the WALLAP analysis has the groundwater pressures at original levels on the retained side. This is inherently conservative as the dewatering process will locally drawdown the groundwater level on the retained side of the wall as well, and therefore the deflection results presented in the analysis would likely be larger than what occurs in practice.

Estimated Deflection and Deflection Monitoring

The predicted maximum deflections (listed below) of the shoring walls occur at the base of the excavation.

Elevation	Predicted horizontal deflection at ground level** (mm)	Predicted horizontal deflection at base of excavation (mm)
Arnott Avenue	10	24

**** In practice there will be a nominal amount of additional horizontal deflection due to shrinkage and shortening of the supporting concrete slabs.**

General guidance in *CIRIA C580: Embedded Retaining Walls* notes that the adjacent vertical ground movements due to retention wall deflections could be expected to be in the order of 0.15% to 0.225% of the excavated depth. At an excavation depth (*H*) of 6500mm, vertical ground settlement at the surface of 10mm to 15mm could be expected adjacent to the wall reducing to zero at an extent of '*H*' to '4x*H*' horizontally from the wall. This approximation is general in nature and the vertical settlements of the ground adjacent to the excavation will be assessed by the project geotechnical engineer using finite element modelling to confirm.

Deflection monitoring is recommended to be installed. Baseline readings should be taken prior to excavation, with readings taken every week until the basement construction has been completed.

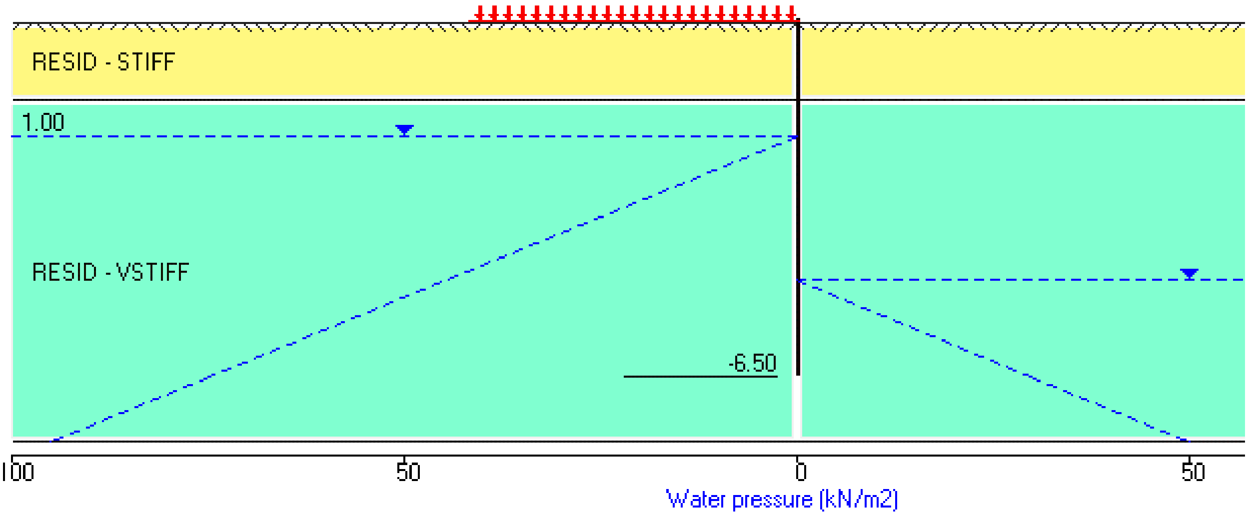
Construction Sequence

The following outlines the construction sequence to be adopted for constructing the basement. It is critical that the construction sequence is adhered to, to ensure the wall performance and stability is achieved.

The proposed construction methodology to adopt is:

Stage 1:

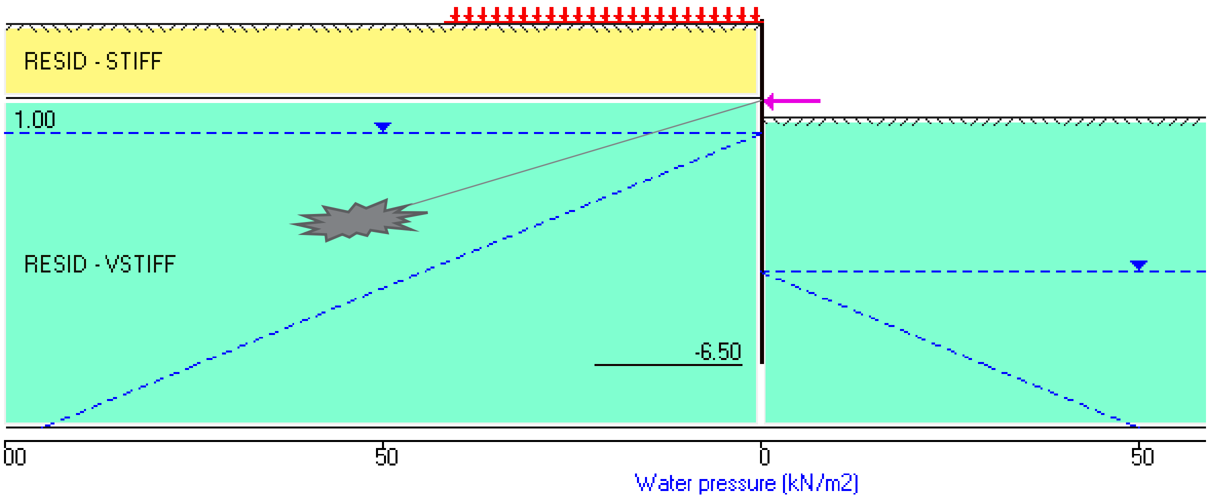
- Install 600mm diameter secant pile wall to extent of basement with CFA piling rig.
- Turn on temporary dewatering to locally lower the ground water level within the extent of the basement excavation.



