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REPORT ON GEOTECHNICAL SITE ASSESSMENT

for

PROPOSED ALTERATIONS AND ADDITIONS

at

74 BOWER STREET, MANLY

Prepared For

Roger Band

Project No.: 2018-182

December, 2018

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GEOTECHNICAL REPORT FOR PROPOSED ALTERATIONS AND ADDITIONS
74 BOWER STREET, MANLY, NSW

1. INTRODUCTION:

This report details the results of a geotechnical assessment carried out for proposed alterations and additions at 74 Bower Street, Manly, NSW. The assessment was undertaken by Crozier Geotechnical Consultants (CGC) at the request of Architect, Mark Hurcum Design Practice on behalf of the client Roger Band.

The site is situated on the low north side of Bower Street within moderate to steeply north dipping topography. The site is currently occupied by a three level residential house with driveway, garage and gardens at front and gardens above a cliff line at the rear.

Reference to Northern Beaches (Manly) Councilôs Development Control Plan 2013 ï Schedule 1 Map C, the rear northern edge of the site is defined within Landslip Risk Class óG1ô. Therefore the Council has requested a site stability (geotechnical) report in support of the Development Application, due to the sites landslip zoning. This report therefore includes a detailed description of the field work, assessment of proposed works, site specific risk assessment where landslip hazards are identified and provides constraints and recommendations as required. The landslip risk assessment for existing/potential instability must be completed as per the guidelines of the AGS Landslide Risk Management March 2007 publication.

The investigation and reporting were undertaken as per the Tender P18-398, Dated: 26th November 2018.

The investigation comprised:

a) A detailed geotechnical inspection and mapping of the site and adjacent properties by a Senior Engineering Geologist.
b) Review of Ortho Photomaps and Aerial Photography of the site.

The following plans and diagrams were supplied for the work:

- Architectural drawings (DA Issue) by Architect, Mark Hurcum Design Practice, Drawing No. 001, A101 to A104, A201, A202. A204, A221 and SK31, Issue A, Dated: 14th November 2018.

2. PROPOSED DEVELOPMENT

It is understood that the proposed works involve alterations and additions to the upper floor level only, with 1.00m to 2.00m extension to the north requiring wall and roof modification. The proposed extension will not require any ground floor level works, excavations or new footings.

3. SITE FEATURES:

3.1. Description:

The site is a skewed rectangular shaped block located on the low north side of Bower Street, situated at the lower end of the slope on an east-west striking ridgeline. It has the front south and rear north boundaries of 16.37m each and east and west side boundaries of 45.84m each, as referenced from the provided survey plan.

The site contains a three level residence located approximately at the centre of the site. The front of the site is formed with a concrete paved driveway and terraced gardens with a tiled court and a raised garden at the rear. An aerial photograph of the site and its surrounds is provided below (Photograph 1), as sourced from NSW Government Six Map spatial data system.

Photograph 1: Aerial photo of site and surrounds

3.2. Geology:

Reference to the Sydney 1: 100,000 Geological Series sheet (9130) indicates that the site is underlain by Hawkesbury Sandstone (Rh) which is of Triassic Age. Hawkesbury Sandstone typically comprises of medium to coarse grained quartz sandstone with minor lenses of shale. Units of this rock were identified within the front and rear portions of the site and within the road reserve of Bower Street, opposite to the site.

4. FIELD WORK:

4.1. Methods:

The field investigation comprised a walk over inspection and mapping of the site and adjacent properties on the 30th November 2018 by a Senior Engineering Geologist. It included a photographic record of site conditions as well as geological/geomorphological mapping of the site and adjacent land with examination of existing structures and bedrock outcrop.

Explanatory notes are included in Appendix: 1 whilst mapping information is shown on Figure: 1, Appendix: 2.

4.2. Field Observations:

Bower Street has a gently (<-5°) west dipping bitumen pavement with low concrete gutter and kerb where it passes the site, with a sandstone cliff extending parallel to the road on its high south side opposite to the site. The cliff is approximately 3.00m to 4.00m high and the exposed bedrock is classified as moderately weathered, medium grained sandstone of medium to high strength containing sub-horizontal and sub-vertical defects. There were no signs of excessive cracking or deformation within the road pavement to suggest any movement or underlying geotechnical issues. Adjacent to the site front boundary the road reserve generally contains gently west dipping garden beds and a concrete pathway.

