

GCA Report No.
Date:

G21319-1
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Geotechnical Letter Report

No. 52 Wakehurst Parkway North Narrabeen NSW 2101

Prepared for:

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Attachment 1: Important Information About Your Geotechnical Report

1. INTRODUCTION

Geotechnical Consultants Australia Pty Ltd (GCA) were engaged by Mr. Matthew Mina (the client) to undertake a geotechnical review on the following provided documentations for a proposed development at No. 52 Wakehurst Parkway North Narrabeen NSW 2101 (the site):

- Architectural drawings prepared by Design Formation Building Design Studio, titled "Secondary Dwelling, 52 Wakehurst Pkway North Narrabeen, Lot 19 in DP 17088", referenced project No. 559 and included drawing nos. DA001 to DA008.
- Site survey plan prepared by C & A Surveyors NSW Pty Ltd, titled "Detail Survey of Lot 19 in DP 17088, Located at No. 52, Wakehurst Parkway North Narrabeen", referenced job No. 16054-20 DET, sheet 1 of 1 and dated 11th December 2020.
- Geotechnical engineering report prepared by Geotechnical Consultants Australia Pty Ltd, titled "Geotechnical Investigation Report, Proposed Development at: 52 Wakehurst Parkway North Narrabeen NSW 2101", referenced report No. G21217-1 and dated 30th April 2021.

For your review, **Attachment 1** contains a document prepared by GCA entitled "Important Information About Your Geotechnical Report", which summarises the general limitations, responsibilities and use of geotechnical engineering reports.

2. SUMMARY OF SUBSURFACE CONDITIONS

Based on the geotechnical investigation at the selected testing locations within the proposed development area, subsurface conditions generally comprised:

- Concrete pavement of approximately 150mm in thickness; underlain by:
- (Unit 1): Fill material predominately comprising variable layers of SAND, Clayey SAND and Silty SAND, gravel inclusions, from below the existing pavement and present to a depth of approximately (at least) 1.0m bgl (varying throughout), overlying:
- (Unit 2): Natural Clayey SAND, fine to medium grained, low plasticity clay, estimated medium dense and extending to depths of greater than 1.3m bgl (varying throughout)

It is noted that Dynamic Cone Penetrometer (DCP) testing at the selected locations within the proposed development area indicated the presence of what we anticipate to be a well-consolidated/highly cemented, natural soil profile at the practical DCP terminated depths of approximately 2.65m to 2.8m bgl. The actual thickness of this layer has not been confirmed and the possibility of softer soils below should not be precluded. Furthermore, the

possibility of bedrock being present shortly below the practical DCP terminated depths should also not be precluded.

In addition, variable composition and consistency/strength natural soils are also likely to be present throughout the site, predominately at locations and depths not assessed during the geotechnical investigation. Taking this into consideration and based on our experience in the local region, natural clayey soils are anticipated to be present at depth within the site

Furthermore, information provided by the client indicates the proposed development comprises construction of a secondary dwelling (granny flat) within the rear portion of the subject site. We also understand that the proposed development will include removal of existing retaining walls in the rear of the site and excavations to prepare the proposed building platform and surrounding.

3. GEOTECHNICAL ASSESSMENT

The geotechnical engineering report provides necessary recommendations for the design and construction of the proposed building foundation system (i.e. piled foundation system). However, due the proposed nature of excavations, it is recommended that a retaining wall be constructed within the rear portion of the site (proposed development footprint) around the site northern, eastern and southern boundaries.

The retaining wall should be designed and certified by a suitably qualified structural engineer and should be sufficiently founded on appropriate material underlying the site (i.e. piles supporting the retaining wall footings and sufficiently embedded into the underlying well-consolidated/highly cemented, natural soil profile or inferred bedrock). The design of the retaining should also take into consideration lateral earth pressures induced by movement along interfaces between soils and bedrock (where present).

Reference should be made to the subsurface conditions encountered during the geotechnical investigation by GCA. However, we anticipate the presence of largely fill material with possible natural soils to be present behind the retaining wall (subject to confirmation). Therefore, the retaining wall can be designed using the recommended design parameters provided in Section 4 below.