Indicative Cross-Section at Stage 1

Stage 2:

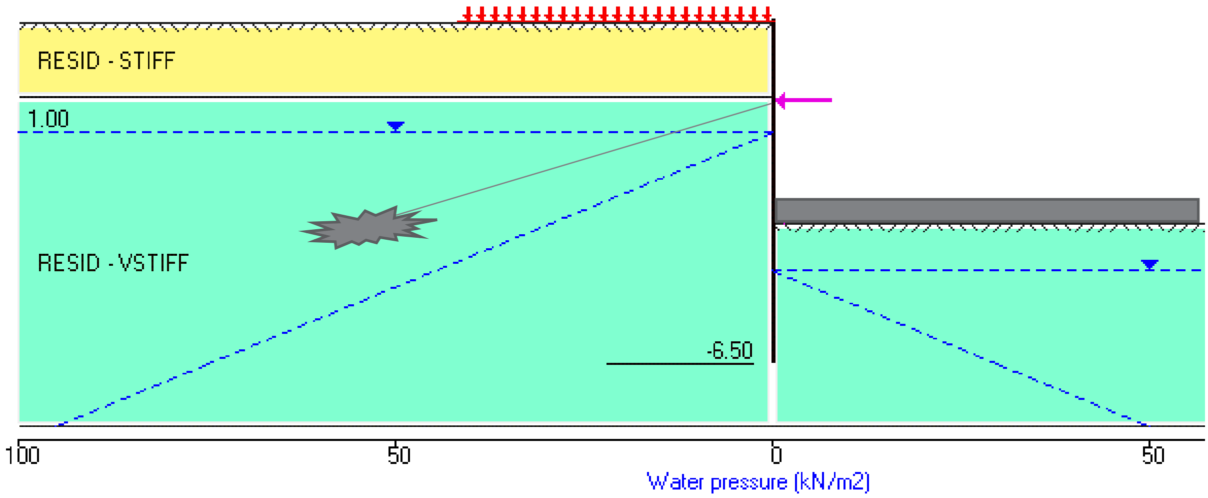
- Partially excavate the basement and install row of temporary ground anchors.



Indicative Cross-Section at Stage 2

Stage 3:

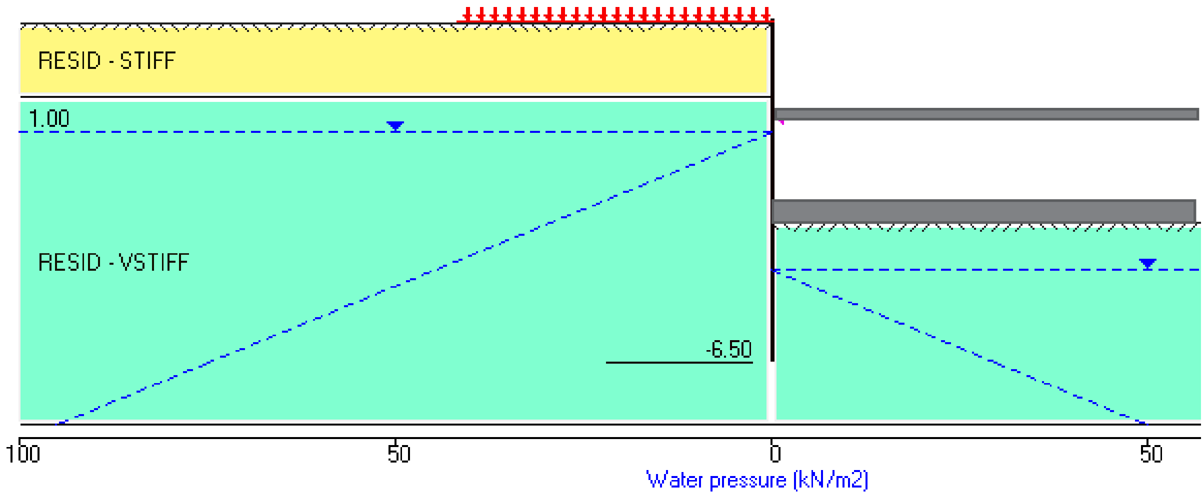
- Excavate basement to base level and install the waterproofing membrane and watertight basement slab (Level B2).



Indicative Cross-Section at Stage 3

Stage 4:

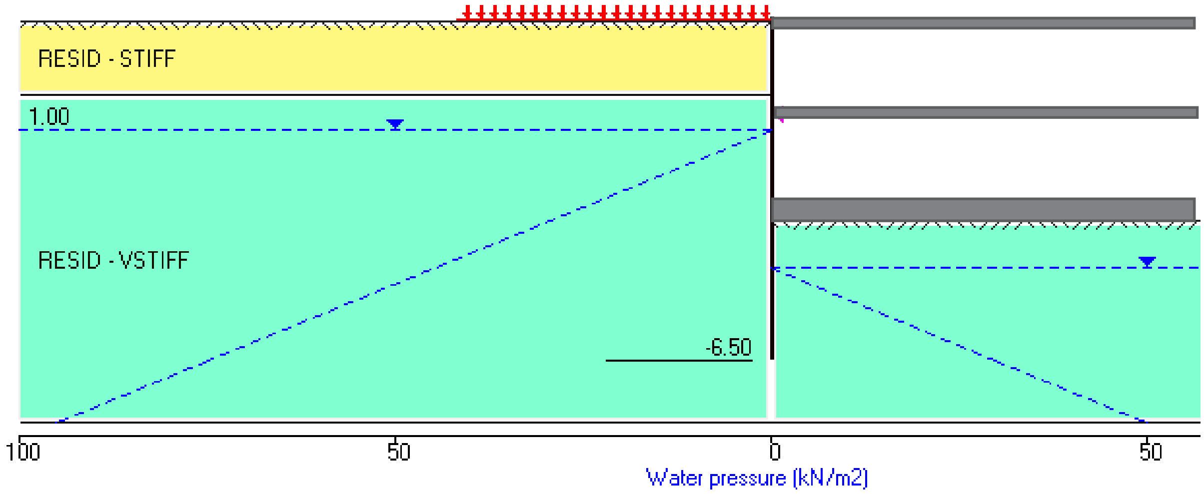
- Construct level B1 floor slab, cast hard against shoring wall to provide permanent support.
- Remove/decommission the temporary anchors.