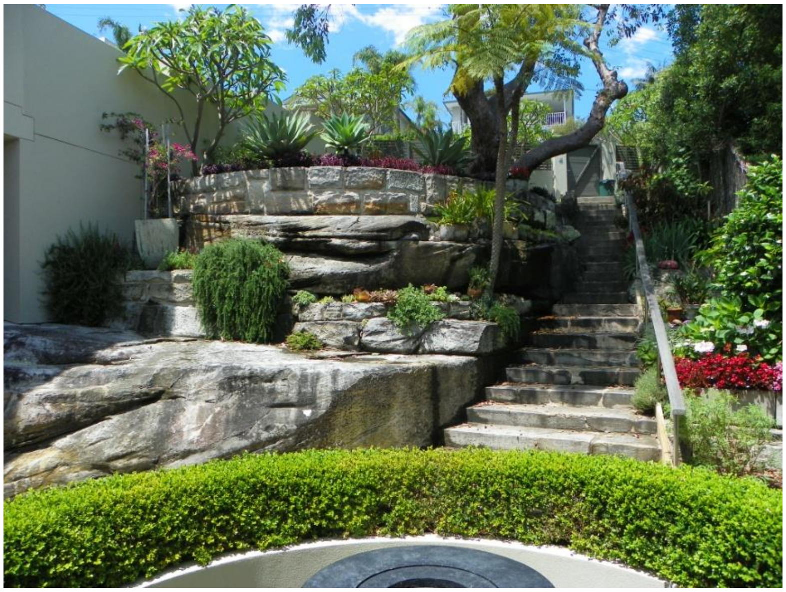
A gently north dipping concrete paved driveway within the front south eastern portion of the site, leads from Bower Street to a double lock up garage located adjacent to the south eastern house corner, at first floor level as shown in the picture below. The western side of the driveway is formed with a stepped, up to 1.50m high concrete wall which is in good condition with no signs of any cracking or settlement.

Picture 2: Front of site, looking north

A front view of the site house is shown in the picture below:

Picture 3: Front view of existing house, looking north from front entrance

A concrete stairway steps down the slope through the front south western portion of the site with a raised lawn on its east side and raised garden beds along the west side boundary as shown in the picture below:



Picture 4: South western portion at front of site, looking south from ground level

The raised lawn is retained by a low (<0.50m) mortared sandstone block wall along the north and west side which is founded off massive sandstone bedrock of medium to high strength. The raised garden beds along the west side boundary are retained by low (<0.50m) stone walls at various levels. All the retaining walls are in good condition with no obvious signs of any movement or settlement.

A stepped, tiled pathway along the west side boundary leads to the rear of the property where there is a tiled courtyard at the lower floor level that extends northwards to the cliff line. A stone stairway from the east side of the courtyard steps up to a raised lawn adjacent to the ground floor level and extends to the cliff line. The garden is retained by a low (<0.50m) mortared sandstone block retaining wall that is in good condition and is founded off a massive sandstone outcrop as shown in the picture below:

Picture 5: Raised lawn at rear of the site, looking north east from rear courtyard

The bedrock outcropping within the rear portion of the site and over the cliff face adjacent to the rear north boundary is characterised as slightly to moderately weathered sandstone of medium to high strength containing sub horizontal bedding defects dipping at 5^{o} to 10^{o} to the south. These bedding defects do not intersect with any persistent sub vertical joints therefore there are no unstable blocks of rock which can potentially topple/slide down and create any instability hazard.

The eastern site boundary is formed with a 1.80m high concrete block wall whilst the western site boundary is formed with a stepped, 1.70m high rendered brick wall. Both walls are in good condition with no obvious signs of cracking or settlement.

The existing site house is a three level concrete and clad structure constructed over the slope, overlooking to Cabbage Tree Bay to the north. The lower ground floor level appears to be constructed within an excavation into sandstone bedrock over the cliff top. The building structure which is anticipated to be supported on concrete columns/strip and slab on ground footings appears to be 20 to 25 years old and is in very good condition, with no sign of settlement or cracking on its external walls.

The neighbouring property to the east (No. 72 Bower Street) contains a multi level residence with a garage and a car parking area at the front and gardens above a cliff line at the rear. The building structure appears to be of similar age to the site house and is in good condition with no signs of any settlement or cracking on its exterior walls. The property is at a similar ground level to the site along the common boundary with building structures located within 1.00m to 2.00m of the common boundary.

The neighbouring property to the west (No. 76 Bower Street) contains a three level concrete and glass residence with driveway, garage and gardens at front and gardens above a cliff line at the rear. The house structure appears to be ofrelatively modern construction and is in good condition with no signs of any settlement or cracking on its exterior walls. The property is at a similar ground level to the site along the common boundary with building structures extending to the common boundary.