Subsurface conditions and materials underlying the proposed development area should be confirmed during construction by inspection from a geotechnical engineer for both the foundations and shoring piles, in order to confirm the preliminary allowable bearing capacities have been achieved and subsurface conditions are consistent throughout.

All filling (where required) within the site should be carried out in accordance with Australian Standards (AS) 3798-2007 and AS 1289, and reference to Section 4.6 and Section 4.7 of the geotechnical engineering report (referenced in Section 1 above).

4. PRELIMINARY DESIGN PARAMETERS (EARTH PRESSURES)

Excavation pressures acting on the support will depend on a number of factors including external forces from surcharge loading, the stiffness of the support, varying groundwater levels within the site, and the construction sequence of the proposed development. Therefore, the following parameters may be used for the design of temporary and permanent retaining walls at the subject site:

- A triangular earth pressure distribution may be adopted for derivation of active pressures where a simple support system (i.e. cantilevered wall or propped/anchored wall with only one row of props/anchors are required) is adopted. Cantilevered walls are typically less than 2.5m in height, and should take ensure deflections remain within tolerable limits.
 - Flexible retaining structures (i.e. cantilevered walls or walls with only one row of anchors), should be based on active lateral earth pressure. "At rest" earth pressure coefficient should be considered to limit the horizontal deformation of the retaining structure. Lateral active (or at rest) and passive earth pressures for cantilever walls or walls with only one row of anchors may be determined as follows:

Lateral active or "at rest" earth pressure:

$$P_a = K \gamma H - 2c\sqrt{K}$$

Passive earth pressure:

$$P_p = K_p \gamma H + 2c\sqrt{K_p}$$

- Where lateral deflection exceeds tolerable limits, or where two or more rows of anchors are required, the retention/shoring system should be designed as a braced structure. This more complex support system should utilise advanced numerical analysis tools such as WALLAP or PLAXIS which can ensure deflections in the walls remain within tolerable limits and to model the sequence of anchor installation and excavation. For braced retaining walls, a uniform lateral earth pressure should be adopted as follows:

Active earth pressure:

$$P_a = 0.65 K \gamma H$$

Where:

- P_a = Active (or at rest) Earth Pressure (kN/m²)
- P_p = Passive Earth Pressure (kN/m²)
- γ = Bulk density (kN/m³)
- K = Coefficient of Earth Pressure (K_a or K_o)
- K_p = Coefficient of Passive Earth Pressure
- H = Retained height (m)
- c = Effective Cohesion (kN/m²)

- Support systems and retaining structures should be designed to withstand hydrostatic pressures, lateral earth pressures and earthquake pressures (if applicable). The applied surcharge loads in their "zone of influence" should also be considered as part of the design, where the "zone of influence" may be obtained by drawing a line 45° above horizontal from the base of the proposed excavations.

Support system designed using the earth pressure approach may be based on the preliminary parameters given in Table 1 below for soils inferred to underlie the site. Table 1 also provides preliminary coefficients of lateral earth pressure for the soil horizons which we anticipate to underlie the site. These are based on fully drained conditions and that the ground behind the retention walls is horizontal.

Where ground conditions vary from those presented in the geotechnical engineering report, GCA should be contacted for further advice.

Table 1. Preliminary Geotechnical Design Parameters

Material	Fill	Natural Soils
Unit Weight (kN/m ³) ³	16	17
Effective Cohesion c' (kPa)	0	2
Angle of Friction ϕ' (°)	24	26
Modulus of Elasticity E_{sh} (MPa)	3	10
Earth Pressure Coefficient At Rest K_o¹	0.59	0.56
Earth Pressure Coefficient Active K_a²	0.42	0.39
Earth Pressure Coefficient Passive K_p²	2.37	2.56
Poisson Ratio ν	0.4	0.35

¹Earth pressure coefficient at rest (K_o) can be calculated using Jacky's equation.

²Earth pressure coefficient of active (K_a) and passive (K_p) can be calculated using Rankine's or Coulomb's equation.

³Above groundwater levels.

Notes:

- For undrained (temporary) clay soils, higher earth pressures (K=1) will apply.
- Varying ground conditions are expected throughout the site and confirmation should be made by a geotechnical engineer due to the limited investigation undertaken within the site.