Indicative Cross-Section at Stage 4

Stage 5:

- Construct ground floor slab, tied into shoring wall to provide permanent support.



Indicative Cross-Section at Stage 4

Stage 6:

- Decommission dewatering system.
- Continue build above ground.

Concluding Statement

In our opinion, the proposed development, shoring and basement solution is optimised to reduce risks associated with constructing a basement for this development.

The role of the project geotechnical engineer and hydrogeological consultant in understanding the project risks and providing expert advice regarding groundwater and related settlements is critical in developing the proposed basement design. This report must be read in conjunction with advice and reports by the project Geotechnical Engineer/Hydrogeological Consultant.

Subject to the approval of a professional geotechnical engineer and hydrogeological consultants, we, Northrop engineers, being professional structural engineers, see no reason why the proposed basement design and construction methodology should detrimentally impact the stability of the adjacent land or infrastructure.

This report has been developed to assist with planning authority approval of the proposed development. We would be pleased to assist with any further queries by contacting the undersigned.

Yours sincerely,

Matthew Allen
Associate | Structural Engineer
BEng (Civil) MIEAust CPEng NER (Structural)

References

CIRIA C580 *Embedded Retaining Walls – Guidance for economic design*, London 2003

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Appendix A – WALLAP Output

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Left side	Soil types Right side
1	4.50	1 RESID - STIFF	1 RESID - STIFF
2	2.10	2 RESID - VSTIFF	2 RESID - VSTIFF
3	-8.50	3 CONGLOMERATE	3 CONGLOMERATE

SOIL PROPERTIES

-- Soil type -- No. Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh,kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1 RESID - STIFF	19.00	15000	0.350	OC (0.300)	0.300 (1.252)	2.800 (4.432)	5.000d
2 RESID - VSTIFF	21.00	25000	0.300	OC (0.300)	0.250 (1.147)	3.000 (4.436)	8.000d
3 CONGLOMERA- TE	24.00	500000	0.000	OC (0.300)	0.172 (0.828)	5.000 (4.472)	50.00d

Additional soil parameters associated with Ka and Kp

	--- parameters for Ka ---			--- parameters for Kp ---		
------- Soil type ------- No. Description	Soil friction angle	Wall adhesion coeff.	Back-fill angle	Soil friction angle	Wall adhesion coeff.	Back-fill angle
1 RESID - STIFF	29.20	0.541	0.00	22.11	0.526	0.00
2 RESID - VSTIFF	33.18	0.587	0.00	24.27	0.400	0.00
3 CONGLOMERATE	45.00	0.000	0.00	41.81	0.000	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	1.00	1.00

Automatic water pressure balancing at toe of wall : No

Water press. profile no.	Left side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2	Right side Point no.	Elev. m	Piezo elev. m	Water press. kN/m2
1	1	1.00	1.00	0.0	1	-3.50	-3.50	0.0

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -6.50
Maximum finite element length = 0.60 m
Youngs modulus of wall E = 3.2000E+07 kN/m2
Moment of inertia of wall I = 0.010600 m4/m run
E.I = 339200 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Prop no.	Elev.	Prop spacing m	Cross-section area sq.m	Youngs modulus kN/m2	Free length m	Inclin-ation (degs)	Pre-stress /prop kN	Strut or Anchor	Allow tension ?	L/R
1	2.00	2.00	0.017700	2.000E+08	3.50	20.00	0	Anchor	n/a	R
2	-1.75	1.00	0.500000	3.200E+07	0.10	0.00	0	Strut	No	R
3	1.50	1.00	0.200000	3.200E+07	0.10	0.00	0	Strut	No	R
4	4.40	1.00	0.200000	3.200E+07	0.10	0.00	0	Strut	No	R

SURCHARGE LOADS

Surch-arge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge ----- kN/m2 ----- Near edge	Far edge	Equiv. soil type	Partial factor/ Category
1	4.50	0.00(L)	100.00	10.00	10.00	=	N/A	N/A

Note: L = Left side, R = Right side

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 4.50
2	Apply water pressure profile no.1
3	Excavate to elevation 1.50 on RIGHT side
4	Install strut or anchor no.1 at elevation 2.00
5	Excavate to elevation -2.00 on RIGHT side
6	Install strut or anchor no.2 at elevation -1.75
7	Install strut or anchor no.3 at elevation 1.50
8	Remove strut or anchor no.1 at elevation 2.00
9	Install strut or anchor no.4 at elevation 4.40

FACTORS OF SAFETY and ANALYSIS OPTIONS

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.50

Parameters for undrained strata:
Minimum equivalent fluid density = 5.00 kN/m3
Maximum depth of water filled tension crack = 0.00 m

Bending moment and displacement calculation:
Method - Subgrade reaction model using Influence Coefficients
Open Tension Crack analysis? - No
Non-linear Modulus Parameter (L) = 0 m

Boundary conditions:
Length of wall (normal to plane of analysis) = 1000.00 m

Width of excavation on Left side of wall = 20.00 m
Width of excavation on Right side of wall = 20.00 m