The neighbouring buildings and properties were only inspected from within the site or from the road reserve and the visible aspects did not show any significant signs of large scale slope instability or other major geotechnical concerns which would impact the site.

5. COMMENTS:

5.1. Geotechnical Assessment:

The inspection and assessment identified no obvious credible landslip hazards within the site or adjacent properties. The existing residence appears to be 20 to 25 years old and is in very good condition, with no signs of excess cracking or settlement. The rock slopes within and around the site are moderate to steeply dipping with no signs of any significant instability.

Most of the retaining walls around the site area appear stable at present with no signs of any movement or settlement. Surface stormwater appears to be well controlled with no signs of surface flow or erosion over the slope within the front and rear portion of the property.

There were no signs of existing or previous landslip instability within the site or adjacent cliff line.

The proposed works require no bulk excavation or new footings, therefore the proposed works are considered separate from and not affected by a geotechnical hazard. As such no further geotechnical investigation or reporting is required as part of this Development Application to meet Councilôs policy requirements.

5.2. Slope Stability & Risk Assessment:

Based on our site mapping no credible geological/geotechnical instability hazards were identified which need to be considered in relation to the existing site and proposed development. As such a risk assessment is not required as the works are considered separate from, and not affected by a geotechnical instability hazard.

The entire site and surrounding slopes have been assessed as per the Northern Beaches (Manly) Councilôs DCP 2013 requirements and no credible instability hazards were identified whilst the proposed works have no geotechnical component, therefore the site is considered to meet an óAcceptableô risk management criteria for the design life of the development, taken as 50 years, provided the property is maintained as per the recommendations of this report.

5.3. Design Life of Future Development:

We have interpreted the design life requirements specified within Councilôs DCP 2013 to refer to structural elements designed to support the adjacent slope, control stormwater and maintain the risk of instability within óAcceptableô limits. Specific structures and features that may affect the maintenance and stability of the site in relation to the proposed development are considered to comprise:

- Stormwater and subsoil drainage systems,
- Retaining walls and soil slope erosion and instability,
- Maintenance of trees/vegetation on this and adjacent properties.

Man-made features should be designed and maintained for a design life consistent with surrounding structures (as per AS2870 ï 2011 (50 years). It is considered that the existing house will have a design life of 50 years from its upgrade following the proposed works.

If a maintenance and inspection schedule are not implemented the ñAcceptableò risk levels for the design life of the property may not be attained. A recommended program is given in Table: 1 below and should also include the following guidelines:

- The conditions on the block donôt change from those present at the time this report was prepared, except for the changes due to new development.
- There is no change to the property due to an extraordinary event external to this site, and the property is maintained in good order and in accordance with the guidelines set out in;
  a) CSIRO sheet BTF 18
  b) Australian Geomechanics ñLandslide Risk Managementò Volume 42, March 2007.
  c) AS 2870 ï 2011, Australian Standard for Residential Slabs and Footings

Table 1: Recommended Maintenance and Inspection Program for Future Developments

Structure	**Maintenance/ Inspection Item**	**Frequency**
Stormwater Drains.	Owner to inspect to ensure that the drains and pipes are free of debris & sediment build-up. Clear surface grates and litter.	Every year or following each major rainfall event
Retaining Walls or remedial measures	Owner to inspect walls for deviation from as constructed condition or for excess deterioration/rotation or signs of soil settlement/erosion or significant cracking adjacent to crest.	Every two years or following major rainfall events. Replace existing non-engineered walls as required prior to their failure

N.B. Provided the above schedule is maintained the design life of the property should conform AS2870

Where changes to site conditions are identified during the maintenance and inspection program, reference should be made to relevant professionals (e.g. structural engineer, geotechnical engineer or Council). It is assumed that Northern Beaches (Manly) Council will control development on neighbouring properties, carry out regular inspections and maintenance of the road verge, stormwater systems and large trees on public land adjacent to the site so as to ensure that stability conditions do not deteriorate with potential increase in risk level to the site. Also individual Government Departments will maintain public utilities in the form of power lines, water and sewer mains to ensure they donꞌt leak and increase either the local groundwater levels or landslide potential.

6. CONCLUSION:

The inspection and assessment identified no obvious significant slope movement, excess surface stormwater flow or seepage, erosion or instability within the site or adjacent properties. The entire site and surrounding slopes have been assessed as per the Northern Beaches (Manly) Council DCP 2013 and no credible instability hazards were identified.