5. ADDITIONAL GEOTECHNICAL COMMENTS

The design and construction of the proposed development should be in accordance with the approved structural engineering drawings and geotechnical engineering report. It is recommended that all foundations and founding materials be inspected and approved by a suitably qualified geotechnical engineer, in to confirm the preliminary allowable bearing capacities have been achieved and inferred ground conditions are consistent across the proposed development area.

All structural elements should be inspected and approved by a suitably qualified structural engineer, with all geotechnical inspections carried out as discussed in this letter and the geotechnical engineering report for the subject site. Appropriate engineering certifications are to be provided during the staged inspections.

If any changes are made to the proposed development and/or structural engineering drawings, GCA should be made aware and updated drawings provided for further review.

6. LIMITATIONS

Geotechnical Consultants Australia Pty Ltd (GCA) has based its geotechnical assessment on available information obtained prior and during the site inspection/investigation. The geotechnical assessment and recommendations provided in the geotechnical engineering report, along with the surface, subsurface and geotechnical conditions are limited to the inspection and test areas during the site inspection/investigation, and then only to the depths investigated at the time the work was carried out. Subsurface conditions can change abruptly, and may occur after GCA's field testing has been completed.

It is recommended that if for any reason, the site surface, subsurface and geotechnical conditions (including groundwater conditions) encountered during the site inspection/investigation vary substantially during construction, and from GCA's recommendations and conclusions, GCA should be contacted immediately for further testing and advice. This may be carried out as necessary, and a review of recommendations and conclusions may be provided at additional fees. GCA's advice and accuracy may be limited by undetected variations in ground conditions between sampling locations.

GCA does not accept any liability for any varying site conditions which have not been observed, and were out of the inspection or test areas, or accessible during the time of the investigation. This letter and any associated information and documentations have been prepared solely for **Mr. Matthew Mina**, and any misinterpretations or reliances by third parties of the geotechnical engineering report shall be at their own risk. Any legal or other liabilities resulting from the use of the geotechnical engineering report by other parties can not be religated to GCA.

This report should be read in full, including all conclusions and recommendations. Consultation should be made to GCA for any misunderstandings or misinterpretations of this report. This letter does not constitute as a detailed geotechnical engineering report and is prepared based on inferred ground conditions encountered during a previous investigation.

For and behalf of

Geotechnical Consultants Australia Pty Ltd (GCA)



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Important Information About Your Geotechnical Report

This geotechnical report has been prepared based on the scopes outlined in the project proposal. The works carried out by Geotechnical Consultants Australia Pty Ltd (GCA), have limitations during the site investigation, and may be affected by a number of factors. Please read the geotechnical investigation report in conjunction with this "Important Information About Your Geotechnical Report".

Geotechnical Services Are Performed for Specific Projects, Clients and Purposes.

Due to the fact that each geotechnical investigation is unique and varies from sites, each geotechnical report is unique, and is prepared solely for the client. A geotechnical report may satisfy the needs of a structural engineer, where it will not for a civil engineer or construction contractor. No one except the client should rely on the geotechnical report without first conferring with the specific geotechnical consultant who prepared the report. The report is prepared for the contemplated project or original purpose of the investigation. No one should apply this report to any other or similar project.

Reading The Full Report.

Do not read selected elements of the report or tables/figures only. Serious problems have occurred because those relying on the specially prepared geotechnical investigation report did not read it all in full context.

The Geotechnical Report is Based on a Unique Set of Project And Specific Factors.

When preparing a geotechnical report, the geotechnical engineering consultant considers a number of unique factors for the specific project. These typically include:

- Clients objectives, goals and risk management preferences;
- The general proposed development or nature of the structure involved (size, location, etc.); and
- Future planned or existing site improvements (parking lots, roads, underground services, etc.);

Care should be taken into identifying the reason of the geotechnical report, where you should not rely on a geotechnical engineering report that was:

- Not prepared for your project;
- Not prepared for the specific site;
- Not prepared for you;
- Does not take into consideration any important changes made to the project; or
- Was carried out prior to any new infrastructure on your subject site.