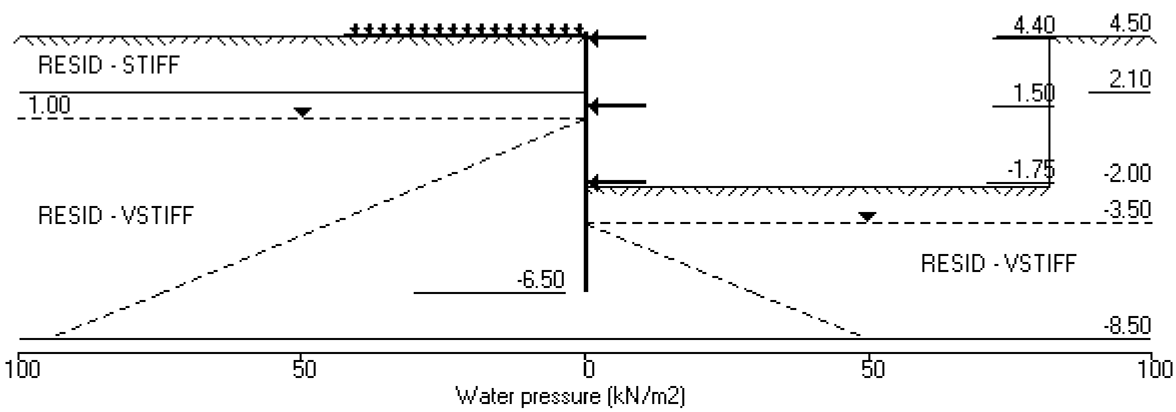
Distance to rigid boundary on Left side = 20.00 m
Distance to rigid boundary on Right side = 20.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement Bending mom. Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 4.50	Yes	No	Yes
2	Apply water pressure profile no.1	Yes	No	Yes
3	Excav. to elev. 1.50 on RIGHT side	Yes	No	Yes
4	Install prop no.1 at elev. 2.00	Yes	No	Yes
5	Excav. to elev. -2.00 on RIGHT side	Yes	No	Yes
6	Install prop no.2 at elev. -1.75	Yes	No	Yes
7	Install prop no.3 at elev. 1.50	Yes	No	Yes
8	Remove prop no.1 at elev. 2.00	Yes	No	Yes
9	Install prop no.4 at elev. 4.40	Yes	No	Yes
*	Summary output	Yes	-	Yes

Units: kN,m

Stage No.9 Install prop no.4 at elev. 4.40



Units: kN,m

Stage No. 3 Excavate to elevation 1.50 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Stage No.	Ground level Act.	Ground level Pass.	Prop Elev.	FoS for toe elev. = -6.50: Factor of Safety	FoS for toe elev. = -6.50: Moment equilib. at elev.	Toe elev. for FoS = 1.500: Toe elev.	Toe elev. for FoS = 1.500: Wall Penetr -ation	Direction of failure
3	4.50	1.50	Cant.	2.520	-5.59	-1.66	3.16	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 1000.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall
Right side 20.00 from wall

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Prop forces kN/m
1	4.50	0.00	0.008	-2.32E-04	0.0	0.0	
2	4.40	0.00	0.008	-2.32E-04	0.0	0.0	
3	4.00	0.00	0.008	-2.32E-04	0.0	-0.0	
4	3.60	1.87	0.008	-2.32E-04	0.4	0.1	
5	3.00	5.28	0.008	-2.33E-04	2.5	1.0	
6	2.55	7.84	0.008	-2.36E-04	5.5	2.8	
7	2.10	10.40	0.009	-2.42E-04	9.6	6.1	
		4.71	0.009	-2.42E-04	9.6	6.1	
8	2.00	5.23	0.009	-2.44E-04	10.1	7.1	
9	1.50	7.85	0.009	-2.58E-04	13.3	13.0	
		-12.39	0.009	-2.58E-04	13.3	13.0	
10	1.00	-10.74	0.009	-2.81E-04	7.6	18.2	
11	0.50	-8.80	0.009	-3.10E-04	2.7	20.8	
12	0.00	-6.92	0.009	-3.41E-04	-1.3	21.2	
13	-0.60	-4.73	0.009	-3.77E-04	-4.7	19.4	
14	-1.18	-2.70	0.010	-4.07E-04	-6.9	16.1	
15	-1.75	-0.74	0.010	-4.31E-04	-7.9	11.9	
16	-2.00	0.11	0.010	-4.39E-04	-8.0	9.9	
17	-2.38	1.36	0.010	-4.48E-04	-7.7	7.0	
18	-2.75	2.59	0.010	-4.54E-04	-6.9	4.3	
19	-3.13	3.82	0.010	-4.58E-04	-5.7	1.9	
20	-3.50	5.05	0.011	-4.59E-04	-4.1	0.1	
21	-3.85	4.19	0.011	-4.59E-04	-2.5	-1.0	
22	-4.20	3.33	0.011	-4.57E-04	-1.1	-1.6	
23	-4.80	1.85	0.011	-4.54E-04	0.4	-1.7	
24	-5.40	0.38	0.012	-4.52E-04	1.1	-1.0	
25	-5.95	-0.99	0.012	-4.51E-04	0.9	-0.4	
26	-6.50	-2.36	0.012	-4.50E-04	0.0	0.0	

(continued)

Stage No.3 Excavate to elevation 1.50 on RIGHT side

LEFT side

Node no.	Y coord	Water press. kN/m2	Vertic -al kN/m2	Effective stresses Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	4.50	0.00	10.00	0.00	50.16	0.00	0.00a	1465
2	4.40	0.00	11.90	0.00	55.47	0.00	0.00a	1465
3	4.00	0.00	19.50	0.00	76.75	0.00	0.00a	1465
4	3.60	0.00	27.10	1.87	98.03	1.87	1.87a	1465
5	3.00	0.00	38.49	5.28	129.92	5.28	5.28a	1465
6	2.55	0.00	47.02	7.84	153.81	7.84	7.84a	1465
7	2.10	0.00	55.54	10.40	177.68	10.40	10.40a	1465
		0.00	55.54	4.71	202.12	4.71	4.71a	2442
8	2.00	0.00	57.64	5.23	208.40	5.23	5.23a	2442
9	1.50	0.00	68.10	7.85	239.77	7.85	7.85a	2442
10	1.00	0.00	78.54	10.46	271.11	10.46	10.46a	2442
11	0.50	5.00	83.97	11.82	287.40	11.82	16.82a	2442
12	0.00	10.00	89.39	13.17	303.65	13.17	23.17a	2442
13	-0.60	16.00	95.87	14.79	323.10	14.79	30.79a	2442
14	-1.18	21.75	102.07	16.34	341.69	16.34	38.09a	2442
15	-1.75	27.50	108.25	17.89	360.24	17.89	45.39a	2442
16	-2.00	30.00	110.94	18.56	368.30	18.56	48.56a	2442
17	-2.38	33.75	114.96	19.56	380.36	19.56	53.31a	2442
18	-2.75	37.50	118.98	20.57	392.42	20.57	58.07a	2442
19	-3.13	41.25	122.99	21.57	404.46	21.57	62.82a	2442
20	-3.50	45.00	127.01	22.57	416.50	22.57	67.57a	2442
21	-3.85	48.50	130.75	23.51	427.73	23.51	72.01a	2442
22	-4.20	52.00	134.49	24.44	438.95	24.44	76.44a	2442
23	-4.80	58.00	140.90	26.05	458.18	26.05	84.05a	2442
24	-5.40	64.00	147.31	27.65	477.41	27.65	91.65a	2442
25	-5.95	69.50	153.18	29.12	495.03	29.12	98.62a	2442
26	-6.50	75.00	159.06	30.59	512.65	30.59	105.59a	2442