The proposed works are relatively minor from a geotechnical perspective and should not create any new instability, therefore the proposed works are separate from and not affected by a geotechnical hazard, and no further geotechnical assessment or reporting is required as part of this DA.

It is considered that the site will meet an óAcceptableô risk management criteria for the design life of the development taken as 50 years from the proposed works provided the property is maintained as per the recommendations of this report.

Prepared by:
Shahzada Rizvi
Senior Engineering Geologist

Reviewed by:
Troy Crozier
Principal Engineering Geologist
MAIG. RPGeo: 10197

7. REFERENCES:

1. Australian Geomechanics Society 2007, ñLandslide Risk Assessment and Managementò, Australian Geomechanics Journal Vol 42, No 1, March 2007.
2. Northern Beaches (Manly) Councilôs Development Control Plan 2013.

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

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

Description and classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigation Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. Sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination.
The strength terms are defined as follows:

Classification	Undrained Shear Strength kPa
Very soft	Less than 12
Soft	12 - 25
Firm	25 – 50
Stiff	50 – 100
Very stiff	100 - 200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT “N” Value (blows/300mm)	CPT Cone Value (Qc – MPa)
Very loose	less than 5	less than 2
Loose	5 – 10	2 – 5
Medium dense	10 – 30	5 -15
Dense	30 – 50	15 – 25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling to allow information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Drilling Methods

The following is a brief summary of drilling methods currently adopted by the company and some comments on their use and application.

Test Pits – these are excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descent into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) – the hole is advanced by a rotating plate or short spiral auger, generally 300mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling – the hole is advanced by pushing a 100mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers – the hole is advanced using 90 – 115mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPT's or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling - the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling – similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. From SPT).

Continuous Core Drilling – a continuous core sample is obtained using a diamond-tipped core barrel, usually 50mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedures is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" – Test 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken

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as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150mm of say 4, 6 and 7 as 4, 6, 7 then N = 13
- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm then as 15, 30/40mm.

The results of the test can be related empirically to the engineering properties of the soil. Occasionally, the test method is used to obtain samples in 50mm diameter thin wall sample tubes in clay. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch Cone – abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australia Standard 1289, Test 6.4.1.

In tests, a 35mm diameter rod with a cone-tipped end is pushed continually into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separte 130mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected buy electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) their information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: -

- Cone resistance – the actual end bearing force divided by the cross-sectional area of the cone – expressed in MPa.
- Sleeve friction – the frictional force on the sleeve divided by the surface area – expressed in kPa.
- Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0 – 5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0 – 50 MPa) is less sensitive and is shown as a full line. The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios 1% - 2% are commonly encountered in sands and very soft clays rising to 4% - 10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range: -

Q_c (MPa) = (0.4 to 0.6) N blows (blows per 300mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range: -

$Q_c = (12 \text{ to } 18)\, C_u$

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculations of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Dynamic Penetrometers

Dynamic penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150mm increments of penetration. Normally, there is a depth limitation of 1.2m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer – a 16mm diameter flattened rod is driven with a 9kg hammer, dropping 600mm (AS1289, Test 6.3.3). The test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as Scala Penetrometer) – a 16mm rod with a 20mm diameter cone end is driven with a 9kg hammer dropping 510mm (AS 1289, Test 6.3.2). The test was developed initially for pavement sub-grade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is generally carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Borehole Logs

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

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

Details of the type and method of sampling are given in the report and the following sample codes are on the borehole logs where applicable:

D	Disturbed Sample	E	Environmental sample	DT	Diatube
B	Bulk Sample	PP	Pocket Penetrometer Test		
U50	50mm Undisturbed Tube Sample	SPT	Standard Penetration Test		
U63	63mm " " " " "	C	Core		

Ground Water

Where ground water levels are measured in boreholes there are several potential problems:

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made. More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. A three-storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty-storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

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

- unexpected variations in ground conditions – the potential for this will depend partly on bore spacing and sampling frequency,
- changes in policy or interpretation of policy by statutory authorities,
- the actions of contractors responding to commercial pressures,