Typical changes that can affect the reliability of an existing geotechnical investigation report include those that affect:

- The function of the proposed structure, where it may change from one basement level to two basement levels, or from a light structure to a heavily loaded structure;
- Location, size, elevation or configuration of the proposed development;
- Changes in the structural design occur; or
- The owner of the proposed development/project has changed.

The geotechnical engineer of the project should always be notified of any changes – even minor – and be asked to evaluate if this has any impact. GCA does not accept responsibility or liability for problems that occur because its report did not consider developments which it was not informed of.

Subsurface Conditions Can Change

This report is based on conditions that existed at the time of the investigation, at the locations of the subsurface tests (i.e. boreholes) carried out during the site investigation. Subsurface conditions can be affected and modified by a number of factors including, but not limited to, the passage of time, man-made influences such as construction on or adjacent to the site, by natural forces such as floods, groundwater fluctuations or earthquakes. GCA should be contacted prior to submitting its report to determine if any further testing may be required. A minor amount of additional testing may prevent any major problems.

Geotechnical Findings Are Professional Opinions

Results of subsurface conditions are limited only to the points where the subsurface tests were carried out, or where samples were collected. The field and laboratory data is analysed and reviewed by a geotechnical engineer, who then applies their professional experience and recommendations about the site's subsurface conditions. Despite investigation, the actual subsurface conditions may differ – in some cases significantly – from the results presented in the geotechnical investigation report, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface anomalies and details.

Therefore, the recommendations in this report can only be used as preliminary. Retaining GCA as your geotechnical consultants on your project to provide construction observations is the most effective method of managing the risks associated with unanticipated subsurface conditions.

Geotechnical Report's Recommendations Are Not Final

Because geotechnical engineers provide recommendations based on experience and judgement, you should not overrely on the recommendations provided – they are not final. Only by observing the actual subsurface conditions revealed during construction may a geotechnical engineer finalise their recommendations. GCA does not assume responsibility or liability for the report's recommendations if no additional observations or testing is carried out.

Geotechnical Report's Are Subject to Misinterpretations

The project geotechnical engineer should consult with appropriate members of the design team following submission of the report. You should review your design teams plans and drawings, in conjunction with the geotechnical report to ensure they have all be incorporated. Due to many issues arising from misinterpretation of geotechnical reports between design teams and building contractors, GCA should participate in pre-construction meetings, and provide adequate construction observations.

Engineering Borehole Logs And Data Should Not be Redrawn

Geotechnical engineers prepare final borehole and testing logs, figure, etc. based on results and interpretation of field logs and laboratory data following the site investigation. The logs, figure, etc. provided in the geotechnical report should never be redrawn or altered for inclusion in any other documents from this report, included architectural or other design drawings.

Providing The Full Geotechnical Report For Guidance

The project design teams, subcontractors and building contractors should have a copy of the full geotechnical investigation report to help prevent any costly issues. This should be prefaced with a clearly written letter of transmittal. The letter should clearly advise the aforementioned that the report was prepared for proposed development/project requirements, and the report accuracy is limited. The letter should also encourage them to confer with GCA, and/or carry out further testing as may be required. Providing the report to your project team will help share the financial responsibilities stemming from any unanticipated issues or conditions in the site.

Understanding Limitation Provisions

As some clients, contractors and design professionals do not recognise geotechnical engineering is much broader and less exact than other engineering disciplines, this creates unrealistic expectations that lead to claims, disputes and other disappointments. As part of the geotechnical report, (in most cases) a 'limitations' explanatory provision is included, outlining the geotechnical engineers' limitations for your project – with the geotechnical engineers responsibilities to help other reduce their own. This should be read closely as part of your report.

Other Limitations

GCA will not be liable to revise or update the report to take into account any events or circumstances (seen or unforeseen), or any fact occurring or becoming apparent after the date of the report. This report is the subject of copyright and shall not be reproduced either totally or in part without the express permission of GCA. The report should not be used if there have been changes to the project, without first consulting with GCA to assess if the report's recommendations are still valid. GCA does not accept any responsibility for problems that occur due to project changes which have not been consulted.