RIGHT side

Node no.	Y coord	Water press. kN/m2	Vertic -al kN/m2	Effective stresses Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	35.49	20.24	20.24	2822
10	1.00	0.00	10.50	0.00	66.99	21.20	21.20	2822
11	0.50	0.00	21.00	0.00	98.50	25.62	25.62	2822
12	0.00	0.00	31.51	0.00	130.02	30.09	30.09	2822
13	-0.60	0.00	44.13	1.85	167.87	35.52	35.52	2822
14	-1.18	0.00	56.23	4.88	204.18	40.79	40.79	2822
15	-1.75	0.00	68.35	7.91	240.54	46.12	46.12	2822
16	-2.00	0.00	73.63	9.23	256.37	48.45	48.45	2822
17	-2.38	0.00	81.55	11.21	280.12	51.96	51.96	2822
18	-2.75	0.00	89.47	13.19	303.91	55.47	55.47	2822
19	-3.13	0.00	97.41	15.18	327.72	59.00	59.00	2822
20	-3.50	0.00	105.36	17.16	351.56	62.52	62.52	2822

(continued)

Stage No.3 Excavate to elevation 1.50 on RIGHT side

		RIGHT side						
			Effective stresses				Total	Coeff. of
Node	Y	Water	Vertic	Active	Passive	Earth	earth	subgrade
no.	coord	press.	-al	limit	limit	pressure	pressure	reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
21	-3.85	3.50	109.29	18.14	363.34	64.32	67.82	2822
22	-4.20	7.00	113.22	19.13	375.14	66.11	73.11	2822
23	-4.80	13.00	119.99	20.82	395.45	69.19	82.19	2822
24	-5.40	19.00	126.79	22.52	415.84	72.27	91.27	2822
25	-5.95	24.50	133.04	24.08	434.61	75.10	99.60	2822
26	-6.50	30.00	139.32	25.65	453.45	77.94	107.94	2822