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

Site Anomalies

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

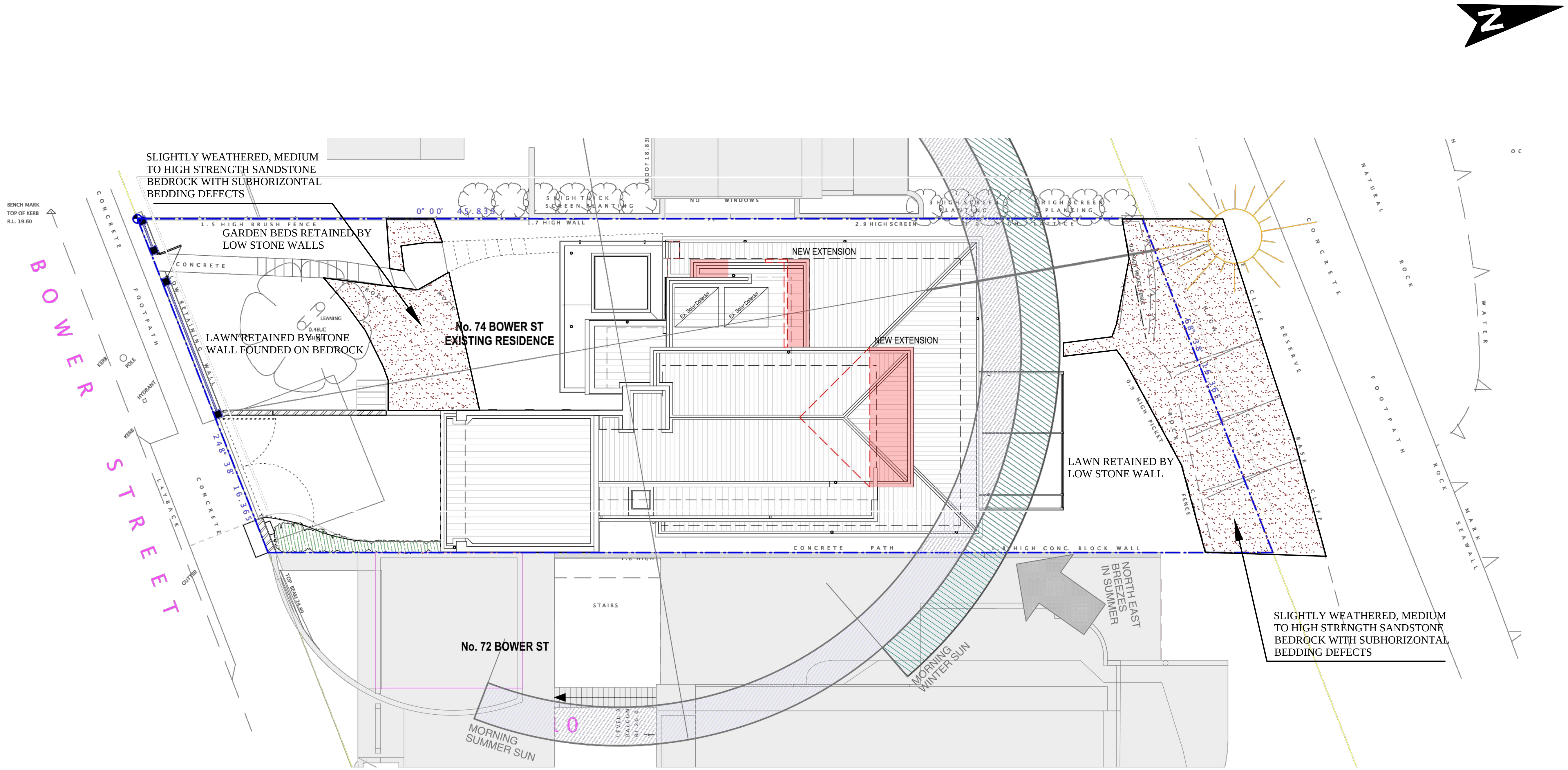
Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a special ally edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

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

Appendix 2



0 1 2 3 4 5 6 7 8 9 10

SCALE: 1:200

SITE PLAN FIGURE 1.

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Crozier Geotechnical, Unit 12, 42-46 Wattle Road, Brookvale NSW 2100; ABN: 96 113 453 624; Phone: (02) 9939 1882; Fax: (02) 9939 1883; *Crozier Geotechnical is a division of PJC Geo-Engineering Pty Ltd*	SANDSTONE OUTCROP	SCALE: 1:200 @ A3 DRAWING: FIGURE 1 DATE: 03/12/2018	PREPARED FOR: Roger Band
		APPROVED BY: TMC DRAWN BY: JY PROJECT: 2018-182	ADDRESS: 74 BOWER STREET, MANLY