Note: 105.59 a Soil pressure at active limit
123.45 p Soil pressure at passive limit

```
NORTHROP CONSULTING ENGINEERS                                | Sheet No.
Program: WALLAP  Version 6.07  Revision A55.B74.R58          | Job No.  171556
                             Licensed from GEOSOLVE          | Made by :
Data filename/Run ID: Typical_wall                           |
New data set - contains default parameters                   | Date:16-06-2021
Please modify / add                                          | Checked :
-----------------------------------------------------------------------------
                                                     Units: kN,m
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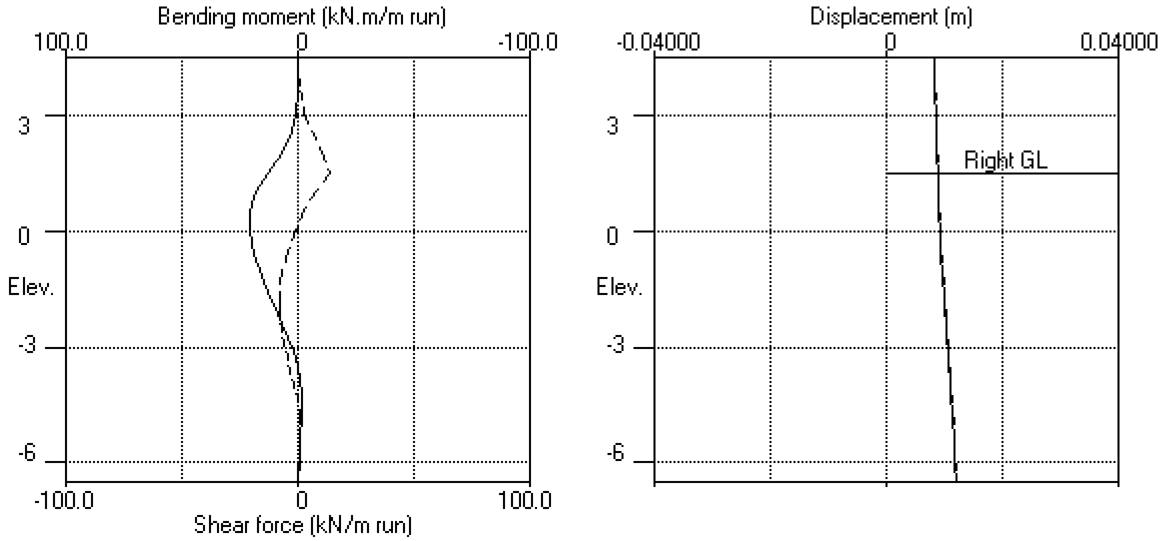
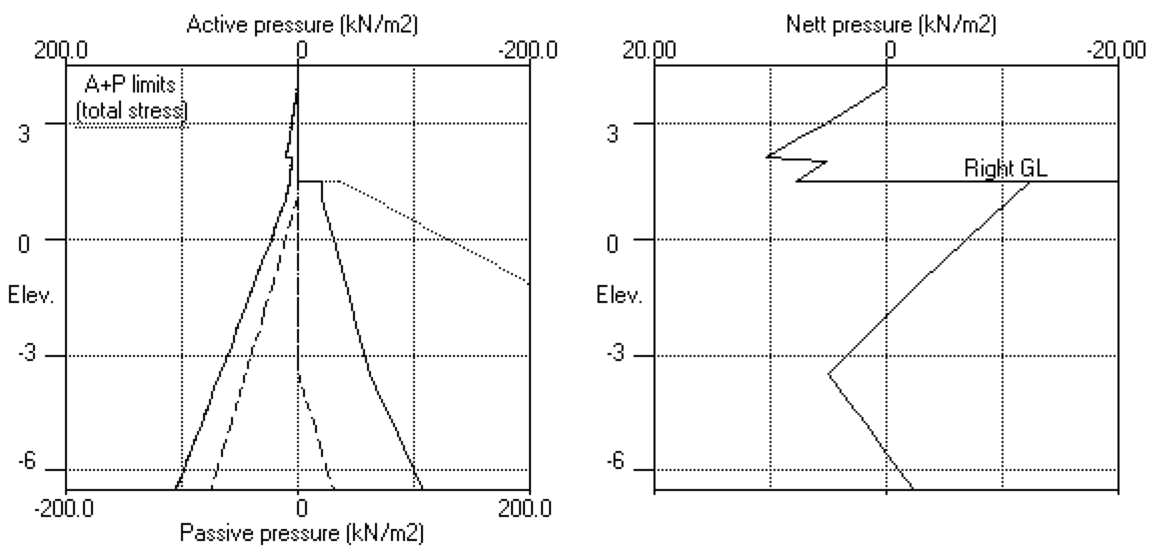
Stage No.3 Excav. to elev. 1.50 on RIGHT side



Stage No.3 Excav. to elev. 1.50 on RIGHT side



Units: kN,m

Stage No. 5 Excavate to elevation -2.00 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

				FoS for toe elev. = -6.50		Toe elev. for FoS = 1.500		
Stage No.	Ground level Act.	Pass.	Prop Elev.	Factor of Safety	Moment equilib. at elev.	Toe elev.	Wall Penetr -ation	Direction of failure
5	4.50	-2.00	2.00	1.537	n/a	-6.26	4.26	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 1000.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall
Right side 20.00 from wall

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Prop forces kN/m
1	4.50	26.60	0.003	-2.17E-03	0.0	0.0	
2	4.40	25.51	0.004	-2.17E-03	2.6	0.1	
3	4.00	21.11	0.004	-2.17E-03	11.9	3.2	
4	3.60	18.58	0.005	-2.18E-03	19.9	9.7	
5	3.00	15.33	0.007	-2.21E-03	30.0	25.4	
6	2.55	12.79	0.008	-2.25E-03	36.4	40.6	
7	2.10	10.40	0.009	-2.32E-03	41.6	58.3	
		4.71	0.009	-2.32E-03	41.6	58.3	
8	2.00	5.23	0.009	-2.33E-03	42.1	62.5	-114.4
		5.23	0.009	-2.33E-03	-72.3	62.5	
9	1.50	7.85	0.010	-2.40E-03	-69.1	27.1	
10	1.00	10.46	0.011	-2.42E-03	-64.5	-6.3	
11	0.50	16.82	0.012	-2.38E-03	-57.7	-36.9	
12	0.00	23.17	0.014	-2.31E-03	-47.7	-63.3	
13	-0.60	30.79	0.015	-2.18E-03	-31.5	-87.2	
14	-1.18	38.09	0.016	-2.02E-03	-11.7	-99.7	
15	-1.75	45.39	0.017	-1.85E-03	12.3	-99.6	
16	-2.00	48.56	0.018	-1.78E-03	24.0	-95.1	
		13.07	0.018	-1.78E-03	24.0	-95.1	
17	-2.38	0.84	0.018	-1.68E-03	26.7	-84.7	
18	-2.75	0.38	0.019	-1.59E-03	26.9	-74.6	
19	-3.13	0.04	0.020	-1.51E-03	27.0	-64.4	
20	-3.50	-0.20	0.020	-1.45E-03	26.9	-54.2	
21	-3.85	-2.35	0.021	-1.40E-03	26.5	-44.8	
22	-4.20	-4.43	0.021	-1.36E-03	25.3	-35.7	
23	-4.80	-7.90	0.022	-1.30E-03	21.6	-21.2	
24	-5.40	-11.30	0.023	-1.28E-03	15.8	-9.7	
25	-5.95	-14.40	0.023	-1.27E-03	8.8	-2.7	
26	-6.50	-17.50	0.024	-1.27E-03	0.0	0.0	

At elev. 2.00 Prop force = 114.4 kN/m run (horiz.)
= 121.8 kN/m run (inclined)

(continued)

Stage No.5 Excavate to elevation -2.00 on RIGHT side

LEFT side

Node no.	Y coord	Water press. kN/m2	Effective stresses Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	4.50	0.00	10.00	0.00	50.16	26.60	26.60	5666
2	4.40	0.00	11.90	0.00	55.47	25.51	25.51	5666
3	4.00	0.00	19.50	0.00	76.75	21.11	21.11	5666
4	3.60	0.00	27.10	1.87	98.03	18.58	18.58	5666
5	3.00	0.00	38.49	5.28	129.92	15.33	15.33	5666
6	2.55	0.00	47.02	7.84	153.81	12.79	12.79	5666
7	2.10	0.00	55.54	10.40	177.68	10.40	10.40a	2040
		0.00	55.54	4.71	202.12	4.71	4.71a	3400
8	2.00	0.00	57.64	5.23	208.40	5.23	5.23a	3400
9	1.50	0.00	68.10	7.85	239.77	7.85	7.85a	3400
10	1.00	0.00	78.54	10.46	271.11	10.46	10.46a	3400
11	0.50	5.00	83.97	11.82	287.40	11.82	16.82a	3400
12	0.00	10.00	89.39	13.17	303.65	13.17	23.17a	3400
13	-0.60	16.00	95.87	14.79	323.10	14.79	30.79a	3400
14	-1.18	21.75	102.07	16.34	341.69	16.34	38.09a	3400
15	-1.75	27.50	108.25	17.89	360.24	17.89	45.39a	3400
16	-2.00	30.00	110.94	18.56	368.30	18.56	48.56a	3400
17	-2.38	33.75	114.96	19.56	380.36	19.56	53.31a	3400
18	-2.75	37.50	118.98	20.57	392.42	20.57	58.07a	3400
19	-3.13	41.25	122.99	21.57	404.46	21.57	62.82a	3400
20	-3.50	45.00	127.01	22.57	416.50	22.57	67.57a	3400
21	-3.85	48.50	130.75	23.51	427.73	23.51	72.01a	3400
22	-4.20	52.00	134.49	24.44	438.95	24.44	76.44a	3400
23	-4.80	58.00	140.90	26.05	458.18	26.05	84.05a	3400
24	-5.40	64.00	147.31	27.65	477.41	27.65	91.65a	3400
25	-5.95	69.50	153.18	29.12	495.03	29.12	98.62a	3400
26	-6.50	75.00	159.06	30.59	512.65	30.59	105.59a	3400

RIGHT side

Node no.	Y coord	Water press. kN/m2	Effective stresses Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
1	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	35.49	35.49	35.49p	3873
17	-2.38	0.00	7.88	0.00	59.11	52.47	52.47	3873
18	-2.75	0.00	15.75	0.00	82.75	57.69	57.69	3873
19	-3.13	0.00	23.63	0.00	106.39	62.78	62.78	3873
20	-3.50	0.00	31.52	0.00	130.06	67.77	67.77	3873

(continued)

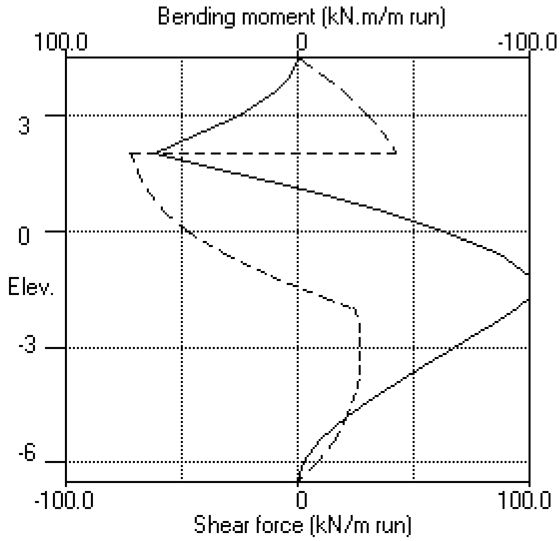
Stage No.5 Excavate to elevation -2.00 on RIGHT side

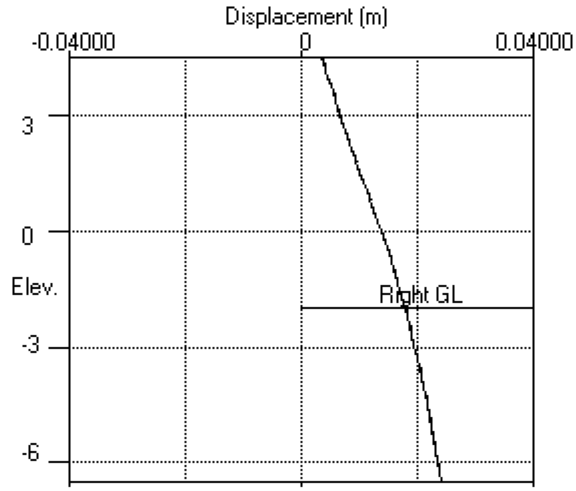
		RIGHT side						
			Effective stresses				Total	Coeff. of
Node no.	Y coord	Water press.	Vertic -al	Active limit	Passive limit	Earth pressure	earth pressure	subgrade reaction
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
21	-3.85	3.50	35.39	0.00	141.67	70.85	74.35	3873
22	-4.20	7.00	39.27	0.64	153.31	73.88	80.88	3873
23	-4.80	13.00	45.95	2.31	173.33	78.95	91.95	3873
24	-5.40	19.00	52.67	3.99	193.48	83.95	102.95	3873
25	-5.95	24.50	58.86	5.54	212.07	88.51	113.01	3873
26	-6.50	30.00	65.10	7.10	230.78	93.08	123.08	3873

Note: 105.59 a Soil pressure at active limit
35.49 p Soil pressure at passive limit

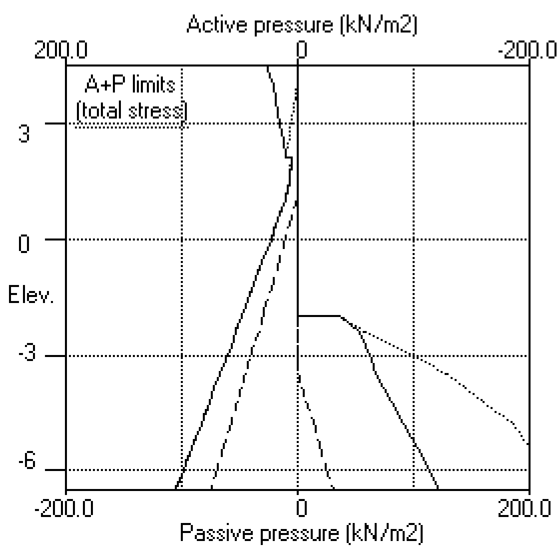
Units: kN,m

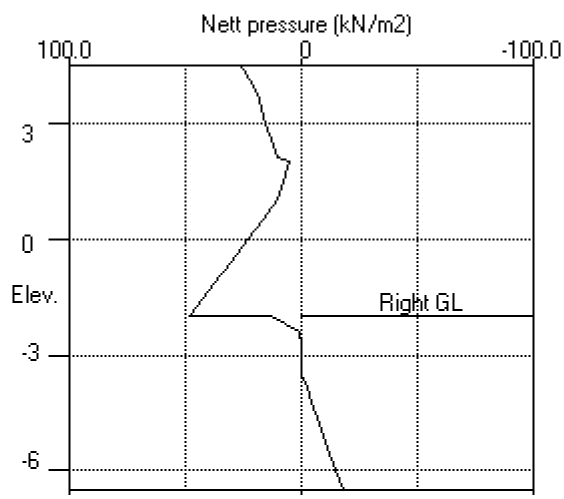
Stage No.5 Excav. to elev. -2.00 on RIGHT side





Stage No.5 Excav. to elev. -2.00 on RIGHT side





Units: kN,m

Summary of results

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

				FoS for toe elev. = -6.50		**Toe elev. for FoS = 1.500**		
Stage No.	Ground level Act.	Pass.	Prop Elev.	Factor of Safety	Moment equilib. at elev.	Toe elev.	Wall Penetr -ation	Direction of failure
1	4.50	4.50	Cant.	Conditions not suitable for FoS calc.				
2	4.50	4.50	Cant.	Conditions not suitable for FoS calc.				
3	4.50	1.50	Cant.	2.520	-5.59	-1.66	3.16	L to R
4	4.50	1.50		No analysis at this stage				
5	4.50	-2.00	2.00	1.537	n/a	-6.26	4.26	L to R
6	4.50	-2.00		No analysis at this stage				

All remaining stages have more than one prop - FoS calculation n/a

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Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 1000.00m
Subgrade reaction model - Boussinesq Influence coefficients
Soil deformations are elastic until the active or passive limit is reached
Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall
Right side 20.00 from wall

Bending moment, shear force and displacement envelopes

Node	Y	Displacement		Bending moment		Shear force	
no.	coord	maximum	minimum	maximum	minimum	maximum	minimum
		m	m	kN.m/m	kN.m/m	kN/m	kN/m
1	4.50	0.008	0.000	0.0	0.0	0.0	0.0
2	4.40	0.008	0.000	0.1	0.0	2.6	0.0
3	4.00	0.008	0.000	3.2	-0.0	11.9	0.0
4	3.60	0.008	0.000	9.7	0.0	19.9	0.0
5	3.00	0.008	0.000	25.4	0.0	30.0	0.0
6	2.55	0.008	0.000	40.6	0.0	36.4	0.0
7	2.10	0.009	0.000	58.3	0.0	41.6	0.0
8	2.00	0.009	0.000	62.5	0.0	42.1	-72.3
9	1.50	0.010	0.000	73.1	0.0	40.0	-80.9
10	1.00	0.011	0.000	33.8	-6.3	7.6	-76.2
11	0.50	0.012	0.000	20.8	-36.9	2.7	-68.9
12	0.00	0.014	0.000	21.2	-63.3	0.0	-58.2
13	-0.60	0.015	0.000	19.4	-87.2	0.0	-41.1
14	-1.18	0.016	0.000	16.1	-99.7	0.0	-20.2
15	-1.75	0.017	0.000	11.9	-99.6	12.3	-7.9
16	-2.00	0.018	0.000	9.9	-95.1	24.0	-8.0
17	-2.38	0.018	0.000	7.0	-84.7	26.7	-7.7
18	-2.75	0.019	0.000	4.3	-74.6	26.9	-6.9
19	-3.13	0.020	0.000	1.9	-64.4	27.0	-5.7
20	-3.50	0.020	0.000	1.1	-54.2	26.9	-4.1
21	-3.85	0.021	0.000	0.9	-44.8	26.5	-2.5
22	-4.20	0.021	0.000	0.7	-35.7	25.3	-1.1
23	-4.80	0.022	0.000	0.4	-21.2	21.6	-0.4
24	-5.40	0.023	0.000	0.2	-9.7	15.8	-0.3
25	-5.95	0.023	0.000	0.1	-2.7	8.8	-0.2
26	-6.50	0.024	0.000	0.0	-0.0	0.0	0.0

Maximum and minimum bending moment and shear force at each stage

Stage	--------- Bending moment --------				---------- Shear force ----------			
no.	maximum	elev.	minimum	elev.	maximum	elev.	minimum	elev.
	kN.m/m		kN.m/m		kN/m		kN/m	
1	3.0	0.00	-0.0	-6.50	1.7	2.10	-0.7	-2.75
2	15.6	1.00	-5.4	-3.85	6.2	2.55	-6.8	-1.18
3	21.2	0.00	-1.7	-4.80	13.3	1.50	-8.0	-2.00
4	No calculation at this stage							
5	62.5	2.00	-99.7	-1.18	42.1	2.00	-72.3	2.00
6	No calculation at this stage							
7	No calculation at this stage							
8	73.1	1.50	-86.7	-1.75	40.0	1.50	-80.9	1.50
9	73.1	1.50	-86.7	-1.75	40.0	1.50	-80.9	1.50

Summary of results (continued)

Maximum and minimum displacement at each stage

Stage no.	Displacement maximum m	elev.	minimum m	elev.	Stage description
1	0.001	4.50	0.000	4.50	Apply surcharge no.1 at elev. 4.50
2	0.005	-6.50	0.000	4.50	Apply water pressure profile no.1
3	0.012	-6.50	0.000	4.50	Excav. to elev. 1.50 on RIGHT side
4	No calculation at this stage				Install prop no.1 at elev. 2.00
5	0.024	-6.50	0.000	4.50	Excav. to elev. -2.00 on RIGHT side
6	No calculation at this stage				Install prop no.2 at elev. -1.75
7	No calculation at this stage				Install prop no.3 at elev. 1.50
8	0.024	-6.50	0.000	4.50	Remove prop no.1 at elev. 2.00
9	0.024	-6.50	0.000	4.50	Install prop no.4 at elev. 4.40

Summary of results (continued)

Prop forces at each stage (horizontal components)

Stage no.	-- Anchor no. 1 --- at elev. 2.00		--- Strut no. 2 --- at elev.-1.75		--- Strut no. 3 --- at elev. 1.50	
	kN/m run	kN/prop	kN/m run	kN/prop	kN/m run	kN/prop
5	114.43	228.86	---	---	---	---
8	---	---	slack	slack	120.95	120.95
9	---	---	slack	slack	120.95	120.95

Stage no.	--- Strut no. 4 --- at elev. 4.40	
	kN/m run	kN/prop
9	0.00	0.00

Units: kN,m

Bending moment, shear force, displacement envelopes